GL01405

TERRAIN CORRECTION TABLES
for Gravity Survey Data Reduction

[redacted]

by J. Hammer

All units $\times 10^{-1}$ for gu
$\times 10^{-2}$ for mgals.

Terrain Corrections, T, are in units of
0.1 gravity unit for density of 2.0

ZONE A
AB
ABC } COMPUTED AS VERTICAL CYLINDERS FOR USE WITH <u>UNDERGROUND</u> STATIONS ONLY!

CORRECTION FOR SURFACE STATIONS IS GIVEN BY FORMULA FOR EFFECT OF A CIRCLE OF RADIUS R INCLINED AT AN ANGLE θ FROM THE HORIZONTAL CENTERED ON & PASSING THROUGH THE GRAVITY STATION [redacted]

$$T_R = 2\gamma\sigma R\left[\pi - 2\cos\theta\, K(\sin\theta)\right]$$

WHERE $K(\sin\theta)$ is the complete elliptical integral of the FIRST KIND (SEE TABLES)

6.56'
54.6'
175'

ZONE A *For Underground Stations only*

Inner Radius - 0 feet
Outer Radius - 6.56 feet Compartments - 1

T J	Δh
1	.2 - .6
2	.6 - 1.1
3	1.1 - 1.6
4	1.6 - 2.1
5	2.1 - 2.7
6	2.7 - 3.3
7	3.3 - 4.1
8	4.1 - 5.0
9	5.0 - 6.2
10	6.2 - 7.6
11	7.6 - 9.4
12	9.4 - 12.1
13	12.1 - 16.2
14	16.2 - 23.9
15	23.9 - 43.4
16	43.4 - 211.2

ZONE AB

For Underground stations only

Inner Radius - 0 feet
Outer Radius - 54.6 feet   Compartments - 1

T	Δh		T	Δh		T	Δh	
1	.2 -	.6	50	24.7 -	25.4	99	85. -	87.
2	.6 -	1.0	51	25.4 -	26.1	100	87. -	90.
3	1.0 -	1.4	52	26.1 -	26.7	101	90. -	93.
4	1.4 -	1.8	53	26.7 -	27.5	102	93. -	96.
5	1.8 -	2.2	54	27.5 -	28.2	103	96. -	99.
6	2.2 -	2.6	55	28.2 -	28.9	104	99. -	102.
7	2.6 -	3.0	56	28.9 -	29.6	105	102. -	105.
8	3.0 -	3.4	57	29.6 -	30.4	106	105. -	109.
9	3.4 -	3.9	58	30.4 -	31.2	107	109. -	113.
10	3.9 -	4.3	59	31.2 -	31.9	108	113. -	117.
11	4.3 -	4.7	60	31.9 -	32.7	109	117. -	121.
12	4.7 -	5.1	61	32.7 -	33.6	110	121. -	126.
13	5.1 -	5.6	62	33.6 -	34.4	111	126. -	131.
14	5.6 -	6.0	63	34.4 -	35.2	112	131. -	136.
15	6.0 -	6.4	64	35.2 -	36.1	113	136. -	141.
16	6.4 -	6.9	65	36.1 -	37.0	114	141. -	147.
17	6.9 -	7.3	66	37.0 -	37.9	115	147. -	154.
18	7.3 -	7.8	67	37.9 -	38.8	116	154. -	161.
19	7.8 -	8.3	68	38.8 -	40.	117	161. -	169.
20	8.3 -	8.7	69	40. -	41.	118	169. -	177.
21	8.7 -	9.2	70	41. -	42.	119	177. -	187.
22	9.2 -	9.7	71	42. -	43.	120	187. -	197.
23	9.7 -	10.1	72	43. -	44.	121	197. -	208.
24	10.1 -	10.6	73	44. -	45.	122	208. -	221.
25	10.6 -	11.1	74	45. -	46.	123	221. -	235.
26	11.1 -	11.6	75	46. -	47.	124	235. -	251.
27	11.6 -	12.1	76	47. -	48.	125	251. -	269.
28	12.1 -	12.6	77	48. -	49.	126	269. -	290.
29	12.6 -	13.1	78	49. -	50.	127	290. -	315.
30	13.1 -	13.6	79	50. -	52.	128	315. -	344.
31	13.6 -	14.1	80	52. -	53.	129	344. -	379.
32	14.1 -	14.7	81	53. -	54.	130	379. -	422.
33	14.7 -	15.2	82	54. -	56.	131	422. -	475.
34	15.2 -	15.7	83	56. -	57.	132	475. -	543.
35	15.7 -	16.3	84	57. -	58.	133	543. -	634.
36	16.3 -	16.8	85	58. -	60.	134	634. -	761.
37	16.8 -	17.4	86	60. -	61.	135	761. -	952.
38	17.4 -	17.9	87	61. -	63.	136	952. -	1270.
39	17.9 -	18.5	88	63. -	65.	137	1270. -	1907.
40	18.5 -	19.1	89	65. -	66.	138	1907. -	3819.
41	19.1 -	19.7	90	66. -	68.			
42	19.7 -	20.3	91	68. -	70.			
43	20.3 -	20.9	92	70. -	72.			
44	20.9 -	21.5	93	72. -	74.			
45	21.5 -	22.1	94	74. -	76.			
46	22.1 -	22.8	95	76. -	78.			
47	22.8 -	23.4	96	78. -	80.			
48	23.4 -	24.0	97	80. -	82.			
49	24.0 -	24.7	98	82. -	85.			

For Underground Stations only

ZONE ABC

Inner Radius - 0 feet
Outer Radius - 175 feet Compartments - 1

T	Δh		T	Δh		T	Δh	
1	.2 -	.6	51	21.0 -	21.5	101	45.0 -	45.6
2	.6 -	1.0	52	21.5 -	21.9	102	45.6 -	46.1
3	1.0 -	1.4	53	21.9 -	22.4	103	46.1 -	46.6
4	1.4 -	1.8	54	22.4 -	22.8	104	46.6 -	47.1
5	1.8 -	2.2	55	22.8 -	23.3	105	47.1 -	47.7
6	2.2 -	2.6	56	23.3 -	23.7	106	47.7 -	48.2
7	2.6 -	3.0	57	23.7 -	24.2	107	48.2 -	48.7
8	3.0 -	3.4	58	24.2 -	24.6	108	48.7 -	49.3
9	3.4 -	3.8	59	24.6 -	25.1	109	49.3 -	49.8
10	3.8 -	4.2	60	25.1 -	25.5	110	49.8 -	50.3
11	4.2 -	4.6	61	25.5 -	26.0	111	50.3 -	50.9
12	4.6 -	5.0	62	26.0 -	26.5	112	50.9 -	51.4
13	5.0 -	5.4	63	26.5 -	26.9	113	51.4 -	52.0
14	5.4 -	5.8	64	26.9 -	27.4	114	52.0 -	52.5
15	5.8 -	6.2	65	27.4 -	27.8	115	52.5 -	53.1
16	6.2 -	6.6	66	27.8 -	28.3	116	53.1 -	53.6
17	6.6 -	7.0	67	28.3 -	28.8	117	53.6 -	54.2
18	7.0 -	7.4	68	28.8 -	29.2	118	54.2 -	54.7
19	7.4 -	7.8	69	29.2 -	29.7	119	54.7 -	55.3
20	7.8 -	8.2	70	29.7 -	30.2	120	55.3 -	55.9
21	8.2 -	8.6	71	30.2 -	30.6	121	55.9 -	56.4
22	8.6 -	9.0	72	30.6 -	31.1	122	56.4 -	57.0
23	9.0 -	9.5	73	31.1 -	31.6	123	57.0 -	57.6
24	9.5 -	9.9	74	31.6 -	32.1	124	57.6 -	58.1
25	9.9 -	10.3	75	32.1 -	32.6	125	58.1 -	58.7
26	10.3 -	10.7	76	32.6 -	33.0	126	58.7 -	59.3
27	10.7 -	11.1	77	33.0 -	33.5	127	59.3 -	59.9
28	11.1 -	11.5	78	33.5 -	34.0	128	59.9 -	60.4
29	11.5 -	12.0	79	34.0 -	34.5	129	60.4 -	61.0
30	12.0 -	12.4	80	34.5 -	35.0	130	61.0 -	61.6
31	12.4 -	12.8	81	35.0 -	35.5	131	61.6 -	62.2
32	12.8 -	13.2	82	35.5 -	35.9	132	62.2 -	62.8
33	13.2 -	13.6	83	35.9 -	36.4	133	62.8 -	63.4
34	13.6 -	14.1	84	36.4 -	36.9	134	63.4 -	64.0
35	14.1 -	14.5	85	36.9 -	37.4	135	64.0 -	64.6
36	14.5 -	14.9	86	37.4 -	37.9	136	64.6 -	65.2
37	14.9 -	15.3	87	37.9 -	38.4	137	65.2 -	65.8
38	15.3 -	15.8	88	38.4 -	38.9	138	65.8 -	66.4
39	15.8 -	16.2	89	38.9 -	39.4	139	66.4 -	67.0
40	16.2 -	16.6	90	39.4 -	39.9	140	67.0 -	67.6
41	16.6 -	17.1	91	39.9 -	40.4	141	67.6 -	68.2
42	17.1 -	17.5	92	40.4 -	40.9	142	68.2 -	68.8
43	17.5 -	17.9	93	40.9 -	41.4	143	68.8 -	69.4
44	17.9 -	18.4	94	41.4 -	41.9	144	69.4 -	70.1
45	18.4 -	18.8	95	41.9 -	42.5	145	70.1 -	70.7
46	18.8 -	19.3	96	42.5 -	43.0	146	70.7 -	71.3
47	19.3 -	19.7	97	43.0 -	43.5	147	71.3 -	71.9
48	19.7 -	20.1	98	43.5 -	44.0	148	71.9 -	72.6
49	20.1 -	20.6	99	44.0 -	44.5	149	72.6 -	73.2
50	20.6 -	21.0	100	44.5 -	45.0	150	73.2 -	73.9

T	h	T	h	T	h
151	73.9 - 74.5	203	112.1 - 112.9	255	165. - 167.
152	74.5 - 75.1	204	112.9 - 113.8	256	167. - 168.
153	75.1 - 75.8	205	113.8 - 114.6	257	168. - 169.
154	75.8 - 76.4	206	114.6 - 115.5	258	169. - 171.
155	76.4 - 77.1	207	115.5 - 116.4	259	171. - 172.
156	77.1 - 77.7	208	116.4 - 117.3	260	172. - 173.
157	77.7 - 78.4	209	117.3 - 118.1	261	173. - 174.
158	78.4 - 79.1	210	118.1 - 119.0	262	174. - 176.
159	79.1 - 79.7	211	119.0 - 119.9	263	176. - 177.
160	79.7 - 80.4	212	119.9 - 120.8	264	177. - 179.
161	80.4 - 81.1	213	120.8 - 121.8	265	179. - 180.
162	81.1 - 81.8	214	121.8 - 122.7	266	180. - 181.
163	81.8 - 82.4	215	122.7 - 123.6	267	181. - 183.
164	82.4 - 83.1	216	123.6 - 124.5	268	183. - 184.
165	83.1 - 83.8	217	124.5 - 125.5	269	184. - 186.
166	83.8 - 84.5	218	125.5 - 126.4	270	186. - 187.
167	84.5 - 85.2	219	126.4 - 127.3	271	187. - 188.
168	85.2 - 85.9	220	127.3 - 128.3	272	188. - 190.
169	85.9 - 86.6	221	128.3 - 129.3	273	190. - 191.
170	86.6 - 87.3	222	129.3 - 130.2	274	191. - 193.
171	87.3 - 88.0	223	130.2 - 131.2	275	193. - 194.
172	88.0 - 88.7	224	131.2 - 132.2	276	194. - 196.
173	88.7 - 89.4	225	132.2 - 133.2	277	196. - 197.
174	89.4 - 90.2	226	133.2 - 134.2	278	197. - 199.
175	90.2 - 90.9	227	134.2 - 135.2	279	199. - 201.
176	90.9 - 91.6	228	135.2 - 136.2	280	201. - 202.
177	91.6 - 92.3	229	136.2 - 137.2	281	202. - 204.
178	92.3 - 93.1	230	137.2 - 138.2	282	204. - 205.
179	93.1 - 93.8	231	138.2 - 139.3	283	205. - 207.
180	93.8 - 94.6	232	139.3 - 140.3	284	207. - 209.
181	94.6 - 95.3	233	140.3 - 141.3	285	209. - 210.
182	95.3 - 96.1	234	141.3 - 142.4	286	210. - 212.
183	96.1 - 96.8	235	142.4 - 143.5	287	212. - 214.
184	96.8 - 97.6	236	143.5 - 144.5	288	214. - 216.
185	97.6 - 98.3	237	144.5 - 145.6	289	216. - 217.
186	98.3 - 99.1	238	145.6 - 146.7	290	217. - 219.
187	99.1 - 99.9	239	146.7 - 147.8	291	219. - 221.
188	99.9 - 100.7	240	147.8 - 148.9	292	221. - 223.
189	100.7 - 101.5	241	148.9 - 150.0	293	223. - 225.
190	101.5 - 102.2	242	150. - 151.	294	225. - 226.
191	102.2 - 103.0	243	151. - 152.	295	226. - 228.
192	103.0 - 103.8	244	152. - 153.	296	228. - 230.
193	103.8 - 104.6	245	153. - 155.	297	230. - 232.
194	104.6 - 105.4	246	155. - 156.	298	232. - 234.
195	105.4 - 106.2	247	156. - 157.	299	234. - 236.
196	106.2 - 107.1	248	157. - 158.	300	236. - 238.
197	107.1 - 107.9	249	158. - 159.	301	238. - 240.
198	107.9 - 108.7	250	159. - 161.	302	240. - 242.
199	108.7 - 109.5	251	161. - 162.	303	242. - 244.
200	109.5 - 110.4	252	162. - 163.	304	244. - 246.
201	110.4 - 111.2	253	163. - 164.	305	246. - 249.
202	111.2 - 112.1	254	164. - 165.	306	249. - 251.

T	Δh
307	251. - 253.
308	253. - 255.
309	255. - 257.
310	257. - 260.
311	260. - 262.
312	262. - 264.
313	264. - 267.
314	267. - 269.
315	269. - 272.
316	272. - 274.
317	274. - 276.
318	276. - 279.
319	279. - 282.
320	282. - 284.
321	284. - 287.
322	287. - 290.
323	290. - 292.
324	292. - 295.
325	295. - 298.
326	298. - 301.
327	301. - 304.
328	304. - 307.
329	307. - 310.
330	310. - 313.
331	313. - 316.
332	316. - 319.
333	319. - 322.
334	322. - 325.
335	325. - 329.
336	329. - 332.
337	332. - 335.
338	335. - 339.
339	339. - 343.
340	343. - 346.
341	346. - 350.
342	350. - 354.
343	354. - 357.
344	357. - 361.
345	361. - 365.
346	365. - 369.
347	369. - 373.
348	373. - 377.
349	377. - 382.
350	382. - 386.
351	386. - 390.
352	390. - 395.
353	395. - 400.
354	400. - 404.
355	404. - 409.
356	409. - 414.
357	414. - 419.
358	419. - 424.
359	424. - 429.
360	429. - 435.

T	Δh
361	435. - 440.
362	440. - 446.
363	446. - 452.
364	452. - 457.
365	457. - 463.
366	463. - 470.
367	470. - 476.
368	476. - 482.
369	482. - 489.
370	489. - 496.
371	496. - 503.
372	503. - 510.
373	510. - 517.
374	517. - 525.
375	525. - 532.
376	532. - 540.
377	540. - 548.
378	548. - 557.
379	557. - 565.
380	565. - 574.
381	574. - 583.
382	583. - 593.
383	593. - 603.
384	603. - 613.
385	613. - 623.
386	623. - 634.
387	634. - 645.
388	645. - 656.
389	656. - 668
390	668. - 680.
391	680. - 693.
392	693. - 706.
393	706. - 719.
394	719. - 733.
395	733. - 748.
396	748. - 763.
397	763. - 779.
398	779. - 795.
399	795. - 812.
400	812. - 830.
401	830. - 849.
402	849. - 868.
403	868. - 889.
404	889. - 910.
405	910. - 932.
406	932. - 955.
407	955. - 980.
408	980. - 1006.
409	1006. - 1033.
410	1033. - 1062.
411	1062. - 1092.
412	1092. - 1124.
413	1124. - 1157.
414	1157. - 1193.

T	Δh
415	1193. - 1232.
416	1232. - 1272.
417	1272. - 1316.
418	1316. - 1362.
419	1362. - 1412.
420	1412. - 1465.
421	1465. - 1523.
422	1523. - 1585.
423	1585. - 1653.
424	1653. - 1726.
425	1726. - 1806.
426	1806. - 1894.
427	1894. - 1991.
428	1991. - 2099.
429	2099. - 2218.
430	2218. - 2352.
431	2352. - 2503.
432	2503. - 2675.
433	2675. - 2872.
434	2872. - 3100.
435	3100. - 3368.
436	3368. - 3686.
437	3686. - 4070.
438	4070. - 4543.
439	4543. - 5141.
440	5141. - 5919.
441	5919. - 6975.

Hammock at Bear Creek
Template

ZONE B

Inner Radius - 6.56 feet
Outer Radius - 54.6 feet   Compartments - 4

T	Δh
.1	1.0 - 1.9
.2	1.9 - 2.5
.3	2.5 - 2.9
.4	2.9 - 3.4
.5	3.4 - 3.7
1	3.7 - 7.
2	7. - 9.
3	9. - 11.
4	11. - 14.
5	14. - 16.
6	16. - 19.
7	19. - 21.
8	21. - 24.
9	24. - 27.
10	27. - 30.
11	30. - 33.
12	33. - 37.
13	37. - 41.
14	41. - 45.
15	45. - 49.
16	49. - 55.
17	55. - 61.
18	61. - 67.
19	67. - 75.
20	75. - 84.
21	84. - 95.
22	95. - 108.
23	108. - 125.
24	125. - 147.
25	147. - 177.
26	177. - 221.
27	221. - 293.
28	293. - 429.
29	429. - 795.
30	795. - 5250.

Hammer at Bear Creek

ZONE C

Inner Radius - 54.6 feet
Outer Radius - 175 feet   Compartments - 6

T	Δh	T	Δh
.1	4.3 - 7.5	31	253. - 269.
.2	7.5 - 9.7	32	269. - 286.
.3	9.7 - 11.5	33	286. - 306.
.4	11.5 13.1	34	306. - 327.
.5	13.1 - 14.5	35	327. - 351.
1	14.5 - 24.	36	351. - 377.
2	24. - 32.	37	377. - 408.
3	32. - 39.	38	408. - 443.
4	39. - 45.	39	443. - 483.
5	45. - 51.	40	483. - 531.
6	51. - 57.	41	531. - 589.
7	57. - 63.	42	589. - 659.
8	63. - 68.	43	659. - 747.
9	68. - 74.	44	747. - 860.
10	74. - 80.	45	860. - 1012.
11	80. - 85.	46	1012. - 1228.
12	85. - 91.	47	1228. - 1557.
13	91. - 97.	48	1557. - 2123.
14	97. - 103.	49	2123. - 3328.
15	103. - 110.	50	3328. - 7671.
16	110. - 116.		
17	116. - 123.		
18	123. - 130.		
19	130. - 138.		
20	138. - 145.		
21	145. - 153.		
22	153. - 162.		
23	162. - 171.		
24	171. - 180.		
25	180. - 190.		
26	190. - 201.		
27	201. - 213.		
28	213. - 225.		
29	225. - 239.		
30	239. - 253.		

Hammond of Bear Creek

ZONE D

Inner Radius - 175 feet
Outer Radius - 558 feet   Compartments - 6

T	Δh	T	Δh	T	Δh
.1	7.7 - 13.4	49	345. - 352.	102	881. - 898.
.2	13.4 - 17.3	50	352. - 358.	103	898. - 916.
.3	17.3 - 20.5	51	358. - 365.	104	916. - 935.
.4	20.5 - 23.3	52	365. - 371.	105	935. - 954.
.5	23.3 - 25.8	53	371. - 378.	106	954. - 974.
1	25.8 - 43.	54	378. - 385.	107	974. - 994.
2	43. - 56.	55	385. - 392.	108	994. - 1016.
3	56. - 66.	56	392. - 399.	109	1016. - 1038.
4	66. - 76.	57	399. - 406.	110	1038. - 1060.
5	76. - 84.	58	406. - 413.	111	1060. - 1084.
6	84. - 92.	59	413. - 420.	112	1084. - 1108.
7	92. - 100.	60	420. - 428.	113	1108. - 1133.
8	100. - 107.	61	428. - 435.	114	1133. - 1160.
9	107. - 114.	62	435. - 443.	115	1160. - 1187.
10	114. - 121.	63	443. - 450.	116	1187. - 1215.
11	121. - 127.	64	450. - 458.	117	1215. - 1245.
12	127. - 133.	65	458. - 466.	118	1245. - 1276.
13	133. - 140.	66	466. - 474.	119	1276. - 1308.
14	140. - 146.	67	474. - 482.	120	1308. - 1342.
15	146. - 152.	68	482. - 491.	121	1342. - 1377.
16	152. - 158.	69	491. - 499.	122	1377. - 1414.
17	158. - 164.	70	499. - 507.	123	1414. - 1452.
18	164. - 169.	71	507. - 516.	124	1452. - 1493.
19	169. - 175.	72	516. - 525.	125	1493. - 1535.
20	175. - 181.	73	525. - 534.	126	1535. - 1580.
21	181. - 187.	74	534. - 543.	127	1580. - 1628.
22	187. - 192.	75	543. - 552.	128	1628. - 1677.
23	192. - 198.	76	552. - 562.	129	1677. - 1730.
24	198. - 204.	77	562. - 572.	130	1730. - 1786.
25	204. - 209.	78	572. - 581.	131	1786. - 1846.
26	209. - 215.	79	581. - 592.	132	1846. - 1909.
27	215. - 221.	80	592. - 602.	133	1909. - 1976.
28	221. - 226.	81	602. - 612.	134	1976. - 2048.
29	226. - 232.	82	612. - 623.	135	2048. - 2125.
30	232. - 238.	83	623. - 634.	136	2125. - 2208.
31	238. - 243.	84	634. - 645.	137	2208. - 2297.
32	243. - 249.	85	645. - 656.	138	2297. - 2394.
33	249. - 255.	86	656. - 668.	139	2394. - 2498.
34	255. - 261.	87	668. - 680.	140	2498. - 2611.
35	261. - 266.	88	680. - 692.	141	2611. - 2735.
36	266. - 272.	89	692. - 704.	142	2735. - 2871.
37	272. - 278.	90	704. - 717.	143	2871. - 3020.
38	278. - 284.	91	717. - 730.	144	3020. - 3185.
39	284. - 290.	92	730. - 743.	145	3185. - 3369.
40	290. - 296.	93	743. - 757.	146	3369. - 3575.
41	296. - 302.	94	757. - 771.	147	3575. - 3807.
42	302. - 308.	95	771. - 786.	148	3807. - 4070.
43	308. - 314.	96	786. - 800.	149	4070. - 4372.
44	314. - 320.	97	800. - 816.	150	4372. - 4721.
45	320. - 326.	98	816. - 831.	151	4721. - 5131.
46	326. - 333.	99	831. - 847.	152	5131. - 5617.
47	333. - 339.	100	847. - 864.	153	5617. - 6205.
48	339. - 345.	101	864. - 881.		

(Hammer's or Bear Creek

ZONE E

Inner Radius - 558 feet
Outer Radius - 1280 feet   Compartments - 8

T	Δh	T	Δh	T	Δh
.1	17.6 - 30.5	45	638. - 648.	94	1209. - 1223.
.2	30.5 - 39.4	46	648. - 658.	95	1223. - 1237.
.3	39.4 - 46.6	47	658. - 669.	96	1237. - 1252.
.4	46.6 - 52.9	48	669. - 679.	97	1252. - 1267.
.5	52.9 - 58.5	49	679. - 689.	98	1267. - 1281.
1	58.5 - 97.	50	689. - 699.	99	1281. - 1296.
2	97. - 126.	51	699. - 710.	100	1296. - 1312.
3	126. - 149.	52	710. - 720.	101	1312. - 1327.
4	149. - 170.	53	720. - 731.	102	1327. - 1343.
5	170. - 189.	54	731. - 741.	103	1343. - 1358.
6	189. - 206.	55	741. - 752.	104	1358. - 1374.
7	206. - 222.	56	752. - 762.	105	1374. - 1391.
8	222. - 238.	57	762. - 773.	106	1391. - 1407.
9	238. - 252.	58	773. - 784.	107	1407. - 1424.
10	252. - 266.	59	784. - 794.	108	1424. - 1440.
11	266. - 280.	60	794. - 805.	109	1440. - 1457.
12	280. - 293.	61	805. - 816.	110	1457. - 1475.
13	293. - 306.	62	816. - 827.	111	1475. - 1492.
14	306. - 318.	63	827. - 838.	112	1492. - 1510.
15	318. - 330.	64	838. - 849.	113	1510. - 1528.
16	330. - 342.	65	849. - 860.	114	1528. - 1546.
17	342. - 354.	66	860. - 871.	115	1546. - 1565.
18	354. - 366.	67	871. - 882.	116	1565. - 1584.
19	366. - 377.	68	882. - 894.	117	1584. - 1603.
20	377. - 388.	69	894. - 905.	118	1603. - 1622.
21	388. - 399.	70	905. - 917.	119	1622. - 1642.
22	399. - 410.	71	917. - 928.	120	1642. - 1662.
23	410. - 421.	72	928. - 940.	121	1662. - 1682.
24	421. - 432.	73	940. - 952.	122	1682. - 1702.
25	432. - 443.	74	952. - 963.	123	1702. - 1723.
26	443. - 453.	75	963. - 975.	124	1723. - 1744.
27	453. - 464.	76	975. - 987.	125	1744. - 1766.
28	464. - 474.	77	987. - 999.	126	1766. - 1788.
29	474. - 485.	78	999. - 1012.	127	1788. - 1810.
30	485. - 495.	79	1012. - 1024.	128	1810. - 1833.
31	495. - 505.	80	1024. - 1036.	129	1833. - 1856.
32	505. - 516.	81	1036. - 1049.	130	1856. - 1880.
33	516. - 526.	82	1049. - 1061.	131	1880. - 1904.
34	526. - 536.	83	1061. - 1074.	132	1904. - 1928
35	536. - 546.	84	1074. - 1087.	133	1928. - 1953.
36	546. - 556.	85	1087. - 1100.	134	1953. - 1978.
37	556. - 567.	86	1100. - 1113.	135	1978. - 2004.
38	567. - 577.	87	1113. - 1126.	136	2004. - 2030.
39	577. - 587.	88	1126. - 1140.	137	2030. - 2057.
40	587. - 597.	89	1140. - 1153.	138	2057. - 2084.
41	597. - 607.	90	1153. - 1167.	139	2084. - 2112.
42	607. - 617.	91	1167. - 1181.	140	2112. - 2140.
43	617. - 628.	92	1181. - 1195.	141	2140. - 2169.
44	628. - 638.	93	1195. - 1209.	142	2169. - 2198.

T	Δh
143	2198. - 2228.
144	2228. - 2259.
145	2259. - 2291.
146	2291. - 2323.
147	2323. - 2355.
148	2355. - 2389.
149	2389. - 2423.
150	2423. - 2458.
151	2458. - 2494.
152	2494. - 2531.
153	2531. - 2569.
154	2569. - 2607.
155	2607. - 2647.
156	2647. - 2687.
157	2687. - 2729.
158	2729. - 2772.
159	2772. - 2815.
160	2815. - 2860.
161	2860. - 2906.
162	2906. - 2954.
163	2954. - 3003.
164	3003. - 3053.
165	3053. - 3105.
166	3105. - 3158.
167	3158. - 3213.
168	3213. - 3269.
169	3269. - 3327.
170	3327. - 3388.
171	3388. - 3450.
172	3450. - 3514.
173	3514. - 3580.
174	3580. - 3649.
175	3649. - 3720.
176	3720. - 3793.
177	3793. - 3869.
178	3869. - 3948.
179	3948. - 4030.
180	4030. - 4116.
181	4116. - 4204.
182	4204. - 4296.
183	4296. - 4392.
184	4392. - 4492.
185	4492. - 4597.
186	4597. - 4706.
187	4706. - 4820.
188	4820. - 4939.
189	4939. - 5064.
190	5064. - 5195.
191	5195. - 5332.
192	5332. - 5477.
193	5477. - 5630.
194	5630. - 5790.
195	5790. - 5960.
196	5960. - 6140.

Hammer's [illegible] Beal [illegible]

ZONE F

Inner Radius - 1280 feet
Outer Radius - 2936 feet   Compartments - 8

T	Δh	T	Δh	T	Δh
.1	26.7 - 46.2	46	873. - 885.	96	1396. - 1406.
.2	46.2 - 59.6	47	885. - 896.	97	1406. - 1416.
.3	59.6 - 70.6	48	896. - 907.	98	1416. - 1426.
.4	70.6 - 80.0	49	907. - 918.	99	1426. - 1437.
.5	80.0 - 88.5	50	918. - 929.	100	1437. - 1447.
1	88.5 - 146.	51	929. - 940.	101	1447. - 1457.
2	146. - 189.	52	940. - 951.	102	1457. - 1467.
3	189. - 224.	53	951. - 962.	103	1467. - 1477.
4	224. - 255.	54	962. - 972.	104	1477. - 1488.
5	255. - 282.	55	972. - 983.	105	1488. - 1498.
6	282. - 307.	56	983. - 994.	106	1498. - 1508.
7	307. - 331.	57	994. - 1005.	107	1508. - 1518.
8	331. - 353.	58	1005. - 1015.	108	1518. - 1529.
9	353. - 374.	59	1015. - 1026.	109	1529. - 1539.
10	374. - 394.	60	1026. - 1036.	110	1539. - 1549.
11	394. - 413.	61	1036. - 1047.	111	1549. - 1559.
12	413. - 431.	62	1047. - 1057.	112	1559. - 1570.
13	431. - 449.	63	1057. - 1068.	113	1570. - 1580.
14	449. - 466.	64	1068. - 1078.	114	1580. - 1590.
15	466. - 482.	65	1078. - 1089.	115	1590. - 1601.
16	482. - 499.	66	1089. - 1099.	116	1601. - 1611.
17	499. - 514.	67	1099. - 1110.	117	1611. - 1622.
18	514. - 530.	68	1110. - 1120.	118	1622. - 1632.
19	530. - 545.	69	1120. - 1130.	119	1632. - 1642.
20	545. - 560.	70	1130. - 1141.	120	1642. - 1653.
21	560. - 574.	71	1141. - 1151.	121	1653. - 1663.
22	574. - 589.	72	1151. - 1161.	122	1663. - 1674.
23	589. - 603.	73	1161. - 1172.	123	1674. - 1684.
24	603. - 616.	74	1172. - 1182.	124	1684. - 1695.
25	616. - 630.	75	1182. - 1192.	125	1695. - 1705.
26	630. - 644.	76	1192. - 1202.	126	1705. - 1716.
27	644. - 657.	77	1202. - 1213.	127	1716. - 1726.
28	657. - 670.	78	1213. - 1223.	128	1726. - 1737.
29	670. - 683.	79	1223. - 1233.	129	1737. - 1747.
30	683. - 695.	80	1233. - 1243.	130	1747. - 1758.
31	695. - 708.	81	1243. - 1253.	131	1758. - 1769.
32	708. - 721.	82	1253. - 1264.	132	1769. - 1779.
33	721. - 733.	83	1264. - 1274.	133	1779. - 1790.
34	733. - 745.	84	1274. - 1284.	134	1790. - 1801.
35	745. - 757.	85	1284. - 1294.	135	1801. - 1811.
36	757. - 769.	86	1294. - 1304.	136	1811. - 1822.
37	769. - 781.	87	1304. - 1315.	137	1822. - 1833.
38	781. - 793.	88	1315. - 1325.	138	1833. - 1844.
39	793. - 805.	89	1325. - 1335.	139	1844. - 1855.
40	805. - 816.	90	1335. - 1345.	140	1855. - 1865.
41	816. - 828.	91	1345. - 1355.	141	1865. - 1876.
42	828. - 839.	92	1355. - 1365.	142	1876. - 1887.
43	839. - 851.	93	1365. - 1376.	143	1887. - 1898.
44	851. - 862.	94	1376. - 1386.	144	1898. - 1909.
45	862. - 873.	95	1386. - 1396.	145	1909. - 1920.

T	Δh
146	1920. - 1931.
147	1931. - 1942.
148	1942. - 1953.
149	1953. - 1964.
150	1964. - 1975.
151	1975. - 1986.
152	1986. - 1998.
153	1998. - 2009.
154	2009. - 2020.
155	2020. - 2031.
156	2031. - 2043.
157	2043. - 2054.
158	2054. - 2065.
159	2065. - 2077.
160	2077. - 2088.
161	2088. - 2100.
162	2100. - 2111.
163	2111. - 2123.
164	2123. - 2134.
165	2134. - 2146.
166	2146. - 2158.
167	2158. - 2169.
168	2169. - 2181.
169	2181. - 2193.
170	2193. - 2205.
171	2205. - 2217.
172	2217. - 2229.
173	2229. - 2241.
174	2241. - 2253.
175	2253. - 2265.
176	2265. - 2277.
177	2277. - 2289.
178	2289. - 2301.
179	2301. - 2313.
180	2313. - 2325.
181	2325. - 2338.
182	2338. - 2350.
183	2350. - 2362.
184	2362. - 2375.
185	2375. - 2387.
186	2387. - 2400.
187	2400. - 2412.
188	2412. - 2425.
189	2425. - 2438.
190	2438. - 2450.
191	2450. - 2463.
192	2463. - 2476.
193	2476. - 2489.
194	2489. - 2502.
195	2502. - 2515.
196	2515. - 2528.
197	2528. - 2541.
198	2541. - 2554.
199	2554. - 2567.
200	2567. - 2580.
201	2580. - 2594.
202	2594. - 2607.
203	2607. - 2621.
204	2621. - 2634.
205	2634. - 2648.
206	2648. - 2661.
207	2661. - 2675.
208	2675. - 2689.
209	2689. - 2702.
210	2702. - 2716.
211	2716. - 2730.
212	2730. - 2744.
213	2744. - 2758.
214	2758. - 2772.
215	2772. - 2786.
216	2786. - 2801.
217	2801. - 2815.
218	2815. - 2829.
219	2829. - 2844.
220	2844. - 2858.
221	2858. - 2873.
222	2873. - 2888.
223	2888. - 2902.
224	2902. - 2917.
225	2917. - 2932.
226	2932. - 2947.
227	2947. - 2962.
228	2962. - 2977.
229	2977. - 2992.
230	2992. - 3008.
231	3008. - 3023.
232	3023. - 3038.
233	3038. - 3054.
234	3054. - 3069.
235	3069. - 3085.
236	3085. - 3101.
237	3101. - 3117.
238	3117. - 3133.
239	3133. - 3149.
240	3149. - 3165.
241	3165. - 3181.
242	3181. - 3197.
243	3197. - 3213.
244	3213. - 3230.
245	3230. - 3247.
246	3247. - 3263.
247	3263. - 3280.
248	3280. - 3297.
249	3297. - 3314.
250	3314. - 3331.
251	3331. - 3348.
252	3348. - 3365.
253	3365. - 3382.
254	3382. - 3400.
255	3400. - 3417.
256	3417. - 3435.
257	3435. - 3453.
258	3453. - 3471.
259	3471. - 3489.
260	3489. - 3507.
261	3507. - 3525.
262	3525. - 3543.
263	3543. - 3562.
264	3562. - 3580.
265	3580. - 3599.
266	3599. - 3617.
267	3617. - 3636.
268	3636. - 3655.
269	3655. - 3674.
270	3674. - 3694.
271	3694. - 3713.
272	3713. - 3733.
273	3733. - 3752.
274	3752. - 3772.
275	3772. - 3792.
276	3792. - 3812.
277	3812. - 3832.
278	3832. - 3852.
279	3852. - 3873.
280	3873. - 3893.
281	3893. - 3914.
282	3914. - 3935.
283	3935. - 3956.
284	3956. - 3977.
285	3977. - 3999.
286	3999. - 4020.
287	4020. - 4042.
288	4042. - 4063.
289	4063. - 4085.
290	4085. - 4107.
291	4107. - 4130.
292	4130. - 4152.
293	4152. - 4175.
294	4175. - 4197.
295	4197. - 4220.
296	4220. - 4243.
297	4243. - 4267.
298	4267. - 4290.
299	4290. - 4314.
300	4314. - 4338.
301	4338. - 4362.
302	4362. - 4386.
303	4386. - 4410.
304	4410. - 4435.

ZONE F

T	Δh		
305	4435.	-	4459.
306	4459.	-	4484.
307	4484.	-	4510.
308	4510.	-	4535.
309	4535.	-	4560.
310	4560.	-	4586.
311	4586.	-	4612.
312	4612.	-	4638.
313	4638.	-	4665.
314	4665.	-	4691.
315	4691.	-	4718.
316	4718.	-	4745.
317	4745.	-	4773.
318	4773.	-	4800.
319	4800.	-	4828.
320	4828.	-	4856.
321	4856.	-	4884.
322	4884.	-	4913.
323	4913.	-	4942.
324	4942.	-	4971.
325	4971.	-	5000.
326	5000.	-	5029.
327	5029.	-	5059.
328	5059.	-	5089.
329	5089.	-	5120.
330	5120.	-	5150.
331	5150.	-	5181.
332	5181.	-	5212.
333	5212.	-	5244.
334	5244.	-	5276.
335	5276.	-	5308.
336	5308.	-	5340.
337	5340.	-	5373.
338	5373.	-	5406.
339	5406.	-	5439.
340	5439.	-	5473.
341	5473.	-	5507.
342	5507.	-	5541.
343	5541.	-	5576.
344	5576.	-	5611.
345	5611.	-	5646.
346	5646.	-	5682.
347	5682.	-	5718.
348	5718.	-	5755.
349	5755.	-	5791.
350	5791.	-	5829.
351	5829.	-	5866.
352	5866.	-	5904.
353	5904.	-	5943.
354	5943.	-	5982.
355	5982.	-	6021.

Hammer of Bear Creek

ZONE G

Inner Radius - 2936 feet
Outer Radius - 5018 feet   Compartments - 12

T	Δh	T	Δh	T	Δh
.1	57.7 - 99.9	46	1901. - 1926.	96	3077. - 3100.
.2	99.9 - 129.0	47	1926. - 1951.	97	3100. - 3124.
.3	129.0 - 152.6	48	1951. - 1975.	98	3124. - 3147.
.4	152.6 - 173.1	49	1975. - 2000.	99	3147. - 3171.
.5	173.1 - 191.4	50	2000. - 2024.	100	3171. - 3194.
1	191.4 - 317.	51	2024. - 2048.	101	3194. - 3218.
2	317. - 410.	52	2048. - 2073.	102	3218. - 3241.
3	410. - 486.	53	2073. - 2097.	103	3241. - 3265.
4	486. - 552.	54	2097. - 2121.	104	3265. - 3289.
5	552. - 611.	55	2121. - 2144.	105	3289. - 3313.
6	611. - 665.	56	2144. - 2168.	106	3313. - 3336.
7	665. - 716.	57	2168. - 2192.	107	3336. - 3360.
8	716. - 764.	58	2192. - 2216.	108	3360. - 3384.
9	764. - 809.	59	2216. - 2239.	109	3384. - 3408.
10	809. - 852.	60	2239. - 2263.	110	3408. - 3432.
11	852. - 894.	61	2263. - 2287.	111	3432. - 3456.
12	894. - 933.	62	2287. - 2310.	112	3456. - 3480.
13	933. - 972.	63	2310. - 2333.	113	3480. - 3505.
14	972. - 1009.	64	2333. - 2357.	114	3505. - 3529.
15	1009. - 1045.	65	2357. - 2380.	115	3529. - 3553.
16	1045. - 1081.	66	2380. - 2404.	116	3553. - 3578.
17	1081. - 1115.	67	2404. - 2427.	117	3578. - 3602.
18	1115. - 1149.	68	2427. - 2450.	118	3602. - 3627.
19	1149. - 1182.	69	2450. - 2473.	119	3627. - 3651.
20	1182. - 1214.	70	2473. - 2497.	120	3651. - 3676.
21	1214. - 1246.	71	2497. - 2520.	121	3676. - 3700.
22	1246. - 1277.	72	2520. - 2543.	122	3700. - 3725.
23	1277. - 1307.	73	2543. - 2566.	123	3725. - 3750.
24	1307. - 1337.	74	2566. - 2589.	124	3750. - 3775.
25	1337. - 1367.	75	2589. - 2613.	125	3775. - 3800.
26	1367. - 1396.	76	2613. - 2636.	126	3800. - 3825.
27	1396. - 1425.	77	2636. - 2659.	127	3825. - 3850.
28	1425. - 1454.	78	2659. - 2682.	128	3850. - 3875.
29	1454. - 1482.	79	2682. - 2705.	129	3875. - 3901.
30	1482. - 1510.	80	2705. - 2728.	130	3901. - 3926.
31	1510. - 1538.	81	2728. - 2751.	131	3926. - 3952.
32	1538. - 1565.	82	2751. - 2775.	132	3952. - 3977.
33	1565. - 1592.	83	2775. - 2798.	133	3977. - 4003.
34	1592. - 1619.	84	2798. - 2821.	134	4003. - 4029.
35	1619. - 1646.	85	2821. - 2844.	135	4029. - 4055.
36	1646. - 1672.	86	2844. - 2867.	136	4055. - 4080.
37	1672. - 1698.	87	2867. - 2890.	137	4080. - 4107.
38	1698. - 1724.	88	2890. - 2914.	138	4107. - 4133.
39	1724. - 1750.	89	2914. - 2937.	139	4133. - 4159.
40	1750. - 1776.	90	2937. - 2960.	140	4159. - 4185.
41	1776. - 1801.	91	2960. - 2983.	141	4185. - 4212.
42	1801. - 1826.	92	2983. - 3007.	142	4212. - 4238.
43	1826. - 1852.	93	3007. - 3030.	143	4238. - 4265.
44	1852. - 1877.	94	3030. - 3053.	144	4265. - 4292.
45	1877. - 1901.	95	3053. - 3077.	145	4292. - 4318.

T	Δh		
146	4318.	-	4345.
147	4345.	-	4372.
148	4372.	-	4400.
149	4400.	-	4427.
150	4427.	-	4454.
151	4454.	-	4482.
152	4482.	-	4509.
153	4509.	-	4537.
154	4537.	-	4565.
155	4565.	-	4593.
156	4593.	-	4621.
157	4621.	-	4649.
158	4649.	-	4678.
159	4678.	-	4706.
160	4706.	-	4735.
161	4735.	-	4764.
162	4764.	-	4793.
163	4793.	-	4822.
164	4822.	-	4851.
165	4851.	-	4880.
166	4880.	-	4910.
167	4910.	-	4939.
168	4939.	-	4969.
169	4969.	-	4999.
170	4999.	-	5029.
171	5029.	-	5060.
172	5060.	-	5090.
173	5090.	-	5121.
174	5121.	-	5151.
175	5151.	-	5182.
176	5182.	-	5213.
177	5213.	-	5244.
178	5244.	-	5276.
179	5276.	-	5307.
180	5307.	-	5339.
181	5339.	-	5371.
182	5371.	-	5403.
183	5403.	-	5436.
184	5436.	-	5468.
185	5468.	-	5501.
186	5501.	-	5534.
187	5534.	-	5567.
188	5567.	-	5600.
189	5600.	-	5633.
190	5633.	-	5667.
191	5667.	-	5701.
192	5701.	-	5735.
193	5735.	-	5769.
194	5769.	-	5804.
195	5804.	-	5838.

T	Δh		
196	5838.	-	5873.
197	5873.	-	5908.
198	5908.	-	5944.
199	5944.	-	5979.
200	5979.	-	6015.

[illegible] Bear Creek

ZONE H

Inner Radius - 5018 feet
Outer Radius - 8578 feet   Compartments - 12

T	Δh	T	Δh	T	Δh
.1	75.4 - 130.6	45	2363. - 2393.	94	3632. - 3656.
.2	130.6 - 168.6	46	2393. - 2422.	95	3656. - 3680.
.3	168.6 - 199.5	47	2422. - 2450.	96	3680. - 3704.
.4	199.5 - 226.2	48	2450. - 2479.	97	3704. - 3728.
.5	226.2 - 250.1	49	2479. - 2507.	98	3728. - 3751.
1	250.1 - 414.	50	2507. - 2535.	99	3751. - 3775.
2	414. - 534.	51	2535. - 2563.	100	3775. - 3799.
3	534. - 633.	52	2563. - 2591.	101	3799. - 3822.
4	633. - 719.	53	2591. - 2619.	102	3822. - 3846.
5	719. - 795.	54	2619. - 2646.	103	3846. - 3870.
6	795. - 866.	55	2646. - 2673.	104	3870. - 3893.
7	866. - 931.	56	2673. - 2701.	105	3893. - 3917.
8	931. - 992.	57	2701. - 2728.	106	3917. - 3940.
9	992. - 1050.	58	2728. - 2754.	107	3940. - 3964.
10	1050. - 1105.	59	2754. - 2781.	108	3964. - 3987.
11	1105. - 1158.	60	2781. - 2808.	109	3987. - 4010.
12	1158. - 1208.	61	2808. - 2834.	110	4010. - 4034.
13	1208. - 1257.	62	2834. - 2860.	111	4034. - 4057.
14	1257. - 1304.	63	2860. - 2887.	112	4057. - 4081.
15	1304. - 1350.	64	2887. - 2913.	113	4081. - 4104.
16	1350. - 1394.	65	2913. - 2939.	114	4104. - 4127.
17	1394. - 1437.	66	2939. - 2965.	115	4127. - 4151.
18	1437. - 1480.	67	2965. - 2990.	116	4151. - 4174.
19	1480. - 1521.	68	2990. - 3016.	117	4174. - 4197.
20	1521. - 1561.	69	3016. - 3042.	118	4197. - 4220.
21	1561. - 1600.	70	3042. - 3067.	119	4220. - 4244.
22	1600. - 1639.	71	3067. - 3092.	120	4244. - 4267.
23	1639. - 1677.	72	3092. - 3118.	121	4267. - 4290.
24	1677. - 1714.	73	3118. - 3143.	122	4290. - 4313.
25	1714. - 1751.	74	3143. - 3168.	123	4313. - 4336.
26	1751. - 1787.	75	3168. - 3193.	124	4336. - 4360.
27	1787. - 1822.	76	3193. - 3218.	125	4360. - 4383.
28	1822. - 1857.	77	3218. - 3243.	126	4383. - 4406.
29	1857. - 1892.	78	3243. - 3268.	127	4406. - 4429.
30	1892. - 1926.	79	3268. - 3292.	128	4429. - 4452.
31	1926. - 1959.	80	3292. - 3317.	129	4452. - 4475.
32	1959. - 1992.	81	3317. - 3342.	130	4475. - 4498.
33	1992. - 2025.	82	3342. - 3366.	131	4498. - 4522.
34	2025. - 2057.	83	3366. - 3391.	132	4522. - 4545.
35	2057. - 2089.	84	3391. - 3415.	133	4545. - 4568.
36	2089. - 2121.	85	3415. - 3439.	134	4568. - 4591.
37	2121. - 2152.	86	3439. - 3464.	135	4591. - 4614.
38	2152. - 2183.	87	3464. - 3488.	136	4614. - 4637.
39	2183. - 2214.	88	3488. - 3512.	137	4637. - 4660.
40	2214. - 2244.	89	3512. - 3536.	138	4660. - 4684.
41	2244. - 2275.	90	3536. - 3560.	139	4684. - 4707.
42	2275. - 2304.	91	3560. - 3584.	140	4707. - 4730.
43	2304. - 2334.	92	3584. - 3608.	141	4730. - 4753.
44	2334. - 2363.	93	3608. - 3632.	142	4753. - 4776.

T	Δh
143	4776. - 4799.
144	4799. - 4822.
145	4822. - 4846.
146	4846. - 4869.
147	4869. - 4892.
148	4892. - 4915.
149	4915. - 4938.
150	4938. - 4962.
151	4962. - 4985.
152	4985. - 5008.
153	5008. - 5031.
154	5031. - 5055.
155	5055. - 5078.
156	5078. - 5101.
157	5101. - 5124.
158	5124. - 5148.
159	5148. - 5171.
160	5171. - 5194.
161	5194. - 5218.
162	5218. - 5241.
163	5241. - 5264.
164	5264. - 5288.
165	5288. - 5311.
166	5311. - 5335.
167	5335. - 5358.
168	5358. - 5382.
169	5382. - 5405.
170	5405. - 5429.
171	5429. - 5452.
172	5452. - 5476.
173	5476. - 5500.
174	5500. - 5523.
175	5523. - 5547.
176	5547. - 5570.
177	5570. - 5594.
178	5594. - 5618.
179	5618. - 5642.
180	5642. - 5665.
181	5665. - 5689.
182	5689. - 5713.
183	5713. - 5737.
184	5737. - 5761.
185	5761. - 5785.
186	5785. - 5809.
187	5809. - 5833.
188	5833. - 5857.
189	5857. - 5881.
190	5881. - 5905.
191	5905. - 5929.
192	5929. - 5953.
193	5953. - 5977.
194	5977. - 6002.

Bear Creek Only

ZONE I

Inner Radius - 8578 feet
Outer Radius - 12,100 feet   Compartments - 16

T	Δh
.1	135.8 - 235.3
.2	235.3 - 303.8
.3	303.8 - 359.5
.4	359.5 - 407.7
.5	407.7 - 450.8
1	450.8 - 745.
2	745. - 964.
3	964. - 1142.
4	1142. - 1296.
5	1296. - 1435.
6	1435. - 1563.
7	1563. - 1681.
8	1681. - 1792.
9	1792. - 1897.
10	1897. - 1997.
11	1997. - 2093.
12	2093. - 2185.
13	2185. - 2274.
14	2274. - 2360.
15	2360. - 2444.
16	2444. - 2525.
17	2525. - 2604.
18	2604. - 2681.
19	2681. - 2757.
20	2757. - 2831.
21	2831. - 2903.
22	2903. - 2974.
23	2974. - 3044.
24	3044. - 3113.
25	3113. - 3180.
26	3180. - 3247.
27	3247. - 3312.
28	3312. - 3377.
29	3377. - 3440.
30	3440. - 3503.
31	3503. - 3566.
32	3566. - 3627.
33	3627. - 3688.
34	3688. - 3748.
35	3748. - 3808.
36	3808. - 3867.
37	3867. - 3925.
38	3925. - 3983.
39	3983. - 4041.
40	4041. - 4098.
41	4098. - 4154.
42	4154. - 4210.
43	4210. - 4266.
44	4266. - 4321.
45	4321. - 4376.
46	4376. - 4431.
47	4431. - 4485.
48	4485. - 4539.
49	4539. - 4592.
50	4592. - 4646.
51	4646. - 4699.
52	4699. - 4751.
53	4751. - 4804.
54	4804. - 4856.
55	4856. - 4908.
56	4908. - 4960.
57	4960. - 5011.
58	5011. - 5062.
59	5062. - 5113.
60	5113. - 5164.
61	5164. - 5215.
62	5215. - 5266.
63	5266. - 5316.
64	5316. - 5366.
65	5366. - 5416.
66	5416. - 5466.
67	5466. - 5516.
68	5516. - 5565.
69	5565. - 5615.
70	5615. - 5664.
71	5664. - 5713.
72	5713. - 5762.
73	5762. - 5811.
74	5811. - 5860.
75	5860. - 5909.
76	5909. - 5957.
77	5957. - 6006.

Bear Creek only

ZONE J

Inner Radius - 12,100 feet
Outer Radius - 17,070 feet   Compartments - 16

T	Δh
.1	161.3 - 279.4
.2	279.4 - 360.8
.3	360.8 - 426.9
.4	426.9 - 484.1
.5	484.1 - 535.2
1	535.2 - 885.
2	885. - 1143.
3	1143. - 1354.
4	1354. - 1537.
5	1537. - 1701.
6	1701. - 1851.
7	1851. - 1990.
8	1990. - 2121.
9	2121. - 2244.
10	2244. - 2362.
11	2362. - 2474.
12	2474. - 2582.
13	2582. - 2686.
14	2686. - 2787.
15	2787. - 2884.
16	2884. - 2979.
17	2979. - 3071.
18	3071. - 3160.
19	3160. - 3248.
20	3248. - 3333.
21	3333. - 3417.
22	3417. - 3499.
23	3499. - 3580.
24	3580. - 3659.
25	3659. - 3737.
26	3737. - 3813.
27	3813. - 3888.
28	3888. - 3962.
29	3962. - 4035.
30	4035. - 4108.
31	4108. - 4179.
32	4179. - 4249.
33	4249. - 4318.
34	4318. - 4387.
35	4387. - 4454.
36	4454. - 4521.
37	4521. - 4587.
38	4587. - 4653.
39	4653. - 4718.
40	4718. - 4782.
41	4782. - 4846.
42	4846. - 4909.
43	4909. - 4972.
44	4972. - 5034.
45	5034. - 5095.
46	5095. - 5157.
47	5157. - 5217.
48	5217. - 5277.
49	5277. - 5337.
50	5337. - 5396.
51	5396. - 5455.
52	5455. - 5514.
53	5514. - 5572.
54	5572. - 5630.
55	5630. - 5687.
56	5687. - 5744.
57	5744. - 5801.
58	5801. - 5858.
59	5858. - 5914.
60	5914. - 5970.
61	5970. - 6025.

Bear Creek only

ZONE K

Inner Radius - 17,070 feet
Outer Radius - 24,290 feet

Compartments - 18

T	Δh
.1	201.1 - 348.4
.2	348.4 - 449.8
.3	449.8 - 532.3
.4	532.3 - 603.6
.5	603.6 - 667.4
1	667.4 - 1103.
2	1103. - 1425.
3	1425. - 1687.
4	1687. - 1915.
5	1915. - 2118.
6	2118. - 2305.
7	2305. - 2478.
8	2478. - 2640.
9	2640. - 2793.
10	2793. - 2938.
11	2938. - 3077.
12	3077. - 3211.
13	3211. - 3339.
14	3339. - 3464.
15	3464. - 3584.
16	3584. - 3700.
17	3700. - 3814.
18	3814. - 3924.
19	3924. - 4032.
20	4032. - 4137.
21	4137. - 4241.
22	4241. - 4341.
23	4341. - 4440.
24	4440. - 4537.
25	4537. - 4633.
26	4633. - 4726.
27	4726. - 4818.
28	4818. - 4909.
29	4909. - 4998.
30	4998. - 5086.
31	5086. - 5173.
32	5173. - 5259.
33	5259. - 5343.
34	5343. - 5427.
35	5427. - 5509.
36	5509. - 5591.
37	5591. - 5671.
38	5671. - 5751.
39	5751. - 5830.
40	5830. - 5908.
41	5908. - 5985.
42	5985. - 6062.

ZONE L

Bear Creek Only

Inner Radius - 24,290 feet
Outer Radius - 34,560 feet

Compartments - 18

T	Δh		
.1	239.9	-	415.6
.2	415.6	-	536.5
.3	536.5	-	634.9
.4	634.9	-	719.9
.5	719.9	-	795.9
1	795.9	-	1315.
2	1315.	-	1699.
3	1699.	-	2011.
4	2011.	-	2282.
5	2282.	-	2524.
6	2524.	-	2745
7	2745.	-	2950.
8	2950.	-	3142.
9	3142.	-	3324.
10	3324.	-	3496.
11	3496.	-	3661.
12	3661.	-	3819.
13	3819.	-	3971.
14	3971.	-	4118.
15	4118.	-	4260.
16	4260.	-	4397.
17	4397.	-	4531.
18	4531.	-	4661.
19	4661.	-	4788.
20	4788.	-	4912.
21	4912.	-	5033.
22	5033.	-	5152.
23	5152.	-	5268.
24	5268.	-	5382.
25	5382.	-	5493.
26	5493.	-	5603.
27	5603.	-	5711.
28	5711.	-	5817.
29	5817.	-	5921.
30	5921.	-	6024.

ZONE M

Bear Creek only

Inner Radius - 34,560 feet
Outer Radius - 47,450 feet

Compartments - 20

I	Δh		
.1	315.6	-	546.6
.2	546.6	-	705.7
.3	705.7	-	835.0
.4	835.0	-	946.9
.5	946.9	-	1046.9
1	1046.9	-	1730.
2	1730.	-	2234.
3	2234.	-	2645.
4	2645.	-	3000.
5	3000.	-	3318.
6	3318.	-	3609.
7	3609.	-	3879.
8	3879.	-	4131.
9	4131.	-	4369.
10	4369.	-	4596.
11	4596.	-	4812.
12	4812.	-	5019.
13	5019.	-	5218.
14	5218.	-	5411.
15	5411.	-	5597.
16	5597.	-	5777.
17	5777.	-	5953.
18	5953.	-	6123.

TERRAIN COMPUTATION SHEET
ZONES ABC THROUGH M

STATION: ELEVATION: LOCATION:

ZONE	ABC	D	E	F	G	H	I	J	K	L	M	
OUTER RADIUS FEET	175	558	1280	2936	5018	8578	12,100	17,070	24,290	34,560	47,450	
												1
												2
												3
												4
												5
												6
												7
												8
												9
												10
												11
												12
												13
												14
												15
												16
												17
												18
												19
												20

TOTAL CORRECTION (d = 2.00) ________

DENSITY USED ÷ 2.00 (d/2.0) ________

TOTAL CORRECTION (d = ____) ________

ORM GD-10-66

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SAMPLE RECORD

The positions of the key fields are shown in the following sample record.

AN 1012344 80-48454

TI **Manganese and copper geochemistry of interstitial fluids from manganese nodule-rich pelagic sediments of the northeastern equatorial Pacific Ocean**
AU Callender, E.; Bowser, C. J.
CS U. S. Geol. Surv., Reston, Va., USA; Univ. Wis., USA
JN PY Am. J. Sci. 280: 10, 1063-1096p., 1980
CO SN CODEN: AJSCAP ISSN: 0002-9599
SF Subfile: B
CP Country of Publ.: United States
DT BL Doc Type: SERIAL Bibliographic Level: ANALYTIC
LA Languages: English
LT LN Latitude: N000000; N200000 Longitude: W18000 E1400000
DE Descriptors: *Pacific Ocean; *nodules; *mangane *diagenesis; *metals; *sediments; *copper oceanography; geochemistry; pore water ; genes secondary structures; sedimentary structur Equatorial Pacific; Northeast Pacific; remobilizat ; solubility; desorption; precipitation
SH Section Headings: 07 (MARINE GEOLOGY OCEANOGRAPHY)
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Key to Data Fields

AB	Abstract	JN	Journal Name
AN	GEOREF Accession Number	LA	Language
AU	Author	LN	Longitude
BL	Bibliographic Level	LT	Latitude
BN	ISBN	PU	Publisher
CL	Conference Location	PY	Publication Year
CO	CODEN	RN	Report Number
CP	Country of Publication	SF	Subfile
CS	Corporate Source	SH	Section Heading Code
CT	Conference Title	SL	Summary Language
CY	Conference Year	SN	ISSN
DE	Descriptor	TI	Title
DT	Document Type		

Data present in record depends on output format requested type of record.

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GEOREF
Dec 1984

DIALOG File 89: GEOREF - 29-84/Nov (Copr. American Geological Institute)

1251353 84-44617
Current geophysical exploration on Taiwan
Fujiwara, C.
Butsuri-Tanko 37: 2, 34-38p., 1984
CODEN: BTANAF ISSN: 0521-9191
Subfile: B
Country of Publ.: Japan
Doc Type: SERIAL Bibliographic Level: ANALYTIC
Languages: Japanese
illus., 5 tables, sketch map
Descriptors: *Taiwan ; geophysical surveys; economic geology ; surveys; geothermal energy; mineral resources; Asia; reserves; chemical composition; Tatun geothermal area ; Chingshui; Lushan geothermal area; Tuchang-Chingshui geothermal area; Chipen geothermal area; hot springs; thermal waters; production; metal ores; nonmetal deposits
Section Headings: 26 .(ECONOMIC GEOLOGY, GENERAL & MINING)

1250709 84-45082
Geothermal study of Reunion Island; audiomagnetotelluric survey
Benderitter, Y.; Gerard, A.
Cent. Natl. Rech. Sci., Cent. Rech. Geophys., Pouilly sur Loire, FRA; Bur. Rech. Geol. et Miniere, FRA
Journal of Volcanology and Geothermal Research 20: 3-4, 311-332p., 1984
CODEN: JVGRDQ ISSN: 0377-0273 14 REFS.
Subfile: B
Country of Publ.: Netherlands
Doc Type: SERIAL Bibliographic Level: ANALYTIC
Languages: English
illus., sects., sketch maps
In 1979 and 1980, 535 magnetotelluric soundings using a frequency range of 1700 Hz-8 Hz were performed on the island of Reunion for geothermal exploration. Favorable geological conditions for this method were encountered and the results, which were controlled using classical electrical methods on test areas, suggest an unusual distribution of resistivities for lava flows situated above suspected geothermal areas. These layeres progressively decrease in resistivity down to a very conductive layer. In areas where these conductive layers were nearest the surface, detailed studies were carried out showing a close correlation between decreasing resistivity and increasing hydrothermal alteration. In addition, gradient wells reveal high geothermal gradients in such areas. The conductive layers revealed by audiomagnetotelluric soundings seem to correlate with thermal effects creating progressive hydrothermal alteration from an inferred hot-water reservoir up toward the surface.--Modified journal abstract.
Descriptors: *Reunion ; geophysical surveys; economic geology ; magnetotelluric surveys; geothermal energy; Indian Ocean; exploration; audiomagnetotelluric surveys; hydrothermal alteration; metasomatism; conductive materials; resistivity; interpretation
Section Headings: 29 .(ECONOMIC GEOLOGY, ENERGY SOURCES)

1250705 84-42905
Magnetotelluric survey across the active spreading zone in Southwest Iceland
Hersir, G. P.; Bjoernsson, A.; Pedersen, L. B.
Den. Lab. Geophys., Aarhus, DNK; Natl. Energy Auth., ISL
Journal of Volcanology and Geothermal Research 20: 3-4, 253-265p., 1984
CODEN: JVGRDQ ISSN: 0377-0273 35 REFS.
Subfile: B
Country of Publ.: Netherlands
Doc Type: SERIAL Bibliographic Level: ANALYTIC
Languages: English
illus., sketch map
The results of 10 magnetotelluric soundings, performed along a 110-km-long profile crossing the constructive plate boundary in Southwest Iceland, are presented. Apparent resistivities are interpreted by a horizontally stratified Earth model to yield a pseudo cross-section along the profile. The crust-mantle interface contains a high-conductivity layer. The depth to the good conductor increases with age of the crust and the distance from the axial zone. This layer is interpreted as partially molten basalt, at a temperature about 1100 degrees C and a volume fraction of the melt phase in the range 10-20%. The high-conductivity layer probably disappears west of the Borgarnes anticlinal axis, which separates the older (to the west) and younger (to the east) flood basalts in western Iceland, indicating that the temperature below the oldest part of the profile lies below the solidus curve of basalt. Recent seismic crustal investigations in the same area indicate a state of partial melting or a magma chamber, which agrees with the results of the magnetotelluric soundings.--Modified journal abstract.
Descriptors: *Iceland ; geophysical surveys; tectonophysics ; magnetotelluric surveys; plate tectonics; southwestern Iceland; Atlantic Ocean; Europe; spreading centers; crust; mantle; partial melting; interpretation; basalt; basalt family; magmas; resistivity; plate boundaries; geothermal energy; exploration; electrical properties
Section Headings: 18 .(GEOPHYSICS, SOLID EARTH)

1250703 84-45236
Geothermal prospecting by ground radon measurements
Whitehead, N. E.
Inst. Nucl. Sci., Lower Hutt, NZL
Journal of Volcanology and Geothermal Research 20: 3-4, 213-229p., 1984
CODEN: JVGRDQ ISSN: 0377-0273 14 REFS.
Subfile: B
Country of Publ.: Netherlands
Doc Type: SERIAL Bibliographic Level: ANALYTIC
Languages: English

(cont. next page)

illus., 1 table, sketch maps

Radon-222 was measured using Kodak LR-115 film in the soils of 2500 locations near the Ngawha hot springs region. New Zealand, which is being exploited for geothermal power; the object was to determine its usefulness for predicting good drill sites. Unlike other surveys, which have shown large areas with consistent high radon values, anomalies here were scattered, and corresponded mainly with fault lineaments. The results suggested a major previously unnoticed fault. The sampling distance was 50 m. There was a strong seasonal effect on ground radon levels, with summer levels about ten times higher than winter levels. Swamps usually had measured radon levels of near zero because of the slow diffusion of radon in stagnant water, and even thermal areas (mainly in the swamps) usually had low measured values. However, where a fault crossed swamp it was sometimes detected, and with high signal/noise ratio, so swamps should be surveyed. The main strength of the method in regions with impermeable soils (such as at Ngawha), seems to be in detecting or confirming the presence of faults, and possibly (through them) indicating geological structure as deep as 300 m.--Modified journal abstract.

Descriptors: *New Zealand; *isotopes; *radon; *faults ; geophysical surveys; economic geology; distribution ; radioactivity surveys; geothermal energy; Rn-222; detection ; exploration; Australasia; paludal environment; drilling; site exploration; lineaments; soils; seasonal variations; Ngawha; North Island

Section Headings: 29 .(ECONOMIC GEOLOGY, ENERGY SOURCES)

1250101 84-43639

Geophysical studies of active geothermal systems in the northern Basin and Range

Ward, S. H.

Univ. Utah Res. Inst., Earth Sci. Lab., Salt Lake City, UT, USA

The role of heat in the development of energy and mineral resources in the northern Basin and Range Province

Anonymous

Special Report - Geothermal Resources Council 13, 121-157 p., 1983

CODEN: RGRCDJ ISSN: 0149-8991 ISBN: 0-934412-13-8 182 REFS.

Subfile: B

Country of Publ.: United States

Doc Type: SERIAL Bibliographic Level: ANALYTIC

Languages: English

illus., 4 tables, geol. sketch maps, sect.

Descriptors: *Basin and Range Province; *seismology ; geophysical surveys; economic geology; microearthquakes ; heat flow; geothermal energy; epicenters; United States; northern Basin and Range Province; high temperature; exploration; teleseismic signals; refraction; reflection; induced polarization; geophysical methods; P-waves; S-waves ; velocity; arrival time; gravity surveys; magnetic surveys; resistivity; magma chambers; Long Valley; Coso Hot Springs KGRA; Roosevelt Hot Springs KGRA; magnetotelluric surveys; Tuscarora; Beowawe; drilling

Section Headings: 21 .(HYDROGEOLOGY AND HYDROLOGY)

1250098 84-43197

Heat flow in the northern Basin and Range Province

Blackwell, D. D.

South. Methodist Univ., Dep. Geol. Sci., Dallas, TX, USA

The role of heat in the development of energy and mineral resources in the northern Basin and Range Province

Anonymous

Special Report - Geothermal Resources Council 13, 81-92p., 1983

CODEN: RGRCDJ ISSN: 0149-8991 ISBN: 0-934412-13-8 49 REFS.

Subfile: B

Country of Publ.: United States

Doc Type: SERIAL Bibliographic Level: ANALYTIC

Languages: English

illus., 3 tables, geol. sketch map

Descriptors: *Basin and Range Province; *ground water ; geophysical surveys; economic geology; surveys ; heat flow; geothermal energy; United States; northern Basin and Range Province; distribution; exploration; models; refraction; aquifers

Section Headings: 20 .(GEOPHYSICS, APPLIED)

1249614 84-45085

The structure of the Mokai geothermal field based on geophysical observations

Bibby, H. M.; Dawson, G. B.; Rayner, H. H.; Stagpoole, V. M. ; Graham, D. J.

N.Z. Dep. Sci. and Ind. Res., Geophys. Div., Wellington, NZL

Journal of Volcanology and Geothermal Research 20: 1-2, 1-20p., 1984

CODEN: JVGRDQ ISSN: 0377-0273 23 REFS.

Subfile: B

Country of Publ.: Netherlands

Doc Type: SERIAL Bibliographic Level: ANALYTIC

Languages: English

illus., sketch maps

The Mokai geothermal area, about 25 km northwest of Taupo, has only minor thermal manifestations with a natural heat output of about 6 MW. In late 1976 a roving dipole resistivity survey was made in the area surrounding Mokai Springs. Since then an extensive Schlumberger resistivity survey has been made using two spacings (nominally 600 m and 1200 m) covering an area of about 400 km 2 around the Mokai area. Interpretation of all the resistivity data suggests the area of Mokai geothermal field below which high temperatures may be expected at depth, is about 12-16 km 2 . Low resistivities from soundings within this area indicate highly conductive (saline) geothermal fluids at a depth of about 60 m, although

(cont. next page)

below this the resistivity increases, suggesting a lowering of porosity. The interpretation of resistivity measurements suggests a considerable subterranean flow of geothermal fluids northward from the Mokai geothermal field, and a further 76 MW of heat is estimated to be carried by springs and seeps into the deeply incised Waipapa Stream. A second low-resistivity region occurs at the Waikato River, about 12 km north of the geothermal field, with an area of 3-4 km 2 . An estimate of the total heat output of the Mokai geothermal area is 400 + or - 160 MW.--Modified journal abstract.
Descriptors: *New Zealand; *ground water ; geophysical surveys; economic geology; surveys ; electrical surveys; geothermal energy; Mokai Field; Australasia; North Island; resistivity; Taupo volcanic zone; Mokai Springs; interpretation; thermal waters; Waipapa Stream; movement; Waikato River; heat flow; exploration; springs; drilling
Section Headings: 29 .(ECONOMIC GEOLOGY, ENERGY SOURCES)

1248552 84-40684
Gravity and magnetic interpretation of Newberry Volcano, Oregon
Griscom, A.; Roberts, C. W.
U. S. Geol. Surv., USA
Survey of potential geothermal exploration sites at Newberry Volcano, Deschutes County, Oregon
Priest, G. R.(EDITOR); Vogt, B. F.(EDITOR); Black, G. L.(EDITOR)
Oreg. Dep. Geol. and Miner. Ind., Portland, OR, USA
Open File Report - State of Oregon, Department of Geology and Mineral Industries O-83-3, 68-81p., 1983
Subfile: B
Country of Publ.: United States
Doc Type: SERIAL; REPORT Bibliographic Level: ANALYTIC
Languages: English
Availability: Oreg. Dep. Geol. and Miner. Ind., Portland, OR, United States
illus.
Latitude: N433500; N435000 Longitude: W1211000; W1212000
Descriptors: *Oregon; *volcanology ; geophysical surveys; economic geology; volcanoes ; surveys; geothermal energy; Newberry; Deschutes County; United States; gravity surveys; magnetic surveys; density; magnetic properties; physical properties; cores; gravity anomalies; magnetic anomalies; interpretation; airborne methods; geophysical methods; exploration
Section Headings: 29 .(ECONOMIC GEOLOGY, ENERGY SOURCES)

1245318 84-40760
A search for geothermal energy in east-central New York State using seismic methods
Mitronovas, W.
N.Y. State Mus., Albany, NY, USA
Symposium volume; Petroleum geology and energy resources of the northeastern United States
Friedman, G. M.(EDITOR)
Petroleum geology and energy resources of the northeastern United States, Troy, NY, United States, Oct. 14, 1983
Northeastern Geology 5: 3-4, 217-232p., 1983
ISSN: 0194-1453 29 REFS.
Subfile: B
Country of Publ.: United States
Doc Type: SERIAL; CONFERENCE PUBLICATION Bibliographic Level: ANALYTIC
Languages: English
illus., sketch maps, 8 tables
Latitude: N423000; N433000 Longitude: W0730000; W0743000
Descriptors: *New York ; economic geology; geophysical surveys ; geothermal energy; seismic surveys; United States ; seismology; east-central New York; exploration; arrays; P-waves; S-waves; earthquakes; seismicity; observations
Section Headings: 29 .(ECONOMIC GEOLOGY, ENERGY SOURCES)

1242456 84-35559
Geothermal exploration of the Mt. Cayley area, British Columbia
Souther, J. G.
Geol. Surv. Can., Vancouver, BC, CAN
Geological Association of Canada; Mineralogical Association of Canada; Canadian Geophysical Union; joint annual meeting
Geological Association of Canada; Mineralogical Association of Canada; Canadian Geophysical Union; joint annual meeting, Victoria, BC, Canada, May 11-13, 1983
Program with Abstracts - Geological Association of Canada 8 , A63p., 1983
CODEN: PAACD6 ISSN: 0701-8738
Subfile: B
Country of Publ.: Canada
Doc Type: SERIAL; CONFERENCE PUBLICATION Bibliographic Level: ANALYTIC
Languages: English
Descriptors: *British Columbia; *absolute age ; economic geology; dates; geophysical surveys ; geothermal energy; dacites; electrical surveys; Canada; Mount Cayley; exploration; Garibaldi Belt; Pliocene; Neogene; Tertiary; Cenozoic; K/Ar; Pleistocene; Quaternary; thermal waters; fractures; sulfate ion; chloride ion; resistivity; geothermal gradient; hydrochemistry
Section Headings: 29 .(ECONOMIC GEOLOGY, ENERGY SOURCES)

1242455 84-35558
An overview of geothermal research in the Quaternary volcanic belts of Western Canada
Souther, J. G.
Geol. Surv. Can., Vancouver, BC, CAN
Geological Association of Canada; Mineralogical Association of Canada; Canadian Geophysical Union; joint annual meeting
Geological Association of Canada; Mineralogical Association of Canada; Canadian Geophysical Union; joint annual meeting,
(cont. next page)

Victoria, BC, Canada, May 11-13, 1983
Program with Abstracts - Geological Association of Canada 8, A63p., 1983
CODEN: PAACD6 ISSN: 0701-8738
Subfile: B
Country of Publ.: Canada
Doc Type: SERIAL; CONFERENCE PUBLICATION Bibliographic Level: ANALYTIC
Languages: English
Descriptors: *British Columbia ; economic geology ; geothermal energy; Western Canada; Canada; Quaternary; Cenozoic; volcanic belts; Meager Mountain; resources; Canadian Cordillera; thermal waters; hot springs; exploration; Mount Cayley; Garibaldi Belt; resistivity; geothermal gradient; Anahim Belt; soils; magnetotelluric surveys; geophysical surveys; geochemistry; hydrochemistry; Mount Silverthrone; Hoodoo Mountain; Mount Edziza; Stikine ; Coastal Mountains
Section Headings: 29 .(ECONOMIC GEOLOGY, ENERGY SOURCES)

1238770 84-33170
Electrical resistivity survey results from the Anahim volcanic belt, B.C.
Shore, G. A.
Premier Geophys., Richmond, BC, CAN
Geothermal resources; energy on tap!
Hunt, H. H.(chairperson)
Eugene Water and Electr. Board, Eugene, OR, USA
Geothermal Resources Council, 1983 annual meeting, Portland, OR, United States, Oct. 24-27, 1983
Transactions - Geothermal Resources Council 7, 551-554p., 1983
ISSN: 0193-5933 7 REFS.
Subfile: B
Country of Publ.: United States
Doc Type: SERIAL; CONFERENCE PUBLICATION Bibliographic Level: ANALYTIC
Languages: English
illus., sketch maps
Descriptors: *British Columbia ; geophysical surveys ; electrical surveys; Canada; Anahim volcanic belt; resistivity; Quaternary; Cenozoic; volcanic rocks; exploration; volcanoes; Kostal Lake; hot spots; anomalies; Blue River; geothermal energy
Section Headings: 20 .(GEOPHYSICS, APPLIED)

1238728 84-35408
Geologic framework for geothermal energy in the Cascade Range
Duffield, W. A.
U. S. Geol. Surv., USA
Geothermal resources; energy on tap!
Hunt, H. H.(chairperson)
Eugene Water and Electr. Board, Eugene, OR, USA
Geothermal Resources Council, 1983 annual meeting, Portland, OR, United States, Oct. 24-27, 1983
Transactions - Geothermal Resources Council 7, 243-246p., 1983
ISSN: 0193-5933 25 REFS.
Subfile: B
Country of Publ.: United States
Doc Type: SERIAL; CONFERENCE PUBLICATION Bibliographic Level: ANALYTIC
Languages: English
illus., sketch map
Descriptors: *Pacific Coast ; economic geology; tectonophysics; geophysical surveys ; geothermal energy; plate tectonics; heat flow; United States; Cascade Range; subduction zones; volcanoes; exploration; boreholes; volcanism; stratovolcanoes; Juan de Fuca Ridge; airborne methods; geophysical methods; magnetic surveys; Curie point ; Newberry Volcano; Meager Mountain; drilling; Breitenbush Hot Spring; Medicine Lake Volcano
Section Headings: 29 .(ECONOMIC GEOLOGY, ENERGY SOURCES)

1237803 84-30695
Discovery and geology of the Desert Peak geothermal field; a case history
Benoit, W. R.; Hiner, J. E.; Forest, R. T.
Bulletin - Nevada Bureau of Mines and Geology 97, 82p., 1982
CODEN: NBMGBR ISSN: 0097-191X 102 REFS.
Subfile: B
Country of Publ.: United States
Doc Type: SERIAL; MAP Bibliographic Level: MONOGRAPHIC
Languages: English
illus., tables, sects., strat. cols., block diags., sketch maps; 1:62,500; econ. geol. maps
Descriptors: *Nevada ; economic geology ; geothermal energy; Churchill County; United States; geothermal fields; Desert Peak geothermal field; exploration; development; geothermal systems; heat flow; geothermal gradient; wells; geophysical surveys; Hot Springs Mountains; thermal regime
Section Headings: 29 .(ECONOMIC GEOLOGY, ENERGY SOURCES)

1235720 84-30774
Heat flow in the vicinity of the Meager volcanic complex, southern British Columbia
Fairbank, B. D.; Reader, J. F.
Nevin Sadlier-Brown Goodbrand, Vancouver, BC, CAN
Geological Association of Canada; Mineralogical Association of Canada; Canadian Geophysical Union; program with abstracts; joint annual meeting
Brown, A. S.(chairperson)
Geological Association of Canada; Mineralogical Association of Canada; Canadian Geophysical Union; joint annual meeting, Victoria, BC, Canada, May 11-13, 1983
Program with Abstracts - Geological Association of Canada 8
(cont. next page)

DIALOG File 89: GEOREF - 29-84/Nov (Copr. American Geological Institute)

, A21p., 1983
CODEN: PAACD6 ISSN: 0701-8738
Subfile: B
Country of Publ.: Canada
Doc Type: SERIAL; CONFERENCE PUBLICATION Bibliographic Level: ANALYTIC
Languages: English
Descriptors: *British Columbia ; economic geology; geophysical surveys ; geothermal energy; heat flow; Canada; southern British Columbia; Meager Mountain; volcanic rocks; thermal conductivity; heat flux; exploration; patterns
Section Headings: 29 .(ECONOMIC GEOLOGY, ENERGY SOURCES)

1233693 84-26072
Heat flow in the Oregon Cascades
Black, G. L.; Blackwell, D. D.; Steele, J. L.
Oreg. Dep. Geol. and Miner. Ind., Portland, OR, USA; South. Methodist Univ., USA
Geology and geothermal resources of the central Oregon Cascade Range
Priest, G. R.(EDITOR); Vogt, B. F.(EDITOR)
Oreg. Dep. Geol. and Miner. Ind., Portland, OR, USA
Special Paper - Oregon, Department of Geology and Mineral Industries 15, 69-76p., 1983
ISSN: 0278-3703
Subfile: B
Country of Publ.: United States
Doc Type: SERIAL Bibliographic Level: ANALYTIC
Languages: English
illus., 1 table, sketch maps
Descriptors: *Oregon ; geophysical surveys; economic geology ; heat flow; geothermal energy; United States; Cascade Range; central Cascade Range; Willamette Valley; Western Cascade Range; High Cascade Range; gravity anomalies ; conceptual models; hot springs; mathematical models; models; exploration
Section Headings: 29 .(ECONOMIC GEOLOGY, ENERGY SOURCES)

1232651 84-26015
Self-potential measurements at Newberry Crater, Oregon
Fitterman, D. V.; Grette, R. O.
Open-File Report (United States Geological Survey, 1978) 12 p., 1983
CODEN: XGROAG ISSN: 0196-1497 1 REFS.
Subfile: B
Country of Publ.: United States
Doc Type: SERIAL; REPORT Bibliographic Level: MONOGRAPHIC
Languages: English
Report No.: 83-0909
Availability: U. S. Geol. Surv., Open-File Serv. Sect., West. Distrib. Branch, Fed. Cent., Denver, CO, United States
illus., sketch map
Latitude: N433700; N434500 Longitude: W1210700; W1212300
Descriptors: *Oregon ; geophysical surveys; economic geology ; electrical surveys; geothermal energy; Deschutes County; USGS; United States; Newberry Crater; Newberry Volanco; Newberry Caldera; self-potential methods; calderas ; exploration
Section Headings: 29 .(ECONOMIC GEOLOGY, ENERGY SOURCES)

1228928 84-24113
Geothermal exploration at Hill Air Force Base, Ogden, Utah
Glenn, W. E.; Chapman, D. S.; Foley, D.; Capuano, R. M.; Sibbett, B. S.; Cole, D.; Ward, S. H.
Univ. Utah Res. Inst., Earth Sci. Lab., Salt Lake City, UT, USA
The Geological Society of America, Rocky Mountain Section, 33rd annual meeting
Ash, S. R.(chairperson)
Geol. Soc. Am., Boulder, CO, USA
The Geological Society of America, Rocky Mountain Section, 33rd annual meeting, Ogden, UT, United States, May 16-17, 1980
Abstracts with Programs - Geological Society of America 12: 6, 274p., 1980
CODEN: GAAPBC ISSN: 0016-7592
Subfile: B
Country of Publ.: United States
Doc Type: SERIAL; CONFERENCE PUBLICATION Bibliographic Level: ANALYTIC
Languages: English
Descriptors: *Utah ; economic geology; hydrogeology ; geothermal energy; thermal waters; United States; Ogden; exploration; Hill Air Force Base; lineaments; aerial photography; infrared surveys; geophysical surveys; soils; hydrochemistry; hot springs; mixing; aquifers; bedrock; seismic surveys; normal faults; faults; Weber River Delta; temperature
Section Headings: 21 .(HYDROGEOLOGY AND HYDROLOGY)

1228003 84-21208
Geothermal exploration at Glass Buttes, Oregon
Johnson, K. E.; Ciancanelli, E. V.
Cascadia Explor. Corp., Escondido, CA, USA
Oregon Geology 46: 2, 15-18, 20p., 1984
ISSN: 0164-3304 14 REFS.
Subfile: B
Country of Publ.: United States
Doc Type: SERIAL Bibliographic Level: ANALYTIC
Languages: English
illus., 1 table, sketch maps
Descriptors: *Oregon ; economic geology; hydrogeology; geophysical surveys ; geothermal energy; thermal waters; heat flow; United States; exploration; Glass Buttes; Pliocene; Neogene; Tertiary; Cenozoic; Pleistocene; Quaternary; Brothers fault zone; hydrothermal alteration; metasomatism; Basin and Range Province; volcanic rocks; geothermal gradient; observations

(cont. next page)

DIALOG File 89: GEOREF - 29-84/Nov (Copr. American Geological Institute)

Section Headings: 29 .(ECONOMIC GEOLOGY, ENERGY SOURCES)

1227265 84-21078
Time-domain electromagnetic soundings of Newberry Volcano, Deschutes County, Oregon
Fitterman, D. V.
U. S. Geol. Surv., USA
Open-File Report (United States Geological Survey. 1978) 64 p., 1983
CODEN: XGROAG ISSN: 0196-1497 6 REFS.
Subfile: B
Country of Publ.: United States
Doc Type: SERIAL; REPORT Bibliographic Level: MONOGRAPHIC
Languages: English
Report No.: 83-0832
Availability: U. S. Geol. Surv., Open-File Serv. Sect., West. Distrib. Branch, Fed. Cent., Denver, CO, United States
illus., sketch map
Latitude: N433700; N434500 Longitude: W1210700; W1212300
Descriptors: *Oregon; *volcanology ; economic geology; geophysical surveys; volcanoes ; geothermal energy; electromagnetic surveys; Newberry; Deschutes County; USGS; United States; Newberry Caldera; time domain analysis; exploration; electromagnetic sounding; inverse problem
Section Headings: 29 .(ECONOMIC GEOLOGY, ENERGY SOURCES)

1227264 84-21071
Results and preliminary inversion of loop-loop frequency-domain electromagnetic soundings near Medicine Lake, California
Anderson, W. L.; Frischknecht, F. C.; Raab, P. V.; Bradley, J. A.; Turnross, J.
U. S. Geol. Surv., USA
Open-File Report (United States Geological Survey. 1978) 126p., 1983
CODEN: XGROAG ISSN: 0196-1497 12 REFS.
Subfile: B
Country of Publ.: United States
Doc Type: SERIAL; REPORT Bibliographic Level: MONOGRAPHIC
Languages: English
Report No.: 83-0830
Availability: U. S. Geol. Surv., Open-File Serv. Sect., West. Distrib. Branch, Fed. Cent., Denver, CO, United States
illus., sketch map
Latitude: N413000; N414000 Longitude: W1213000; W1214000
Descriptors: *California; *geophysical methods ; economic geology; geophysical surveys; electromagnetic methods ; geothermal energy; electromagnetic surveys; interpretation; Siskiyou County; USGS; United States; Medicine Lake; frequency sounding; inverse problem; automatic data processing; frequency domain analysis; exploration
Section Headings: 29 .(ECONOMIC GEOLOGY, ENERGY SOURCES)

1227262 84-21074
Schlumberger soundings near Newberry Caldera, Oregon
Bisdorf, R. J.
U. S. Geol. Surv., USA
Open-File Report (United States Geological Survey. 1978) 52 p., 1983
CODEN: XGROAG ISSN: 0196-1497 9 REFS.
Subfile: B
Country of Publ.: United States
Doc Type: SERIAL; REPORT Bibliographic Level: MONOGRAPHIC
Languages: English
Report No.: 83-0825
Availability: U. S. Geol. Surv., Open-File Serv. Sect., West. Distrib. Branch, Fed. Cent., Denver, CO, United States
illus., sketch map
Latitude: N433700; N434500 Longitude: W1210700; W1212300
Descriptors: *Oregon; *volcanology ; geophysical surveys; volcanoes; economic geology ; electrical surveys; Newberry; geothermal energy; Deschutes County; USGS; United States; Newberry Caldera; calderas; exploration; electrical sounding; Schlumberger methods; thermal waters
Section Headings: 29 .(ECONOMIC GEOLOGY, ENERGY SOURCES)

1226261 84-21197
Geothermal energy development in Japan
Hirose, Y.
Min. Int. Trade & Ind., Agency Natl. Resour. and Energy, Tokyo, JPN
Proceedings of the Sixth annual geothermal conference and workshop
Atlas Corporation, Santa Cruz, CA, USA
Sixth annual geothermal conference and workshop, Snowbird, UT, United States, June 28-July 1, 1982
Proceedings of the Annual Geothermal Conference and Workshop 6, 6.25 - 6.34p., 1982
Subfile: B
Country of Publ.: United States
Doc Type: SERIAL; CONFERENCE PUBLICATION Bibliographic Level: ANALYTIC
Languages: English
illus., 3 tables, sketch maps
Descriptors: *Japan ; economic geology ; geothermal energy ; Asia; Matsukawa; Tohoku; Ohtake; Kyushu; Hokkaido; gravity surveys; geophysical surveys; Curie point; Landsat; site exploration; hydrogen sulfide; thermal waters
Section Headings: 29 .(ECONOMIC GEOLOGY, ENERGY SOURCES)

DIALOG File 89: GEOREF - 29-84/Nov (Copr. American Geological Institute)

1224641 84-19435
Regional geothermal exploration in Egypt
Morgan, P.; Boulos, F. K.; Swanberg, C. A.
NASA, Lunar Planet. Inst., Houston, TX 77058, USA
39th meeting, European Association of Exploration Geophysicists, Zagreb, Yugoslavia, 1977
Geophysical Prospecting 31: 2, 361-376p., 1983
CODEN: GPPRAR ISSN: 0016-8025 23 REFS.
Subfile: B
Country of Publ.: Netherlands
Doc Type: SERIAL; CONFERENCE PUBLICATION Bibliographic Level: ANALYTIC
Languages: English
Descriptors: *Egypt; *Red Sea ; geophysical surveys; economic geology; hydrogeology ; heat flow; geothermal energy; thermal waters; springs; Africa; geothermal gradient; hot springs; temperature; ground water; geochemistry; Gulf of Suez; geothermal reservoirs; Eastern Desert; Abu Tartur region
Section Headings: 21 .(HYDROGEOLOGY AND HYDROLOGY)

1223405 84-16378
U. S. Bur. Mines, USA
Mineral resources of the Cougar Lakes-Mount Aix Study Area, Yakima and Lewis counties, Washington
Simmons, G. C.; Van Noy, R. M.; Zilka, N. T.
U. S. Geol. Surv., USA
Geological Survey Bulletin (Washington) 1504, 81p., 1983
CODEN: XDIGAS ISSN: 0364-4510 25 REFS.
Subfile: B
Country of Publ.: United States
Doc Type: SERIAL; MAP Bibliographic Level: MONOGRAPHIC
Languages: English
Note: Studies related to wilderness-wilderness areas; individual chapters are cited separately; supersedes Open-file report 74-243, illus., 2400 anal., 8 tables, sketch maps; 1:62,500; colored geol. map
Latitude: N463730; N470000 Longitude: W1210730; W1213000
Descriptors: *Washington; *mineral exploration ; economic geology; programs ; mineral resources; Yakima County; Lewis County; USGS; United States; Cougar Lakes; Mount Aix ; magnetic surveys; geophysical surveys; Eocene; Paleogene ; Tertiary; granites; rhyodacite; andesite-rhyolite family ; volcanic rocks; geochemical methods; geological methods; metal ores; copper ores; geothermal energy; geologic maps; maps; index maps
Section Headings: 26 .(ECONOMIC GEOLOGY, GENERAL & MINING)

1221376 01221376
Thailand
Fournier, R. O.(investigator); Hite, R. J.(investigator); Wynn, J. C.(investigator); Swanson, V. E.(investigator); McCord, J. R.(investigator)
Geological Survey Professional Paper 1375, 290-291p., 1983
CODEN: XGPPA9 ISSN: 0096-0446
Subfile: B
Country of Publ.: United States
Doc Type: SERIAL Bibliographic Level: ANALYTIC
Languages: English
Descriptors: *Thailand ; economic geology; geophysical surveys ; geothermal energy; potash; lignite; electrical surveys; remote sensing; USGS; Asia; carnallite; halides; Khorat Plateau; exploration; models; ground water; resistivity; drilling; organic residues; international cooperation
Section Headings: 26 .(ECONOMIC GEOLOGY, GENERAL & MINING)

1219996 84-15521
Application of resistivity surveying to geothermal exploration in the Puga Valley, India
Singh, S. B.; Drolia, R. K.; Sharma, S. R.; Gupta, M. L.
Natl. Geophys. Res. Inst., Hyderabad 500 007, IND
Geoexploration 21: 1, 1-11p., 1983
CODEN: GEOXAV ISSN: 0016-7142 6 REFS.
Subfile: B
Country of Publ.: Netherlands
Doc Type: SERIAL Bibliographic Level: ANALYTIC
Languages: English
Descriptors: *India ; economic geology; geophysical surveys ; geothermal energy; electrical surveys; Jammu and Kashmir; resistivity; boreholes; geothermal fields; Asia; Puga valley
Section Headings: 21 .(HYDROGEOLOGY AND HYDROLOGY)

1218679 84-12851
Exploration methods and their results in the Humeros de Caldera and Derrumbadas areas of northern Puebla, Mexico
Yanez-Garcia, C.; Garcia-Duran, S.
Com. Fed. Electricidad, MEX
International conference on geothermal energy; Vol. I
Stephens, H. S.(EDITOR); Stapleton, C. A.(EDITOR)
International conference on geothermal energy, Florence, Italy, May 11-14, 1982
Publ: BHRA Fluid Eng.
137-148p., 1982
11 REFS.
Subfile: B
Country of Publ.: United Kingdom
(cont. next page)

DIALOG File 89: GEOREF - 29-84/Nov (Copr. American Geological Institute)

Doc Type: BOOK; CONFERENCE PUBLICATION Bibliographic Level: ANALYTIC
Languages: English
illus., sketch map, geol. sketch map, sect.
Latitude: N185500; N200000 Longitude: W0971000; W0975000
Descriptors: *Mexico ; geophysical surveys; economic geology ; electrical surveys; geothermal energy; anomalies; temperature; gases; geothermal reservoirs; North America; Puebla; Veracruz; Los Humeros; Los Derrumbadas
Section Headings: 29 .(ECONOMIC GEOLOGY, ENERGY SOURCES)

1217516 84-10931
Subsurface temperature distribution in western Czechoslovakia and its mapping for appraising the exploitable sources of geothermal energy
Cermak, V.; Safanda, J.
Czech. Acad. Sci., Geophys. Inst., Prague 14131, CSK
Geothermics and geothermal energy; symposium held during the joint general assemblies of EGS and ESC
Cermak, V.(EDITOR); Haenel, R.(EDITOR)
Czech. Acad. Sci., Geophys. Inst., Prague-Sporilov 14131, CSK
Geothermics and geothermal energy; symposium, Budapest, Hungary, Aug. 1980
Publ: E. Schweizer. Verlagsbuchhandlung (Naegele u. Obermiller)
265-270p., 1982
ISBN: 3-510-65109-X 5 REFS.
Subfile: B
Country of Publ.: Germany, Federal Republic of
Doc Type: BOOK; CONFERENCE PUBLICATION Bibliographic Level: ANALYTIC
Languages: English
illus., 1 table, geol. sketch map
Latitude: N484000; N510000 Longitude: E0185000; E0122000
Descriptors: *Czechoslovakia ; economic geology; geophysical surveys ; geothermal energy; heat flow; thermal conductivity; temperature; depth; isopleth maps; maps; exploration; tectonics; rift zones; sedimentary basins; Cretaceous; Mesozoic; Europe; Bohemia-Moravia System; Bohemian Massif; Bohemian Basin; Czech Erzgebirge; Czech Sudeten Mountains; structural geology; Krusne-Hory rift zone
Section Headings: 21 .(HYDROGEOLOGY AND HYDROLOGY)

1217513 84-10921
Geothermal exploration in the hot spring area, Baden-Schinznach, Switzerland
Bodmer, P.; Jaffe, F.; Rybach, L.; Schneider, J. F.; Tripet, J. P.; Vuataz, F.; Werner, D.
Swiss Fed. Inst. Technol., Zuerich, CHE; Univ. Geneva, CHE
Geothermics and geothermal energy; symposium held during the joint general assemblies of EGS and ESC
Cermak, V.(EDITOR); Haenel, R.(EDITOR)
Czech. Acad. Sci., Geophys. Inst., Prague-Sporilov 14131, CSK
Geothermics and geothermal energy; symposium, Budapest, Hungary, Aug. 1980
Publ: E. Schweizer. Verlagsbuchhandlung (Naegele u. Obermiller)
241-248p., 1982
ISBN: 3-510-65109-X 7 REFS.
Subfile: B
Country of Publ.: Germany, Federal Republic of
Doc Type: BOOK; CONFERENCE PUBLICATION Bibliographic Level: ANALYTIC
Languages: English
illus., 1 table, geol. sketch map
Latitude: N472500; N473500 Longitude: E0082700; E0081000
Descriptors: *Switzerland ; hydrogeology; economic geology ; geophysical surveys ; thermal waters; geothermal energy; heat flow; geothermal fields; hot springs; medicinal waters; boreholes; Jurassic; Mesozoic; faults; mathematical models; models; geothermal systems; Swiss Jura Mountains; Swiss Molasse Basin; springs; ground water; stratigraphy; Europe; Baden-Schinznach Basin; thrust planes
Section Headings: 21 .(HYDROGEOLOGY AND HYDROLOGY)

1214870 84-08477
Impact of hydrothermally altered soil on vegetation as a tool in geothermal exploration
Camacho, S.; del Rio, L.; Sanchez, L.; Gonzalez, J.
Univ. Nac. Auton. Mex., Inst. Geofis., Mexico City, MEX; IBM Mex., MEX
Sanchez Pena, M.(chairperson); Cook, J. J.(chairperson)
Sixteenth international symposium on remote sensing of environment, Buenos Aires, Argentina, June 2-9, 1982
Proceedings of the International Symposium on Remote Sensing of Environment 16, Vol. 1, 145-153p., 1982
CODEN: PISEDM ISSN: 0275-5505 7 REFS.
Subfile: B
Country of Publ.: International
Doc Type: SERIAL; CONFERENCE PUBLICATION Bibliographic Level: ANALYTIC
Languages: English
illus., 1 table
Latitude: N193500; N194500 Longitude: W0972000; W0973500
Descriptors: *Mexico; *soils ; economic geology; geophysical surveys; surveys ; geothermal energy; remote sensing; vegetation; North America; hydrothermal alteration ; metasomatism; materials; Los Humeros Caldera; exploration
Section Headings: 29 .(ECONOMIC GEOLOGY, ENERGY SOURCES)

1211906 84-08419
Lab. Geocienc. e Technol. Azores, PRT
Preliminary report on audio-magnetotelluric survey on Sao Miguel Island, Azores, Portugal
Hoover, D.; Amaral, R.; Broker, M.

(cont. next page)

DIALOG File 89: GEOREF - 29-84/Nov (Copr. American Geological Institute)

U. S. Geol. Surv., Denver, CO, USA
Open-File Report (United States Geological Survey. 1978) 111p., 1983
CODEN: XGROAG ISSN: 0196-1497 13 REFS.
Subfile: B
Country of Publ.: United States
Doc Type: SERIAL; REPORT; MAP Bibliographic Level: MONOGRAPHIC
Languages: English
Report No.: 83-0441
Availability: U. S. Geol. Surv., Open-File Serv. Sect., West. Distrib. Branch, Denver Fed. Cent., Lakewood, CO, United States
illus., sketch map; 1:50,000; geophys. surv. maps
Latitude: N373000; N380000 Longitude: W0272000; W0280000
Descriptors: *Azores ; economic geology; geophysical surveys ; geothermal energy; magnetotelluric surveys; USGS; Atlantic Ocean; Sao Miguel Island; geophysical maps; maps; audiomagnetotelluric methods; fumaroles; hot springs; calderas; international cooperation; exploration; thermal waters
Section Headings: 29 .(ECONOMIC GEOLOGY, ENERGY SOURCES)

1211125 84-08432
McCoy area, Nevada; geothermal reservoir assessment case history, northern Basin and Range; final report; 1 October 1978 - 30 September 1982
Pilkington, H. D.
Amax Explor., Golden, CO, USA
68p., 1982
15 REFS.
Subfile: B
Doc Type: REPORT Bibliographic Level: MONOGRAPHIC
Languages: English
Report No.: DOE/ET/27010-1
Availability: U. S. Dep. Energy, Div. Energy Technol., United States
illus., sketch maps
Latitude: N393000; N395000 Longitude: W1173000; W1182000
Descriptors: *Nevada; *soils; *geochemistry ; economic geology; surveys ; geothermal energy; Churchill County; United States; north-central Nevada; Augusta Mountains; Clan Alpine Mountains; New Pass Range; exploration; geophysical surveys; heat flow; hydrochemistry; thermal waters; magnetic surveys; gravity surveys; electrical surveys; seismic surveys; electromagnetic surveys; magnetotelluric surveys; Permian; Paleozoic; Pennsylvanian; resources
Section Headings: 29 .(ECONOMIC GEOLOGY, ENERGY SOURCES)

1209620 84-03784
Seismic array noise studies at Roosevelt Hot Springs, Utah geothermal areadiscussion
Asten, M. W.
Broken Hill Pty. Co., Brisbane, Qld., AUS
Geophysics 48: 11, 1560p., 1983
CODEN: GPYSA7 ISSN: 0016-8033 7 REFS.
Subfile: B
Country of Publ.: United States
Doc Type: SERIAL Bibliographic Level: ANALYTIC
Languages: English
Note: For reference to paper by Douze, E. J., and Laster, S. J., see Geophysics, Vol. 44, p. 1570, 1979.
Latitude: N381500; N385000 Longitude: W1122000; W1133000
Descriptors: *Utah; *geophysical methods ; geophysical surveys; economic geology; seismic methods ; seismic surveys; geothermal energy; interpretation; Beaver County; United States; Roosevelt Hot Springs KGRA; noise; exploration
Section Headings: 29 .(ECONOMIC GEOLOGY, ENERGY SOURCES)

1208069 84-03911
Geothermal prospecting with Shallo-Temp surveys
LeSchack, L. A.; Lewis, J. E.
LeSchack Assoc., Long Key, FL, USA; McGill Univ., Dep. Geogr., CAN
Geophysics 48: 7, 975-996p., 1983
CODEN: GPYSA7 ISSN: 0016-8033 40 REFS.
Subfile: B
Country of Publ.: United States
Doc Type: SERIAL Bibliographic Level: ANALYTIC
Languages: English
illus., 5 tables, sketch maps
The Shallo-Temp survey is an inexpensive and rapid ''first look'' geophysical technique. The technique is based on making many soil temperature measurements at 2-m depths over a given exploration area and correcting these measurements for the effects of elevation and surface geologic and meteorologic conditions. Corrections for surface conditions are made with an ''annual wave correction model.'' The difference between the measured and computed 2-m temperature data represents effects of geothermal heat flow. A Shallo-Temp residual map is compared both to a 2-m temperature map for a specific date (September, 1977) and to a mean annual 2-m temperature map for the Coso known geothermal resource area producing the same anomaly pattern in each case. Case studies at Upsal Hogback in Nevada, and Animus Valley in New Mexico support the applicability of the Shallo-Temp technique throughout the Basin and Range Province. The technique developed is not designed to replace reconnaissance drilling but rather help focus standard reconnaissance programs.--Modified journal abstract.
Descriptors: *California; *Nevada; *New Mexico ; economic geology; geophysical surveys ; geothermal energy; heat flow ; exploration; Coso geothermal field; Shallo-Temp surveys; soils; temperature; United States; temperature surveys; applications; Upsal Hogback; Animus Valley; techniques; Basin and Range Province; Coso KGRA
Section Headings: 29 .(ECONOMIC GEOLOGY, ENERGY SOURCES)

DIALOG File 89: GEOREF - 29-84/Nov (Copr. American Geological Institute)

1204552 83-59605
Thermal infrared survey of Sunlight Basin, Park County, Wyoming
Vice, D. H.; Crowley, J. P.; Vice, M. A.
Consult., Billings, MT, USA; Crowley Environ. and Plann. Assoc., CAN
AAPG Rocky Mountain Section meeting
Anonymous
AAPG Rocky Mountain Section meeting, Billings, MT, United States, Sept. 18-21, 1983
AAPG Bulletin 67: 8, 1359p., 1983
CODEN: AABUD2 ISSN: 0149-1423
Subfile: B
Country of Publ.: United States
Doc Type: SERIAL; CONFERENCE PUBLICATION Bibliographic Level: ANALYTIC
Languages: English
Latitude: N440000; N450000 Longitude: W1085000; W1103000
Descriptors: *Wyoming ; geophysical surveys; economic geology; hydrogeology ; remote sensing; infrared surveys; geothermal energy; thermal waters; Park County; United States; Sunlight Basin; Sulphur Camp; Rocky Mountains; North America; fumaroles; exploration; lineaments; airborne methods; geophysical methods; thermal emission
Section Headings: 29 .(ECONOMIC GEOLOGY, ENERGY SOURCES)

1203406 83-59289
Precision gravity network for monitoring the Lassen geothermal system, Northern California
Jachens, R. C.; Saltus, R. W.
Open-File Report (United States Geological Survey. 1978) 17 p., 1983
CODEN: XGROAG ISSN: 0196-1497 10 REFS.
Subfile: B
Country of Publ.: United States
Doc Type: SERIAL; REPORT; MAP Bibliographic Level: MONOGRAPHIC
Languages: English
Report No.: 83-0193
Availability: U. S. Geol. Surv., Open-File Serv. Sect., West. Distrib. Branch, Denver Fed. Cent., Lakewood, CO, United States
1:62,500; gravity surv. map
Latitude: N402000; N403600 Longitude: W1211100; W1213800
Descriptors: *California ; economic geology; geophysical surveys ; geothermal energy; gravity surveys; Lassen County ; Shasta County; Plumas County; USGS; United States; Northern California; Lassen Volcanic National Park; geothermal systems; exploration; networks; monitoring; accuracy; gravity survey maps; maps
Section Headings: 29 .(ECONOMIC GEOLOGY, ENERGY SOURCES)

1200780 83-55344
Experience with the EM-60 electromagnetic system for geothermal exploration in Nevada
Wilt, M.; Goldstein, N. E.; Stark, M.; Haught, J. R.; Morrison, H. F.
Lawrence Berkeley Lab., Earth Sci. Lab., Berkeley, CA, USA; Union Oil Co., USA
Geophysics 48: 8, 1090-1101p., 1983
CODEN: GPYSA7 ISSN: 0016-8033 24 REFS.
Subfile: B
Country of Publ.: United States
Doc Type: SERIAL Bibliographic Level: ANALYTIC
Languages: English
illus., sketch maps
Descriptors: *Nevada; *geophysical methods ; geophysical surveys; economic geology; electromagnetic methods ; electromagnetic surveys; geothermal energy; applications; Churchill County; Lander County; Pershing County; United States; Panther Canyon; Grass Valley; Soda Lakes; McCoy; Great Basin; Fallon; Winnemucca; exploration; frequency sounding; frequency domain analysis
Section Headings: 29 .(ECONOMIC GEOLOGY, ENERGY SOURCES)

1199822 83-55178
Geophysical exploration for geothermal prospects west of Albuquerque, New Mexico
Jiracek, G. R.; Gustafson, E. P.; Parker, M. D.
San Diego State Univ., San Diego, CA, USA; Law Eng. Test. Co., USA
Albuquerque country II
Callender, J. F.(EDITOR); Grambling, J. A.(EDITOR); Wells, S. G.(EDITOR)
Univ. N.M., Dep. Geol., Albuquerque, NM, USA
New Mexico Geological Society, 33rd annual field conference; Albuquerque country II, Albuquerque, NM, United States, Nov. 4-6, 1982
Guidebook - New Mexico Geological Society 33, 333-342p., 1982
CODEN: NMGGA5 ISSN: 0077-8567
Subfile: B
Country of Publ.: United States
Doc Type: SERIAL; CONFERENCE PUBLICATION Bibliographic Level: ANALYTIC
Languages: English
illus., sketch maps
Latitude: N350000; N350000 Longitude: W1060000; W1060000
Descriptors: *New Mexico ; economic geology; geophysical surveys ; geothermal energy; surveys; Bernalillo County; United States; central New Mexico; Albuquerque region; Basin and Range Province; Llano de Atrisco region; geothermal gradient; resistivity; magnetic surveys; models; distribution; prediction
(cont. next page)

Section Headings: 29 .(ECONOMIC GEOLOGY, ENERGY SOURCES)

1199428 83-55343
Deep electromagnetic sounding in central Nevada
Wilt, M.; Goldstein, N. E.; Haught, J. R.; Morrison, H. F.
Lawrence Berkeley Lab., Berkeley, CA, USA
Society of Exploration Geophysicists, 52nd annual meeting
Society of Exploration Geophysicists, 52nd annual meeting, Dallas, TX, United States, Oct. 17-21, 1982
Geophysics 48: 4, 479p., 1983
CODEN: GPYSA7 ISSN: 0016-8033
Subfile: B
Country of Publ.: United States
Doc Type: SERIAL; CONFERENCE PUBLICATION Bibliographic Level: ANALYTIC
Languages: English
Latitude: N405000; N410000 Longitude: W1173000; W1174500
Descriptors: *Nevada ; geophysical surveys; economic geology ; electromagnetic surveys; geothermal energy; Humboldt County; United States; Winnemucca; Buena Vista Valley; electrical conductivity; automatic data processing; crust; exploration
Section Headings: 29 .(ECONOMIC GEOLOGY, ENERGY SOURCES)

1199427 83-55211
Detection of geothermal microtremors using seismic arrays
Liaw, A.; Suyenaga, W.
Arco Oil and Gas, USA
Society of Exploration Geophysicists, 52nd annual meeting
Society of Exploration Geophysicists, 52nd annual meeting, Dallas, TX, United States, Oct. 17-21, 1982
Geophysics 48: 4, 479p., 1983
CODEN: GPYSA7 ISSN: 0016-8033
Subfile: B
Country of Publ.: United States
Doc Type: SERIAL; CONFERENCE PUBLICATION Bibliographic Level: ANALYTIC
Languages: English
Latitude: N381500; N385000 Longitude: W1122000; W1133000
Descriptors: *Basin and Range Province; *Utah; *Nevada; *geophysical methods; *seismology ; geophysical surveys; economic geology; seismic methods; microearthquakes ; seismic surveys; geothermal energy; applications; geothermal systems; Eureka County; Beaver County; United States; passive methods; exploration; Beowawe; Roosevelt Hot Springs KGRA; arrays
Section Headings: 29 .(ECONOMIC GEOLOGY, ENERGY SOURCES)

1199424 83-55172
Search for geothermal heat sources in the Oregon Cascades by means of teleseismic P-residual technique
Iyer, H. M.; Rite, A.; Green, S. M.
Chevron Int. Oil Co., USA; U. S. Geol. Surv., USA
Society of Exploration Geophysicists, 52nd annual meeting
Society of Exploration Geophysicists, 52nd annual meeting, Dallas, TX, United States, Oct. 17-21, 1982
Geophysics 48: 4, 478p., 1983
CODEN: GPYSA7 ISSN: 0016-8033
Subfile: B
Country of Publ.: United States
Doc Type: SERIAL; CONFERENCE PUBLICATION Bibliographic Level: ANALYTIC
Languages: English
Latitude: N400000; N510000 Longitude: W1203000; W1230000
Descriptors: *Oregon; *geophysical methods ; economic geology; geophysical surveys; seismic methods ; geothermal energy; heat flow; applications; Clakamas County; Hood River County; United States; Cascade Range; heat sources; P-waves; teleseismic signals; passive methods; volcanoes; Mount Hood; Newberry; crust; upper mantle; mantle; velocity structure
Section Headings: 29 .(ECONOMIC GEOLOGY, ENERGY SOURCES)

1199224 83-55255
Geotermalna energija novi vid energije u SR Srbiji
Geothermal energy; a new type of energy in Serbia
Paradanin, L.; Dajic, N.
Univ. Belgrade, Belgrade, YUG
Zbornik Radova Rudarsko-Geoloskog Fakulteta, Universitet u Beogradu 22, 459-474p., 1980
CODEN: ZRGFAX ISSN: 0409-0233 7 REFS.
Subfile: B
Country of Publ.: Yugoslavia
Doc Type: SERIAL Bibliographic Level: ANALYTIC
Languages: Serbian Summary Languages: English
illus., 2 tables, sketch maps
Descriptors: *Yugoslavia ; economic geology; geophysical surveys ; geothermal energy; heat flow; Europe; Serbia; Vovodina region; temperature; pre-Pliocene complex; distribution; design; energy conversion; programs; exploration; development; methods; utilization; applications
Section Headings: 29 .(ECONOMIC GEOLOGY, ENERGY SOURCES)

1198872 83-52760
Review of heat flow in the Southeast United States; tectonic implications
Costain, J.; Glover, L., III
Va. Polytech. Inst. and State Univ., Blacksburg, VA, USA
Geological Society of America, 93rd annual meeting
93rd annual meeting of the Geological Society of America, Atlanta, GA, United States, Nov. 17-20, 1980
Abstracts with Programs - Geological Society of America 12, 407p., 1980
CODEN: GAAPBC ISSN: 0016-7592
Subfile: B
Country of Publ.: United States
(cont. next page)

DIALOG File 89: GEOREF - 29-84/Nov (Copr. American Geological Institute)

Doc Type: SERIAL; CONFERENCE PUBLICATION Bibliographic Level: ANALYTIC
Languages: English
Descriptors: *Virginia; *North Carolina; *South Carolina; *Georgia; *Atlantic Coastal Plain; *New Jersey ; tectonophysics ; heat flow; United States; North America; Piedmont; New England; temperature; geothermal energy; possibilities; southeastern United States; exploration; resources; granites; reflection methods; seismic methods; seismic surveys; geophysical surveys; basement
Section Headings: 18 .(GEOPHYSICS, SOLID EARTH)

1198237 83-53480
Model of the geothermal system in southwestern South Dakota from gravity and aeromagnetic studies
Hildenbrand, T. G.; Kucks, R. P.
U. S. Geol. Surv., USA
Abstracts of papers presented at the 52nd annual international SEG meeting
Anonymous
Society of Exploration Geophysicists, 52nd annual meeting, Dallas, TX, United States, Oct. 17-21, 1982
Geophysics 48: 4, 454p., 1983
CODEN: GPYSA7 ISSN: 0016-8033
Subfile: B
Country of Publ.: United States
Doc Type: SERIAL; CONFERENCE PUBLICATION Bibliographic Level: ANALYTIC
Languages: English
Latitude: N431500; N443500 Longitude: W1023000; W1040500
Descriptors: *South Dakota ; economic geology; geophysical surveys ; geothermal energy; surveys; Custer County; United States; Black Hills; gravity anomalies; magnetic anomalies; faults; density; airborne methods; geophysical methods; exploration
Section Headings: 21 .(HYDROGEOLOGY AND HYDROLOGY)

1197282 83-55337
Exploration of the Okoy geothermal field, Negros, Philippines
Ward, C. W.
Kingston Reynolds Thom & Allardice, Auckland, NZL
Proceedings of the New Zealand geothermal workshop 1980
Anonymous
1980 New Zealand geothermal workshop, Auckland, New Zealand, Nov. 3-5, 1980
Publ: Univ. Auckland Geotherm. Inst.
105-108p., 1980
ISBN: 0-86869-015-5 14 REFS.
Subfile: B
Country of Publ.: New Zealand
Doc Type: BOOK; CONFERENCE PUBLICATION Bibliographic Level: ANALYTIC
Languages: English
2 tables, sketch maps
Descriptors: *Philippine Islands; *ground water ; economic geology; geophysical surveys; surveys ; geothermal energy; electrical surveys; Okoy Field; Negros; Asia; exploration ; resistivity; springs; drilling; chemical composition
Section Headings: 29 .(ECONOMIC GEOLOGY, ENERGY SOURCES)

1195335 83-50207
Inversion results of time-domain electromagnetic soundings near Medicine Lake, California, geothermal area
Anderson, W. L.; Frischknecht, F. C.; Raab, P. V.; Bradley, J. A.; Turnross, J.; Buckley, T. W.
U. S. Geol. Surv., USA
Open-File Report (United States Geological Survey. 1978) 31 p., 1983
CODEN: XGROAG ISSN: 0196-1497 9 REFS.
Subfile: B
Country of Publ.: United States
Doc Type: SERIAL; REPORT Bibliographic Level: MONOGRAPHIC
Languages: English
Report No.: 83-0233
Availability: U. S. Geol. Surv., Open-File Serv. Sect., West. Distrib. Branch, Denver Fed. Cent., Lakewood, CO, United States
illus., sketch map
Latitude: N413000; N414000 Longitude: W1213000; W1214000
Descriptors: *California; *geophysical methods; *automatic data processing ; economic geology; geophysical surveys; electromagnetic methods ; geothermal energy; electromagnetic surveys; interpretation; Siskiyou County; USGS; United States; Medicine Lake; exploration; time domain analysis; inverse problem
Section Headings: 29 .(ECONOMIC GEOLOGY, ENERGY SOURCES)

1193978 83-50244
Geothermal resource assessment of Canon City, Colorado area
Zacharakis, T. G.; Pearl, R. H.
Resource Series - Colorado Geological Survey, Department of Natural Resources, State of Colorado 20, 81p., 1982
CODEN: RSSSDK ISSN: 0197-7490 47 REFS.
Subfile: B
Country of Publ.: United States
Doc Type: SERIAL; REPORT Bibliographic Level: MONOGRAPHIC
Languages: English
Report No.: DOE/ET/28365-22
Availability: Colo. Geol. Surv., Dep. Nat. Resour., Denver, CO, United States
illus., 9 tables, geol. sketch maps
Descriptors: *Colorado ; economic geology ; geothermal energy; Fremont County; United States; Canon City; programs; resources; exploration; possibilities; hot springs; geophysical surveys; surveys
Section Headings: 29 .(ECONOMIC GEOLOGY, ENERGY SOURCES)

DIALOG File 89: GEOREF - 29-84/Nov (Copr. American Geological Institute)

1193959 83-50435
Introduction
Priest, G. R.
Oreg. Dep. Geol. Miner. Ind., Portland, OR, USA
Geology and geothermal resources of the Cascades, Oregon
Priest, G. R.(EDITOR); Vogt, B. F.(EDITOR)
Oreg. Dep. Geol. Miner. Ind., Portland, OR, USA
Open File Report - State of Oregon, Department of Geology and Mineral Industries O-82-7, 1-4p., 1982
Subfile: B
Country of Publ.: United States
Doc Type: SERIAL Bibliographic Level: ANALYTIC
Languages: English
1 table, sketch map
Latitude: N420000; N460000 Longitude: W1210000; W1240000
Descriptors: *Oregon ; economic geology; geophysical surveys ; geothermal energy; heat flow; United States; exploration; resources; Cascade Range; central Cascade Range
Section Headings: 29 .(ECONOMIC GEOLOGY, ENERGY SOURCES)

1192281 83-50352
Geothermal and dissolved methane resources of the northern Gulf of Mexico Basin
Jones, P. H.
P. H. Jones Hydrogeol., Baton Rouge, LA, USA
The Interstate Oil Compact Commission Committee Bulletin 24 : 2, 28-51p., 1982
CODEN: IOCBAV ISSN: 0020-9732 23 REFS.
Subfile: B
Country of Publ.: United States
Doc Type: SERIAL Bibliographic Level: ANALYTIC
Languages: English
illus., 2 tables, geol. sketch maps
Descriptors: *Texas; *Louisiana; *Mississippi; *Gulf of Mexico ; economic geology; geophysical surveys ; geothermal energy; heat flow; United States; methane; organic materials; exploration; resources; P-T conditions
Section Headings: 29 .(ECONOMIC GEOLOGY, ENERGY SOURCES)

1192025 83-50246
Geothermal resource assessment of western San Luis Valley, Colorado
Zacharakis, T. G.; Pearl, R. H.; Ringrose, C. D.
Colo. Geol. Surv., Dep. Nat. Resour., Denver, CO, USA
Resource Series - Colorado Geological Survey, Department of Natural Resources, State of Colorado 19, 71p., 1983
CODEN: RSSSDK ISSN: 0197-7490 75 REFS.
Subfile: B
Country of Publ.: United States
Doc Type: SERIAL; REPORT Bibliographic Level: MONOGRAPHIC
Languages: English
Report No.: DOE/ET/28365-25
Availability: Colo. Geol. Surv., Dep. Nat. Resour., Denver, CO, United States
illus., 13 tables, geol. sketch maps
Latitude: N373500; N374000 Longitude: W1062000; W1062500
Descriptors: *Colorado; *geochemistry; *hydrology; *soils ; economic geology; geophysical surveys; surveys ; geothermal energy; electrical surveys; Rio Grande County; United States; Shaw Warm Springs; resources; possibilities; temperature; resistivity; western San Luis Valley; thermal waters; heat flow; south central Colorado; exploration; stratigraphy; tectonics; anomalies; trace elements; Oligocene; Paleogene; Tertiary; Cenozoic; Masonic Park Tuff; Fish Canyon Tuff; Carpenter Ridge Tuff
Section Headings: 29 .(ECONOMIC GEOLOGY, ENERGY SOURCES)

1192024 83-50229
Geothermal resource assessment of Hot Sulphur Springs, Colorado
Pearl, R. H.; Zacharakis, T. G.; Ringrose, C. D.
Colo. Geol. Surv., Dep. Nat. Resour., Denver, CO, USA
Resource Series - Colorado Geological Survey, Department of Natural Resources, State of Colorado 23, 50p., 1982
CODEN: RSSSDK ISSN: 0197-7490 40 REFS.
Subfile: B
Country of Publ.: United States
Doc Type: SERIAL; REPORT Bibliographic Level: MONOGRAPHIC
Languages: English
Report No.: DOE/ET/28365-23
Availability: Colo. Geol. Surv., Dep. Nat. Resour., Denver, CO, United States
illus., 11 tables, sketch maps
Latitude: N400500; N401000 Longitude: W1060500; W1061000
Descriptors: *Colorado; *geochemistry; *hydrology; *soils ; economic geology; geophysical surveys; surveys ; geothermal energy; electrical surveys; Grand County; Morrison Formation; Dakota Formation; Benton Formation; Niobrara Formation; Pierre Formation; Middle Park Formation; United States; Hot Sulphur Springs; resources; possibilities; temperature; resistivity; Middle Park; thermal waters; heat flow; western Colorado; exploration; stratigraphy; tectonics; trace elements; anomalies; Tertiary; Cenozoic; Cretaceous; Mesozoic
Section Headings: 29 .(ECONOMIC GEOLOGY, ENERGY SOURCES)

1192023 83-50230
Geothermal resource assessment of the Steamboat-Routt Hot Springs area, Colorado
Pearl, R. H.; Zacharakis, T. G.; Ringrose, C. D.
Colo. Geol. Surv., Dep. Nat. Resour., Denver, CO, USA
Resource Series - Colorado Geological Survey, Department of Natural Resources, State of Colorado 22, 86p., 1983
CODEN: RSSSDK ISSN: 0197-7490 55 REFS.
Subfile: B

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DIALOG File 89: GEOREF - 29-84/Nov (Copr. American Geological Institute)

Country of Publ.: United States
Doc Type: SERIAL; REPORT Bibliographic Level: MONOGRAPHIC
Languages: English
Report No.: DOE/ET/28365-24
Availability: Colo. Geol. Surv., Dep. Nat. Resour., Denver, CO, United States
illus., 20 tables
Latitude: N402500; N403000 Longitude: W1065000; W1065500
Descriptors: *Colorado; *geochemistry; *hydrology; *soils ; economic geology; geophysical surveys; surveys ; geothermal energy; electrical surveys; Routt County; Brown Park Formation; Mancos Shale; Niobrara Formation; Benton Shale; Dakota Formation; Morrison Formation; Chinle Formation; Chugwater Formation; United States; Routt Hot Springs; Steamboat Springs; resources; possibilities; temperature; resistivity; thermal waters; heat flow; northwestern Colorado; exploration; stratigraphy; tectonics; anomalies; trace elements; Quaternary; Cenozoic; Tertiary; Cretaceous; Mesozoic
Section Headings: 29 .(ECONOMIC GEOLOGY, ENERGY SOURCES)

1192021 83-50226
Geothermal resource assessment of Hartsel, Colorado
McCarthy, K. P.; Zacharakis, T. G.; Pearl, R. H.
Colo. Geol. Surv., Dep. Nat. Resour., Denver, CO, USA
Resource Series - Colorado Geological Survey, Department of Natural Resources, State of Colorado 19, 86p., 1982
CODEN: RSSSDK ISSN: 0197-7490 55 REFS.
Subfile: B
Country of Publ.: United States
Doc Type: SERIAL; REPORT Bibliographic Level: MONOGRAPHIC
Languages: English
Report No.: DOE/ET/28365-19
Availability: Colo. Geol. Surv., Dep. Nat. Resour., Denver, CO, United States
illus., 20 tables, geol. sketch maps
Latitude: N390000; N390500 Longitude: W1054500; W1055000
Descriptors: *Colorado; *geochemistry; *hydrology; *soils ; economic geology; geophysical surveys; surveys ; geothermal energy; electrical surveys; Park County; Morrison Formation ; Maroon Formation; Garo Formation; Dakota Formation; Benton Formation; Niobrara Formation; Pierre Formation; United States; Hartsel Hot Springs; resources; possibilities; temperature; resistivity; Hartsel; thermal waters; heat flow; central Colorado; exploration; stratigraphy; tectonics; anomalies; trace elements; Jurassic; Mesozoic; faults; Permian; Paleozoic; Cretaceous
Section Headings: 29 .(ECONOMIC GEOLOGY, ENERGY SOURCES)

1192020 83-50225
U. S. Geol. Surv., USA
Helium and ground temperature surveys at Steamboat Springs, Colorado
McCarthy, K. P.; Been, J.; Reimer, G. M.; Bowles, C. G.; Murrey, D. G.
Colo. Geol. Surv., Dep. Nat. Resour., Denver, CO, USA
Special Publication - Colorado Geological Survey 21, 11p., 1982
CODEN: CGSSA6 ISSN: 0099-6459 25 REFS.
Subfile: B
Country of Publ.: United States
Doc Type: SERIAL; REPORT Bibliographic Level: MONOGRAPHIC
Languages: English
Report No.: DOE/ET/28365-21
Availability: Colo. Geol. Surv., Dep. Nat. Resour., Denver, CO, United States
illus., 1 table, geol. sketch maps
Latitude: N402500; N403000 Longitude: W1065000; W1065500
Descriptors: *Colorado; *geochemistry; *soils; *helium ; economic geology; geophysical surveys; surveys ; geothermal energy; heat flow; Routt County; Dakota Formation; United States; temperature; Steamboat Springs; exploration; resources; possibilities; tectonics; faults; Cretaceous; Mesozoic
Section Headings: 29 .(ECONOMIC GEOLOGY, ENERGY SOURCES)

1191400 83-50245
Geothermal resource assessment of Ranger Warm Spring, Colorado
Zacharakis, T. G.; Pearl, R. H.; Ringrose, C. D.
Colo. Geol. Surv., Dep. Nat. Resour., Denver, CO, USA
Resource Series - Colorado Geological Survey, Department of Natural Resources, State of Colorado 24, 65p., 1983
CODEN: RSSSDK ISSN: 0197-7490 38 REFS.
Subfile: B
Country of Publ.: United States
Doc Type: SERIAL; REPORT Bibliographic Level: MONOGRAPHIC
Languages: English
Report No.: DOE/ET/28365-26
Availability: Colo. Geol. Surv., Dep. Nat. Resour., Denver, CO, United States
illus., 16 tables, sketch maps
Latitude: N385000; N385500 Longitude: W1074000; W1075000
Descriptors: *Colorado; *geochemistry; *hydrology; *soils ; economic geology; geophysical surveys; surveys ; geothermal energy; electrical surveys; Gunnison County; United States; Ranger Warm Springs; resources; possibilities; temperature ; resistivity; Cement Creek; thermal waters; heat flow; western Colorado; exploration; stratigraphy; tectonics; anomalies; trace elements
Section Headings: 29 .(ECONOMIC GEOLOGY, ENERGY SOURCES)

1191399 83-50227
Geothermal resource assessment of the Animas Valley, Colorado
McCarthy, K. P.; Zacharakis, T. G.; Ringrose, C. D.
Colo. Geol. Surv. Dep. Nat. Resour., Denver, CO, USA

(cont. next page)

DIALOG File 89: GEOREF - 29-84/Nov (Copr. American Geological Institute)

Resource Series - Colorado Geological Survey, Department of Natural Resources, State of Colorado 17, 60p., 1982
CODEN: RSSSDK ISSN: 0197-7490 63 REFS.
Subfile: B
Country of Publ.: United States
Doc Type: SERIAL; REPORT Bibliographic Level: MONOGRAPHIC
Languages: English
Report No.: DOE/ET/28365-18
Availability: Colo. Geol. Surv., Dep. Nat. Resour., Denver, CO, United States
illus., 9 tables, sects., sketch maps
Latitude: N371500; N372000 Longitude: W1074500; W1075000
Descriptors: *Colorado; *geochemistry; *hydrology; *soils ; economic geology; geophysical surveys; surveys ; geothermal energy; electrical surveys; La Plata County; San Jose Formation; Animas Formation; McDermott Formation; Kirkland Shale; Fruitland Formation; Lewis Shale; Cliff House Sandstone; United States; Pinkerton Springs; Tripp-Trimble-Stratten Springs; resources; possibilities; temperature; resistivity; Animas Valley; thermal waters; heat flow; southwestern Colorado; stratigraphy; exploration ; tectonics; anomalies; trace elements; Tertiary; Cenozoic; Cretaceous; Mesozoic; Pictured Cliffs Sands
Section Headings: 29 .(ECONOMIC GEOLOGY, ENERGY SOURCES)

1185328 83-40722
Canadian geothermal research program
Souther, J. G.
Geol. Surv. Can., Vancouver, BC, CAN
Energy resources of the Pacific region
Halbouty, M. T.(EDITOR)
Symposium on energy resources of the Pacific region, Honolulu, HI, United States, July 30-Aug. 4, 1978
AAPG Studies in Geology 12, 391-400p., 1981
ISSN: 0271-8510 ISBN: 0-89181-016-1 25 REFS.
Subfile: B
Country of Publ.: United States
Doc Type: SERIAL; CONFERENCE PUBLICATION Bibliographic Level: ANALYTIC
Languages: English
illus., 3 tables, sects., geol. sketch maps
Descriptors: *Canada; *British Columbia ; economic geology ; geothermal energy; exploration; research; programs; Meager Mountain; hot springs; geophysical surveys; electrical surveys; seismic surveys; magnetotelluric surveys ; self-potential methods; resistivity; geothermal gradient; Winnipeg Sandstone; aquifers; thermal waters; volcanism; volcanoes; possibilities; chemical composition; rhyolite; andesite-rhyolite family; domes; folds; current research
Section Headings: 29 .(ECONOMIC GEOLOGY, ENERGY SOURCES)

1185311 83-40592
Exploration and development of geothermal resources in Taiwan
Ke-Kong Hwang; Weng-Tse Cheng
Ind. Technol. Res. Inst., Min. Res. Serv. Org., Taipei, TWN
Energy resources of the Pacific region
Halbouty, M. T.(EDITOR)
Symposium on energy resources of the Pacific region, Honolulu, HI, United States, July 30-Aug. 4, 1978
AAPG Studies in Geology 12, 215-221p., 1981
ISSN: 0271-8510 ISBN: 0-89181-016-1 4 REFS.
Subfile: B
Country of Publ.: United States
Doc Type: SERIAL; CONFERENCE PUBLICATION Bibliographic Level: ANALYTIC
Languages: English
illus., 4 tables, sect., geol. sketch maps
Descriptors: *Taiwan; *ground water ; economic geology; surveys; geophysical surveys ; geothermal energy; electrical surveys; Asia; exploration; development; hot springs; Tatun region; wells; Tuchang region; Chingshui region; Lushan region; volcanoes; distribution; Cenozoic; Phanerozoic; chemical composition; temperature; sodium bicarbonate; resistivity
Section Headings: 29 .(ECONOMIC GEOLOGY, ENERGY SOURCES)

1185294 83-40521
Geothermal development in El Salvador
Cuellar, G.
Com. Ejec. Hidroelec. Rio Lempa, San Salvador, SLV
Energy resources of the Pacific region
Halbouty, M. T.(EDITOR)
Symposium on energy resources of the Pacific region, Honolulu, HI, United States, July 30-Aug. 4, 1978
AAPG Studies in Geology 12, 21-25p., 1981
ISSN: 0271-8510 ISBN: 0-89181-016-1 3 REFS.
Subfile: B
Country of Publ.: United States
Doc Type: SERIAL; CONFERENCE PUBLICATION Bibliographic Level: ANALYTIC
Languages: English
1 table
Descriptors: *El Salvador; *ground water ; economic geology ; surveys; geophysical surveys ; geothermal energy; electrical surveys; Central America; Ahuachapan Field; progress report; exploration; grabens; Cerro Laguna volcanic group; basins; hot springs; thermal waters; artificial recharge; wells; programs; temperature; movement; Berlin region; Chinameca region; San Vicente region; Lempa region; fumaroles; resistivity; heat flow
Section Headings: 29 .(ECONOMIC GEOLOGY, ENERGY SOURCES)

DIALOG File 89: GEOREF - 29-84/Nov (Copr. American Geological Institute)

1182367 83-40745
Conclusions and recommendations for phase-two geophysics, hydrology, exploratory drilling, and geochemistry at Pilgrim Springs, Alaska
Turner, D. L.; Forbes, R. B.; Osterkamp, T. E.; Wescott, E. M.; Kienle, J.
A geological and geophysical study of the geothermal energy potential of Pilgrim Springs, Alaska
Turner, D. L.(EDITOR); Forbes, R. B.(EDITOR)
UAGR (Geophysical Institute, University of Alaska) 271, 157-165p., 1980
CODEN: AUGGAK ISSN: 0271-4892 1 REFS.
Subfile: B
Country of Publ.: United States
Doc Type: SERIAL; REPORT Bibliographic Level: ANALYTIC
Languages: English
Availability: U. S. Dep. Energy, Washington, DC, United States
sketch map
Descriptors: *Alaska ; geophysical surveys; economic geology ; surveys; geothermal energy; United States; Pilgrim Springs; hydrology; exploration; geochemistry; resources
Section Headings: 29 .(ECONOMIC GEOLOGY, ENERGY SOURCES)

1182366 83-40669
A reconnaissance study of the hydrothermal characteristics and accessible power of Pilgrim Springs, Alaska
Osterkamp, T. E.; Gosink, J. P.; Forbes, R. B.; Gaffi, R. G. ; Hanscom, J. T.; Kane, M. L.
A geological and geophysical study of the geothermal energy potential of Pilgrim Springs, Alaska
Turner, D. L.(EDITOR); Forbes, R. B.(EDITOR)
UAGR (Geophysical Institute, University of Alaska) 271, 113-156p., 1980
CODEN: AUGGAK ISSN: 0271-4892 4 REFS.
Subfile: B
Country of Publ.: United States
Doc Type: SERIAL; REPORT Bibliographic Level: ANALYTIC
Languages: English
Availability: U. S. Dep. Energy, Washington, DC, United States
illus., 1 tables, sketch maps
Descriptors: *Alaska; *hydrology : geophysical surveys; economic geology; surveys : electrical surveys; geothermal energy; United States; Pilgrim Springs; electrical conductivity; exploration
Section Headings: 29 .(ECONOMIC GEOLOGY, ENERGY SOURCES)

1182365 83-40571
Water and heat flow measurements and their relationship to power estimates at Pilgrim Springs
Harrison, W.; Hawkins, D.
A geological and geophysical study of the geothermal energy potential of Pilgrim Springs, Alaska
Turner, D. L.(EDITOR); Forbes, R. B.(EDITOR)
UAGR (Geophysical Institute, University of Alaska) 271, 101-112p., 1980
CODEN: AUGGAK ISSN: 0271-4892 1 REFS.
Subfile: B
Country of Publ.: United States
Doc Type: SERIAL; REPORT Bibliographic Level: ANALYTIC
Languages: English
Availability: U. S. Dep. Energy, Washington, DC, United States
illus., 2 tables, sketch map
Descriptors: *Alaska : economic geology; geophysical surveys ; geothermal energy; heat flow; United States; Pilgrim Springs; temperature; exploration; boreholes
Section Headings: 29 .(ECONOMIC GEOLOGY, ENERGY SOURCES)

1182364 83-40770
Electrical resisitivity survey of the Pilgrim Springs geothermal area, Alaska
Wescott, E. M.; Sydora, R.; Peace, J.; Lockhart, A.
A geological and geophysical study of the geothermal energy potential of Pilgrim Springs, Alaska
Turner, D. L.(EDITOR); Forbes, R. B.(EDITOR)
UAGR (Geophysical Institute, University of Alaska) 271, 81-100p., 1980
CODEN: AUGGAK ISSN: 0271-4892 3 REFS.
Subfile: B
Country of Publ.: United States
Doc Type: SERIAL; REPORT Bibliographic Level: ANALYTIC
Languages: English
Availability: U. S. Dep. Energy, Washington, DC, United States
illus.
Descriptors: *Alaska : geophysical surveys; economic geology ; electrical surveys; geothermal energy; United States; resistivity; Pilgrim Springs; exploration
Section Headings: 29 .(ECONOMIC GEOLOGY, ENERGY SOURCES)

1182363 83-40595
Gravity survey of the Pilgrim Springs geothermal area, Alaska
Kienle, J.; Lockhart, A.
A geological and geophysical study of the geothermal energy potential of Pilgrim Springs, Alaska
Turner, D. L.(EDITOR); Forbes, R. B.(EDITOR)
(cont. next page)

DIALOG File 89: GEOREF - 29-84/Nov (Copr. American Geological Institute)

UAGR (Geophysical Institute, University of Alaska) 271, 73-79p., 1980
CODEN: AUGGAK ISSN: 0271-4892 3 REFS.
Subfile: B
Country of Publ.: United States
Doc Type: SERIAL Bibliographic Level: ANALYTIC
Languages: English
Availability: U. S. Dep. Energy, Washington, DC, United States
illus., sketch map
Descriptors: *Alaska ; geophysical surveys; economic geology ; gravity surveys; geothermal energy; United States ; Pilgrim Springs; basement; exploration
Section Headings: 29 .(ECONOMIC GEOLOGY, ENERGY SOURCES)

1182362 83-40596
Seismic refraction survey of the Pilgrim Springs geothermal area, Alaska
Kienle, J.; Lockhart, A.; Peace, J.
A geological and geophysical study of the geothermal energy potential of Pilgrim Springs, Alaska
Turner, D. L.(EDITOR); Forbes, R. B.(EDITOR)
UAGR (Geophysical Institute, University of Alaska) 271, 53-72p., 1980
CODEN: AUGGAK ISSN: 0271-4892 3 REFS.
Subfile: B
Country of Publ.: United States
Doc Type: SERIAL; REPORT Bibliographic Level: ANALYTIC
Languages: English
Availability: U. S. Dep. Energy, Washington, DC, United States
illus., sketch map
Descriptors: *Alaska ; geophysical surveys; economic geology ; seismic surveys; geothermal energy; United States ; Pilgrim Springs; exploration; basement; tectonics; Tertiary; Cenozoic
Section Headings: 29 .(ECONOMIC GEOLOGY, ENERGY SOURCES)

1182359 83-40601
Surficial geology and test drilling at Pilgrim Springs, Alaska
Kline, J. T.; Reger, R. D.; McFarlane, R. M.; Williams, T.
A geological and geophysical study of the geothermal energy potential of Pilgrim Springs, Alaska
Turner, D. L.(EDITOR); Forbes, R. B.(EDITOR)
UAGR (Geophysical Institute, University of Alaska) 271, 21-28p., 1980
CODEN: AUGGAK ISSN: 0271-4892 1 REFS.
Subfile: B
Country of Publ.: United States
Doc Type: SERIAL; REPORT Bibliographic Level: ANALYTIC
Languages: English
Availability: U. S. Dep. Energy, Washington, DC, United States
sketch map
Descriptors: *Alaska; *geomorphology ; economic geology; geophysical surveys; landform description ; geothermal energy; electrical surveys; surficial geology; United States; Pilgrim Springs; exploration
Section Headings: 29 .(ECONOMIC GEOLOGY, ENERGY SOURCES)

1182357 83-40456
A geological and geophysical study of the geothermal energy potential of Pilgrim Springs, Alaska
Turner, D. L.(EDITOR); Forbes, R. B.(EDITOR)
UAGR (Geophysical Institute, University of Alaska) 271, 165p., 1980
CODEN: AUGGAK ISSN: 0271-4892
Subfile: B
Country of Publ.: United States
Doc Type: SERIAL; REPORT; MAP Bibliographic Level: MONOGRAPHIC
Languages: English
Availability: U. S. Dep. Energy, Washington, DC, United States
Note: Individual papers are cited separately; prepared for U. S. Dep. Energy and Alaska, Div. Energy and Power Dev., illus., geol. sketch maps; 1:63,360; geol. map
Latitude: N650000; N651500 Longitude: W1643000; W1650500
Descriptors: *Alaska ; economic geology; geophysical surveys ; geothermal energy; surveys; United States; Pilgrim Springs; resources; possibilities; exploration; geologic maps; maps
Section Headings: 29 .(ECONOMIC GEOLOGY, ENERGY SOURCES)

1180816 83-40454
The upper Centennial Valley, Beaverhead and Madison counties, Montana; an investigation of resources utilizing geological, geophysical, hydrochemical and geothermal methods
Sonderegger, J. L.; Schofield, J. D.; Berg, R. B.; Mannick, M. L.
Memoir - State of Montana, Bureau of Mines and Geology 50, 53p., 1982
CODEN: MBGMA3 ISSN: 0077-1120 68 REFS.
Subfile: B
Country of Publ.: United States
Doc Type: SERIAL; MAP Bibliographic Level: MONOGRAPHIC
Languages: English
Note: Individual paper is cited separately, illus., geol. sketch maps; 1:62,500; colored geol. map
Latitude: N443500; N444500 Longitude: W1113000; W1120000
Descriptors: *Montana; *ground water ; economic geology; geophysical surveys; surveys ; geothermal energy; Madison County; Beaverhead County; Madison Group; United States; Centennial Valley; possibilities; resources; utilization; exploration; Wolf Creek Hot Spring; Mississippian; Paleozoic; Precambrian; petrology; Gravelly Range; Henrys Lake Mountains; Phanerozoic; Mesozoic; Cenozoic;
(cont. next page)

paleogeography; gravity surveys; magnetic surveys; springs; tectonics; Centennial Fault; Odell Creek Fault; aquifers; geochemistry; geologic maps; maps; site locations maps
Section Headings: 29 .(ECONOMIC GEOLOGY, ENERGY SOURCES)

1180284 83-32848
Audiomagnetotelluric measurements in Iceland
Jepsen, J. B.; Pedersen, C. B.; Hersir, G. P.; Bjornsson, A.
Natl. Energy Auth., Reykjavik 108, ISL
Technical programme and abstracts of papers/European Association of Exploration Geophysicists, 43rd meeting
Anonymous
43rd meeting, European Association of Exploration Geophysicists, Venice, Italy, May 26-29, 1981
Publ: European Assoc. Explor. Geophysicists
40p., 1981
Subfile: B
Doc Type: BOOK; CONFERENCE PUBLICATION Bibliographic Level: ANALYTIC
Languages: English
Descriptors: *Iceland ; geophysical surveys; economic geology ; magnetotelluric surveys; geothermal energy; geothermal fields; high temperature; Atlantic Ocean; Europe
Section Headings: 20 .(GEOPHYSICS, APPLIED)

1180107 83-34419
Geology and mineral resources of 18 BLM wilderness study areas, Harney and Malheur counties, Oregon
Gray, J. J.; Peterson, N. N.; Clayton, J.; Baxter, G.
Oreg. Dep. Geol. Miner. Ind., Portland, OR, USA
Open File Report - State of Oregon, Department of Geology and Mineral Industries O-83-2, 106p., 1983
130 REFS.
Subfile: B
Country of Publ.: United States
Doc Type: SERIAL; REPORT Bibliographic Level: MONOGRAPHIC
Languages: English
Availability: Oreg., Dep. Geol. and Miner. Ind., United States
Note: Maps and raw data on microfiche, illus., 17 tables, geol. sketch maps
Descriptors: *Oregon ; economic geology; geophysical surveys ; mineral resources; surveys; Harney County; Malheur County; United States; petroleum; natural gas; geothermal energy; metal ores; possibilities; resources; mineral exploration; exploration; sediments; soils; geochemical methods; Owyhee Reservoir region; tectonics; Trout Creek region; Pueblo Mountains region; Steens Mountain region
Section Headings: 26 .(ECONOMIC GEOLOGY, GENERAL & MINING)

1179993 83-34980
Interpretation of geophysical data from the Colado KGRA, Pershing County, Nevada
Mackelprang, C. E.
27p., 1982
12 REFS.
Subfile: B
Doc Type: REPORT; MAP Bibliographic Level: MONOGRAPHIC
Languages: English
Report No.: DOE/ID/12079-58
Availability: U. S. Dep. Energy, Washington, DC, United States
Note: Univ. Utah Res. Inst., Earth Sci. Lab., Salt Lake City, UT, illus., geol. sketch maps; 1:24,000; geol. maps
Latitude: N400500; N401000 Longitude: W1182500; W1183000
Descriptors: *Nevada ; economic geology; geophysical surveys ; geothermal energy; surveys; Pershing County; United States; Colado; interpretation; gravity surveys; electrical surveys; magnetic surveys; boreholes; exploration; Basin and Range Province; geologic maps; maps
Section Headings: 29 .(ECONOMIC GEOLOGY, ENERGY SOURCES)

1179378 83-35135
Preliminary regional gravimetric study of Los-Humeros geothermal volcanic area
Gonzalez-Moran, T.
UNAM, Mexico 20, MEX
Technical programme and abstracts of papers/European Association of Exploration Geophysicists, 43rd meeting
Anonymous
43rd meeting, European Association of Exploration Geophysicists, Venice, Italy, May 26-29, 1981
Publ: European Assoc. Explor. Geophysicists
35p., 1981
Subfile: B
Doc Type: BOOK; CONFERENCE PUBLICATION Bibliographic Level: ANALYTIC
Languages: English
Descriptors: *Mexico ; geophysical surveys; economic geology ; gravity surveys; geothermal energy; residual anomalies; volcanic belts; North America; Los Humeros; Transmexican volcanic belt
Section Headings: 29 .(ECONOMIC GEOLOGY, ENERGY SOURCES)

1175784 83-35322
Vozmozhnyye petrogeotermicheskiye resursy noveyshego vulkanicheskogo poyasa Armyanskoy SSR i nekotoryye problemy ikh poiskov i izucheniya
Possible petrogeothermal resources in a recent volcanic belt of Armenia and some problems in their study and exploration
Shirinyan, K. G.

(cont. next page)

Akad. nauk Armyan. SSR, Inst. geol. nauk, Yerevan, SUN
Izvestiya Akademiy Nauk Armyanskoy SSR, Nauki o Zemle 33: 3
. 36-46p., 1980
CODEN: IAAZAT ISSN: 0515-961X 28 REFS.
Subfile: B
Country of Publ.: Union of Soviet Socialist Republics
Doc Type: SERIAL Bibliographic Level: ANALYTIC
Languages: Russian Summary Languages: English
Latitude: N373000; N450000 Longitude: E0500000; E0400000
Descriptors: *USSR ; economic geology; tectonophysics; geophysical surveys ; geothermal energy; plate tectonics; heat flow; Armenia; Lesser Caucasus; Transcaucasia; Pliocene; Neogene; Tertiary; Cenozoic; Quaternary; volcanic belts; anomalies
Section Headings: 29 .(ECONOMIC GEOLOGY, ENERGY SOURCES)

1173542 83-29909
D.C. resistivity soundings on the Mokapu Peninsula, Oahu
Lienert, B. R.
A preliminary geothermal evaluation of the Mokapu Peninsula on the island of Oahu, Hawaii
Cox, M., E.; Cuff, K. E.; Lienert, B. R.; Sinton, J. M.; Thomas, D. M.
HIG 82-2, 33-41p., 1982
CODEN: HIGRDF ISSN: 0440-4866
Subfile: B
Country of Publ.: United States
Doc Type: SERIAL Bibliographic Level: ANALYTIC
Languages: English
Asses. Geotherm. Resour. Hawaii No. 5, illus., sketch map
Descriptors: *Hawaii ; economic geology; geophysical surveys ; geothermal energy; electrical surveys; Pacific Ocean; United States; Mokapu Peninsula; Oahu; resistivity; resources; possibilities; exploration
Section Headings: 29 .(ECONOMIC GEOLOGY, ENERGY SOURCES)

1173175 83-29978
Resistivity survey in the Chingshui prospect, I-Lan, Taiwan
Su, F.
Chinese Pet. Corp., TWN
Petroleum Geology of Taiwan 15, 255-263p., 1978
CODEN: PGTWAU ISSN: 0553-8890 7 REFS.
Subfile: B
Country of Publ.: Taiwan, Province of
Doc Type: SERIAL Bibliographic Level: ANALYTIC
Languages: English Summary Languages: Chinese
sketch maps
Latitude: N240000; N240000 Longitude: E1210000; E1210000
Descriptors: *Taiwan; *ground water ; geophysical surveys; economic geology; surveys ; electrical surveys; geothermal energy; Asia; northeastern Taiwan; resistivity; Chingshui; exploration; Ilan; Chingshuichi; Hanhsi; thermal waters; thickness; aquifers; faults
Section Headings: 29 .(ECONOMIC GEOLOGY, ENERGY SOURCES)

1171410 83-29949
Geology and geothermal resources of the Mount Hood area, Oregon; introduction
Priest, G. R.
Ore. Dep. Geol. Miner. Ind., Portland, OR, USA
Geology and geothermal resources of the Mount Hood area, Oregon
Priest, G. R.(EDITOR); Vogt, B. F.(EDITOR)
Ore. Dep. Geol. Miner. Ind., Portland, OR, USA
Special Paper - Oregon, Department of Geology and Mineral Industries 14, 1-2p., 1982
ISSN: 0278-3703 7 REFS.
Subfile: B
Country of Publ.: United States
Doc Type: SERIAL Bibliographic Level: ANALYTIC
Languages: English
sketch map
Latitude: N450000; N450000 Longitude: W1210000; W1210000
Descriptors: *Oregon ; geophysical surveys; economic geology ; gravity surveys; geothermal energy; Hood River County; United States; northern Oregon; Mount Hood; Pacific Coast; exploration; programs; evaluation
Section Headings: 29 .(ECONOMIC GEOLOGY, ENERGY SOURCES)

1164572 83-24608
Geothermal investigations in Idaho; Part 11, Geological, hydrological, geochemical and geophysical investigations of the Nampa-Caldwell and adjacent areas, southwestern Idaho
Mitchell, J. C.(EDITOR)
Water Information Bulletin (Boise) 30, 143p., 1981
CODEN: WBIRD5 ISSN: 0511-3598 175 REFS.
Subfile: B
Country of Publ.: United States
Doc Type: SERIAL; MAP Bibliographic Level: MONOGRAPHIC
Languages: English
illus., tables, geol. sketch maps; 1:68,898; colored geol. maps
Latitude: N432500; N434230 Longitude: W1162730; W1164500
Descriptors: *Idaho ; economic geology ; geothermal energy ; Ada County; Canyon County; United States; geologic maps; maps; Nampa; Caldwell; geophysical surveys; exploration; resources; hydrology; properties; heat flow; southwestern Idaho; Columbia Plateau
Section Headings: 29 .(ECONOMIC GEOLOGY, ENERGY SOURCES)

1164117 83-24712
The Kemp thermal anomaly; a newly discovered geothermal resource in Pumpernickel Valley, Nevada
Flynn, T.; Trexler, D. T.; Koenig, B. A.
Nev. Div. Earth Sci., Reno, NV, USA; Union Oil Co., Santa Rosa, CA, USA

(cont. next page)

DIALOG File 89: GEOREF - 29-84/Nov (Copr. American Geological Institute)

Geothermal energy; turn on the power!
Lacy, R. G.(chairperson)
San Diego Gas and Electr. Co., San Diego, CA, USA
Geothermal Resources Council; 1982 annual meeting; Geothermal energy; turn on the power. San Diego, CA, United States, Oct. 11-14, 1982
Transactions - Geothermal Resources Council 6, 121-124p., 1982
ISSN: 0193-5933 ISBN: 0-934412-56-1 6 REFS.
Subfile: B
Country of Publ.: United States
Doc Type: SERIAL; CONFERENCE PUBLICATION Bibliographic Level: ANALYTIC
Languages: English
illus., sketch map
Descriptors: *Nevada ; geophysical surveys; economic geology ; gravity surveys; geothermal energy; Humboldt County; Pershing County; Valmy Formation; Osgood Mountain Formation; Preble Formation; United States; Pumpernickel Valley; exploration; Ordovician; Paleozoic; Edna Mountain; Bouguer anomalies; three-dimensional models; models
Section Headings: 29 .(ECONOMIC GEOLOGY, ENERGY SOURCES)

1164092 83-22973
Prospecting for near vertical aquifers in low temperature geothermal areas in Iceland
Flovenz, O. G.; Georgsson, L. S.
Iceland Natl. Energy Auth., Geothermal Div., Reykjavik, ISL
Geothermal energy; turn on the power!
Lacy, R. G.(chairperson)
San Diego Gas and Electr. Co., San Diego, CA, USA
Geothermal Resources Council; 1982 annual meeting; Geothermal energy; turn on the power. San Diego, CA, United States, Oct. 11-14, 1982
Transactions - Geothermal Resources Council 6, 19-22p., 1982
ISSN: 0193-5933 ISBN: 0-934412-56-1 6 REFS.
Subfile: B
Country of Publ.: United States
Doc Type: SERIAL; CONFERENCE PUBLICATION Bibliographic Level: ANALYTIC
Languages: English
illus., geol. sketch map
Descriptors: *Iceland; *ground water ; economic geology; geophysical surveys; surveys ; geothermal energy; electrical surveys; Atlantic Ocean; Europe; exploration; dikes; intrusions; faults; fractures; aquifers; Mid-Atlantic Ridge; drilling; cartography; resistivity
Section Headings: 21 .(HYDROGEOLOGY AND HYDROLOGY)

1160638 83-15082
Multielement geochemistry of three geothermal wells, Cove Fort-Sulphurdale geothermal area, Utah
Christensen, O. D.
41p., 1982
16 REFS.
Subfile: B
Doc Type: REPORT Bibliographic Level: MONOGRAPHIC
Languages: English
Report No.: ESL-101; DOE/ID/12079-80
Availability: Univ. Utah Res. Inst., Earth Sci. Lab., Salt Lake City, UT, United States
illus., tables
Descriptors: *Utah; *ground water ; economic geology; surveys ; geothermal energy; United States; geochemistry; Cove Fort; Sulphurdale; Colorado Plateau; Basin and Range Province; wells; exploration; geophysical surveys
Section Headings: 02 .(GEOCHEMISTRY)

1160636 83-19861
The Cove Fort-Sulphurdale KGRA; a geologic and geophysical case study
Ross, H. P.; Moore, J. N.; Christensen, O. D.
Univ. Utah Res. Inst., Earth Sci. Lab., Salt Lake City, UT, USA
47p., 1982
37 REFS.
Subfile: B
Doc Type: REPORT Bibliographic Level: MONOGRAPHIC
Languages: English
Report No.: ESL-90; DOE/ID/12079-64
Availability: Univ. Utah Res. Inst., Earth Sci. Lab., Salt Lake City, UT, United States
illus.
Descriptors: *Utah ; economic geology ; geothermal energy; United States; geophysical surveys; magnetic surveys; gravity surveys; tectonics; exploration; Cove Fort-Sulphurdale KGRA; Sulphurdale; Colorado Plateau; Basin and Range Province; case studies
Section Headings: 29 .(ECONOMIC GEOLOGY, ENERGY SOURCES)

1159465 83-19860
Geothermal resource assessment of Idaho Springs, Colorado
Repplier, F. N.; Zacharakis, T. G.; Ringrose, C. D.
Resource Series - Colorado Geological Survey, Department of Natural Resources, State of Colorado 16; DOE/ET/28365-17, 50p., 1982
CODEN: RSSSDK ISSN: 0197-7490 45 REFS.
Subfile: B
Country of Publ.: United States
Doc Type: SERIAL Bibliographic Level: MONOGRAPHIC
Languages: English
illus., 8 tables
Latitude: N394000; N394000 Longitude: W1053500; W1053500
Descriptors: *Colorado ; economic geology ; geothermal energy; Clear Creek County; United States; Idaho Springs; resources; possibilities; exploration; Tertiary; Cenozoic; Precambrian; tectonics; thermal waters; geophysical

(cont. next page)

surveys; electrical surveys
Section Headings: 29 .(ECONOMIC GEOLOGY, ENERGY SOURCES)

1159459 83-17523
Gravity anomalies in the Cascade Range in Oregon; structural and thermal implications
Couch, R. W.; Pitts, G. S.; Gemperle, M.; Braman, D. E.; Veen, C. A.
Open File Report - State of Oregon, Department of Geology and Mineral Industries 0-82-9, 66p., 1982
78 REFS.
Subfile: B
Country of Publ.: United States
Doc Type: SERIAL Bibliographic Level: MONOGRAPHIC
Languages: English
illus., geol. sketch maps
Descriptors: *Oregon ; geophysical surveys; economic geology ; gravity surveys; geothermal energy; United States ; Cascade Range; gravity anomalies; profiles; crust; exploration
Section Headings: 20 .(GEOPHYSICS, APPLIED)

1159436 83-19868
Geothermal resources assessment of Ouray, Colorado
Zacharakis, T. G.; Ringrose, C. D.; Pearl, R. H.
Resource Series - Colorado Geological Survey, Department of Natural Resources, State of Colorado 15: DOE/ET/28365-9, 70 p., 1981
CODEN: RSSSDK ISSN: 0197-7490 28 REFS.
Subfile: B
Country of Publ.: United States
Doc Type: SERIAL Bibliographic Level: MONOGRAPHIC
Languages: English
illus., 13 tables
Latitude: N380000; N380500 Longitude: W1073500; W1074000
Descriptors: *Colorado ; economic geology ; geothermal energy; Ouray County; United States; resources; exploration; Ouray; possibilities; tectonics; volcanism; geophysical surveys
Section Headings: 29 .(ECONOMIC GEOLOGY, ENERGY SOURCES)

1157577 83-13935
U. S. Bur. Mines, USA
Mineral-resource potential of the Whipple Mountains wilderness study area (CDCA-312), San Bernardino County, California
Marsh, S. P.; Ridenour, J.; Raines, G. L.; Howard, K. A.; Simpson, R. W.; Moyle, P. R.; Willett, S. L.; Hoover, D. P.
U. S. Geol. Surv., USA
Open-File Report (United States Geological Survey. 1978) 40 p., 1982
CODEN: XGROAG ISSN: 0196-1497 67 REFS.
Subfile: B
Country of Publ.: United States
Doc Type: SERIAL; REPORT Bibliographic Level: MONOGRAPHIC
Languages: English
Report No.: 82-0956
Availability: U. S. Geol. Surv., Open-File Serv. Sect., West. Distrib. Branch, Denver, CO, United States
illus., 1 table, sketch maps
Latitude: N341000; N343000 Longitude: W1140000; W1143500
Descriptors: *California; *mineral exploration ; economic geology; programs ; mineral resources; San Bernardino County; USGS; United States; Southern California; Whipple Mountains; possibilities; base metals; precious metals; geochemical methods; remote sensing; magnetic surveys; geophysical surveys; gravity surveys; electrical surveys; mining geology; economic evaluation; nonmetal deposits; geothermal energy; uranium ores
Section Headings: 26 .(ECONOMIC GEOLOGY, GENERAL & MINING)

1157553 83-14448
E-field ratio telluric survey near Medicine Lake in the Medicine Lake Highlands caldera, Siskiyou County, California
Broker, M. M.; Christopherson, K.; Heller, R.
Open-File Report (United States Geological Survey. 1978) 11 p., 1982
CODEN: XGROAG ISSN: 0196-1497 4 REFS.
Subfile: B
Country of Publ.: United States
Doc Type: SERIAL; REPORT Bibliographic Level: MONOGRAPHIC
Languages: English
Report No.: 82-0900
Availability: U. S. Geol. Surv., Open-File Serv. Sect., West. Distrib. Branch, Denver, CO, United States
illus., sketch maps
Latitude: N412500; N414500 Longitude: W1212500; W1214000
Descriptors: *California ; geophysical surveys; economic geology ; Earth-current surveys; geothermal energy; Siskiyou County; USGS; United States; Northern California; Medicine Lake; Medicine Lake Highlands; calderas; exploration; geophysical profiles
Section Headings: 29 .(ECONOMIC GEOLOGY, ENERGY SOURCES)

1156437 83-14522
Use of remote sensing techniques to study geothermal resources in arid and semi-arid zones in Chile
Araya F., M.; Piraces L., R.
Univ. Chile, Dep. Geol. Geophys., Santiago, CHL; Natl. Cadaster Proj., Santiago, CHL
10. Symposium on the study of land transformation processes Twenty-fourth plenary meeting, COSPAR Committee on Space Research, Ottawa, ON, Canada, May 16-June 2, 1982
COSPAR Plenary Meet., Program Abstr. 24, 285p., 1982
CODEN: CSRMAX
Subfile: B
Country of Publ.: International

(cont. next page)

DIALOG File 89: GEOREF - 29-84/Nov (Copr. American Geological Institute)

Doc Type: SERIAL; CONFERENCE PUBLICATION Bibliographic Level: ANALYTIC
Languages: English
Descriptors: *Chile ; geophysical surveys; economic geology ; remote sensing; geothermal energy; South America; techniques; exploration
Section Headings: 29 .(ECONOMIC GEOLOGY, ENERGY SOURCES)

1156229 83-14804
Geology and geothermal exploration, southernmost Peru
Prostka, H. J.; Moore, J. L.; La Fleur, J.
Consult., Estes Park, CO, USA; Calif. Energy Co., USA
Circum-Pacific energy and mineral resources conference
Anonymous
Circum-Pacific energy and mineral resources conference, Honolulu, HI, United States, Aug. 23-27, 1982
AAPG Bulletin 66: 7, 981p., 1982
CODEN: AABUD2 ISSN: 0149-1423
Subfile: B
Country of Publ.: United States
Doc Type: SERIAL; CONFERENCE PUBLICATION Bibliographic Level: ANALYTIC
Languages: English
Latitude: S180000; S120000 Longitude: W0690000; W0770000
Descriptors: *Andes; *Peru ; geophysical surveys; economic geology ; remote sensing; geothermal energy; South America; Central Andes; thermal waters; hot springs; calderas; exploration; volcanoes; faults
Section Headings: 29 .(ECONOMIC GEOLOGY, ENERGY SOURCES)

1156223 83-14791
Exploration for geothermal resources in Dixie Valley, Nevada; a case history
Parchman, W. L., Jr.; Knox, J. W.
Sunoco Energy Dev., Dallas, TX, USA
Circum-Pacific energy and mineral resources conference
Anonymous
Circum-Pacific energy and mineral resources conference, Honolulu, HI, United States, Aug. 23-27, 1982
AAPG Bulletin 66: 7, 980p., 1982
CODEN: AABUD2 ISSN: 0149-1423
Subfile: B
Country of Publ.: United States
Doc Type: SERIAL; CONFERENCE PUBLICATION Bibliographic Level: ANALYTIC
Languages: English
Latitude: N390000; N400000 Longitude: W1173000; W1191500
Descriptors: *Nevada ; economic geology; geophysical surveys ; geothermal energy; surveys; Churchill County; United States; Dixie Valley; exploration; magnetotelluric surveys; seismic surveys; heat flow
Section Headings: 29 .(ECONOMIC GEOLOGY, ENERGY SOURCES)

1156125 83-14814
Roosevelt Hot Springs geothermal system, Utah; case study
Ross, H. P.; Nielson, D. L.; Moore, J. N.
Univ. Utah Res. Inst., Earth Sci. Lab., Salt Lake City, UT, USA
AAPG Bulletin 66: 7, 879-902p., 1982
CODEN: AABUD2 ISSN: 0149-1423 55 REFS.
Subfile: B
Country of Publ.: United States
Doc Type: SERIAL Bibliographic Level: ANALYTIC
Languages: English
illus., 6 tables, geol. sketch map
Latitude: N381500; N385000 Longitude: W1122000; W1133000
Descriptors: *Utah ; economic geology ; geothermal energy; Beaver County; United States; Roosevelt Hot Springs KGRA; Basin and Range Province; case studies; exploration; faults ; reservoir properties; hydrothermal alteration; metasomatism; thermal waters; geochemistry; geophysical surveys; hydrochemistry; review; geothermal systems
Section Headings: 29 .(ECONOMIC GEOLOGY, ENERGY SOURCES)

1155155 83-14486
Schlumberger soundings in the Medicine Lake area, California
Zohdy, A. A. R.; Bisdorf, R. J.
U. S. Geol. Surv., USA
Open-File Report (United States Geological Survey. 1978) 163p., 1982
CODEN: XGROAG ISSN: 0196-1497 6 REFS.
Subfile: B
Country of Publ.: United States
Doc Type: SERIAL; REPORT Bibliographic Level: MONOGRAPHIC
Languages: English
Report No.: 82-0887
Availability: U. S. Geol. Surv., Open-File Serv. Sect., West. Distrib. Branch, Denver, CO, United States
illus., sketch map
Latitude: N413000; N414200 Longitude: W1213000; W1214500
Descriptors: *California ; economic geology; geophysical surveys ; geothermal energy; electrical surveys; Siskiyou County; USGS; United States; Northern California; Medicine Lake; sounding; Schlumberger methods; resistivity; exploration; data
Section Headings: 29 .(ECONOMIC GEOLOGY, ENERGY SOURCES)

1155052 83-14494
Bipole-dipole electrical technique applied to geothermal exploration in New Mexico
Gerety, M. T.
Univ. of New Mexico, Albuquerque, NM, USA
unknownp., 1980
Subfile: B

(cont. next page)

DIALOG File 89: GEOREF - 29-84/Nov (Copr. American Geological Institute)

Degree Level: Master's
Country of Publ.: United States
Doc Type: THESIS Bibliographic Level: MONOGRAPHIC
Languages: English
Descriptors: *New Mexico ; geophysical surveys; economic geology ; electrical surveys; geothermal energy; United States; exploration; applications; accuracy; errors; bipole-dipole surveys
Section Headings: 29 .(ECONOMIC GEOLOGY, ENERGY SOURCES)

1154544 83-14848
Geophyscial/geothermal studies in the southeastern Mimbres Basin near the City of Columbus, southern Rio Grande Rift, New Mexico
Swanberg, C. A.; Sanders, R.; Marvin, P. R.; Daggett, P.; Young, C. T.; Morgan, P.
N. Mex. State Univ., Las Cruces, NM, USA; Univ. Tex., El Paso, USA
Geology of the border; southern New Mexico-northern Chihuahua
Hoffer, J. M.(EDITOR); Hoffer, R. L.(EDITOR)
Univ. Tex., Dep. Geol. Sci., El Paso, TX, USA
Publ: El Paso Geol. Soc.
91-96p., 1981
6 REFS.
Subfile: B
Country of Publ.: United States
Doc Type: BOOK Bibliographic Level: ANALYTIC
Languages: English
illus., 1 table, sketch map
Latitude: N310000; N310000 Longitude: W1070000; W1070000
Descriptors: *New Mexico ; geophysical surveys; economic geology ; surveys; geothermal energy; Luna County; United States; heat flow; electrical surveys; Basin and Range Province; Mimbres Basin; U.S.-Mexico boundary; Rio Grande Rift; temperature; land use; planning; industrial parks; site exploration; southern New Mexico
Section Headings: 29 .(ECONOMIC GEOLOGY, ENERGY SOURCES)

1147370 83-04898
Self-potential measurements and interpretation at Riviere Langevin and Cirque de Salazie, Ile de la Reunion
Fitterman, D. V.
Open-File Report (United States Geological Survey. 1978) 52 p., 1982
CODEN: XGROAG ISSN: 0196-1497 8 REFS.
Subfile: B
Country of Publ.: United States
Doc Type: SERIAL; REPORT Bibliographic Level: MONOGRAPHIC
Languages: English
Report No.: 82-0580
Availability: U. S. Geol. Surv., Open-File Serv. Sect., West. Distrib. Branch, Denver, CO, United States
illus., sketch maps
Latitude: S205000; S212500 Longitude: E0560000; E0550000
Descriptors: *Reunion; *geophysical methods ; geophysical surveys; economic geology; electrical methods ; electrical surveys; geothermal energy; interpretation; USGS; Indian Ocean; Riviere Langevin; Langevin River; Cirque de Salazie; Salazie; self-potential methods; exploration
Section Headings: 29 .(ECONOMIC GEOLOGY, ENERGY SOURCES)

1147034 83-04947
Magnetotelluric exploration in Arizona and New Mexico for hot dry rock geothermal energy using SQUID magnetometers
Ander, M. E.
Los Alamos Sci. Lab., Los Alamos, NM, USA; Los Alamos Sci. Lab., USA
SQUID applications to geophysics
Weinstock, H.(EDITOR); Overton, W. C., Jr.(EDITOR)
Ill. Inst. Technol., Chicago, IL, USA
Workshop on SQUID applications ; SQUID applications to geophysics, Los Alamos, NM, United States, June 2-4, 1980
Publ: Soc. Explor. Geophys.
61-65p., 1981
ISBN: 0-931830-18-4 21 REFS.
Subfile: B
Country of Publ.: United States
Doc Type: BOOK; CONFERENCE PUBLICATION Bibliographic Level: ANALYTIC
Languages: English
Note: With discussion, illus., sketch maps
Descriptors: *Southwestern U.S.; *automatic data processing; *Arizona; *New Mexico ; geophysical surveys; economic geology ; magnetotelluric surveys; geothermal energy; United States; hot dry rocks; SQUID; magnetometers; two-dimensional models; models; Jemez Lineament; continental crust; upper mantle; mantle
Section Headings: 29 .(ECONOMIC GEOLOGY, ENERGY SOURCES)

1144249 83-05158
Update on geothermal exploration and drilling in the Capital District of New York
Sneeringer, M. R.; Dunn, J. R.
Dunn Geosci., USA
Geothermal Direct Heat Program; roundup technical conference proceedings; Volume I; papers presented; State Coupled Resource Assessment Program
Ruscetta, C. A.(EDITOR)
Geothermal Direct Heat Program; roundup technical conference , Salt Lake City, UT, United States, April 5-7, 1982
171-175p., 1982
Subfile: B
Doc Type: REPORT; CONFERENCE PUBLICATION Bibliographic Level: ANALYTIC
Languages: English
Report No.: DOE/ID/12079-71; ESL-98
Availability: Univ. Utah Res. Inst., Earth Sci. Lab., Salt

(cont. next page)

Lake City, UT, United States
illus., sketch map
Latitude: N423000; N430000 Longitude: W0734000; W0741000
Descriptors: *New York; *ground water ; economic geology; hydrogeology; surveys; geophysical surveys ; geothermal energy; heat flow; United States; Capital District region; Albany region; Schenectady region; Saratoga Springs region; hydrochemistry; geothermal gradient
Section Headings: 29 .(ECONOMIC GEOLOGY, ENERGY SOURCES)

1144247 83-05023
Three years of geothermal research in Nebraska
Gosnold, W. D., Jr.; Eversoll, D. A.; Carlson, M. P.
Univ. Nebr., Omaha, NE, USA
Geothermal Direct Heat Program; roundup technical conference proceedings; Volume I; papers presented; State Coupled Resource Assessment Program
Ruscetta, C. A.(EDITOR)
Geothermal Direct Heat Program; roundup technical conference , Salt Lake City, UT, United States, April 5-7, 1982
141-157p., 1982
8 REFS.
Subfile: B
Doc Type: REPORT; CONFERENCE PUBLICATION Bibliographic Level: ANALYTIC
Languages: English
Report No.: DOE/ID/12079-71; ESL-98
Availability: Univ. Utah Res. Inst., Earth Sci. Lab., Salt Lake City, UT, United States
illus., sketch maps
Descriptors: *Nebraska; *well-logging ; economic geology; geophysical surveys; applications ; geothermal energy; heat flow; temperature logging; United States; Cretaceous; Mesozoic; geothermal gradient; exploration
Section Headings: 29 .(ECONOMIC GEOLOGY, ENERGY SOURCES)

1144245 83-05163
Relationships between geology and geothermal gradients in Kansas
Stavnes, S. A.; Steeples, D. W.
Kans. Geol. Surv., Lawrence, KS, USA
Geothermal Direct Heat Program; roundup technical conference proceedings; Volume I; papers presented; State Coupled Resource Assessment Program
Ruscetta, C. A.(EDITOR)
Geothermal Direct Heat Program; roundup technical conference , Salt Lake City, UT, United States, April 5-7, 1982
88-121p., 1982
23 REFS.
Subfile: B
Doc Type: REPORT; CONFERENCE PUBLICATION Bibliographic Level: ANALYTIC
Languages: English
Report No.: DOE/ID/12079-71; ESL-98
Availability: Univ. Utah Res. Inst., Earth Sci. Lab., Salt Lake City, UT, United States
illus., sects., setch maps
Descriptors: *Kansas; *well-logging ; economic geology; geophysical surveys; applications ; geothermal energy; heat flow; temperature logging; United States; geothermal gradient; exploration
Section Headings: 29 .(ECONOMIC GEOLOGY, ENERGY SOURCES)

1144243 83-05085
Helium and ground temperature surveys at Steamboat Springs, Colorado
McCarthy, K. P.; Been, J.; Reimer, G. M.; Bowles, C. G.; Murrey, D. G.
Colo. Geol. Surv., Colo., USA; U. S. Geol. Surv., USA
Geothermal Direct Heat Program; roundup technical conference proceedings; Volume I; papers presented; State Coupled Resource Assessment Program
Ruscetta, C. A.(EDITOR)
Geothermal Direct Heat Program; roundup technical conference , Salt Lake City, UT, United States, April 5-7, 1982 .
64-75p., 1982
25 REFS.
Subfile: B
Doc Type: REPORT; CONFERENCE PUBLICATION Bibliographic Level: ANALYTIC
Languages: English
Report No.: DOE/ID/12079-71; ESL-98
Availability: Univ. Utah Res. Inst., Earth Sci. Lab., Salt Lake City, UT, United States
1 table, sketch maps
Latitude: N402500; N403500 Longitude: W1064000; W1070000
Descriptors: *Colorado; *helium ; geochemistry; geophysical surveys; economic geology ; heat flow; soils; geothermal energy; Routt County; United States; Steamboat Springs; faults; exploration
Section Headings: 29 .(ECONOMIC GEOLOGY, ENERGY SOURCES)

1144242 83-05199
Resource investigations of low- and moderate-temperature geothermal areas in San Bernardino, California
Youngs, L. G.
Calif. Div. Mines and Geol., Calif., USA
Geothermal Direct Heat Program; roundup technical conference proceedings; Volume I; papers presented; State Coupled Resource Assessment Program
Ruscetta, C. A.(EDITOR)
Geothermal Direct Heat Program; roundup technical conference , Salt Lake City, UT, United States, April 5-7, 1982
62-63p., 1982
Subfile: B
Doc Type: REPORT; CONFERENCE PUBLICATION Bibliographic Level: ANALYTIC
Languages: English

(cont. next page)

Report No.: DOE/ID/12079-71; ESL-98
Availability: Univ. Utah Res. Inst., Earth Sci. Lab., Salt Lake City, UT, United States
Latitude: N340000; N341500 Longitude: W1171500; W1172500
Descriptors: *California ; economic geology; geophysical surveys ; geothermal energy; surveys; San Bernardino County ; United States; San Bernardino region; Arrowhead Hot Springs; South San Bernardino; Harlem Hot Springs; San Bernardino Mountains; exploration; faults; Loma Linda Fault ; gravity surveys; resistivity; electrical surveys
Section Headings: 29 .(ECONOMIC GEOLOGY, ENERGY SOURCES)

1144241 83-05194
Exploration for geothermal energy in Arizona Basin and Range
Witcher, J. C.
Ariz. Bur. Geol. and Miner. Technol., Tucson, AZ, USA
Geothermal Direct Heat Program; roundup technical conference proceedings; Volume I; papers presented; State Coupled Resource Assessment Program
Ruscetta, C. A.(EDITOR)
Geothermal Direct Heat Program; roundup technical conference , Salt Lake City, UT, United States, April 5-7, 1982
33-61p., 1982
29 REFS.
Subfile: B
Doc Type: REPORT; CONFERENCE PUBLICATION Bibliographic Level: ANALYTIC
Languages: English
Report No.: DOE/ID/12079-71; ESL-98
Availability: Univ. Utah Res. Inst., Earth Sci. Lab., Salt Lake City, UT, United States
illus., 2 tables, sketch maps
Latitude: N323000; N325000 Longitude: W1093000; W1095000
Descriptors: *Arizona; *Basin and Range Province; *mercury ; economic geology; geophysical surveys; geochemistry ; geothermal energy; heat flow; soils; United States; exploration; Safford Basin; ground water; hydrochemistry; faults; Bouguer anomalies; geologic thermometry
Section Headings: 29 .(ECONOMIC GEOLOGY, ENERGY SOURCES)

1144239 83-04961
Heat flow and geothermal potential of the Cascade Range
Blackwell, D. D.
South. Methodist Univ., Dep. Geol. Sci., Dallas, TX, USA
Geothermal Direct Heat Program; roundup technical conference proceedings; Volume I; papers presented; State Coupled Resource Assessment Program
Ruscetta, C. A.(EDITOR)
Geothermal Direct Heat Program; roundup technical conference , Salt Lake City, UT, United States, April 5-7, 1982
6-7p., 1982
Subfile: B
Doc Type: REPORT; CONFERENCE PUBLICATION Bibliographic Level: ANALYTIC
Languages: English
Report No.: DOE/ID/12079-71; ESL-98
Availability: Univ. Utah Res. Inst., Earth Sci. Lab., Salt Lake City, UT, United States
Descriptors: *Oregon; *Washington ; geophysical surveys; economic geology ; heat flow; geothermal energy; Cascade Range; United States; exploration
Section Headings: 29 .(ECONOMIC GEOLOGY, ENERGY SOURCES)

1141691 82-61929
Comments on utility of geothermal well logs and an evaluation of the logs from COSO-BDH-1
Sheff, J. R.; Upton, J. W., Jr.
Univ. Lowell, Lowell, MA, USA; Battelle, Pac. Northwest Lab., Richland, WA, USA
Society of Professional Well Log Analysts, Houston, TX, USA
SPWLA twentieth annual logging symposium, Tulsa, OK, United States, June 3-6, 1979
Transactions of the SPWLA Annual Logging Symposium 20, Vol. 2, XX1-XX18p., 1979
CODEN: LGSTA6 ISSN: 0081-1718 2 REFS.
Subfile: B
Country of Publ.: United States
Doc Type: SERIAL; CONFERENCE PUBLICATION Bibliographic Level: ANALYTIC
Languages: English
illus., 6 tables
Descriptors: *California; *well-logging ; geophysical surveys; radioactivity; economic geology ; gamma-ray methods; geothermal energy; United States; Coso Hot Springs KGRA; geothermal fields; exploration; calibration; analysis; thermal conductivity; neutron probe; geophysical methods
Section Headings: 29 .(ECONOMIC GEOLOGY, ENERGY SOURCES)

1141675 82-61918
Classification of geothermal reservoirs from the viewpoint of log analysis
Sanyal, S. K.; Wells, L. E.; Mathews, M. A.
Stanford Univ., Stanford, CA, USA; Sci. Software Corp., Denver, CO, USA
Society of Professional Well Log Analysts, Houston, TX, USA
SPWLA twentieth annual logging symposium, Tulsa, OK, United States, June 3-6, 1979
Transactions of the SPWLA Annual Logging Symposium 20, Vol. 2, HH1-HH20p., 1979
CODEN: LGSTA6 ISSN: 0081-1718 12 REFS.
Subfile: B
Country of Publ.: United States
Doc Type: SERIAL; CONFERENCE PUBLICATION Bibliographic Level: ANALYTIC
Languages: English
illus., 4 tables, sketch map
Descriptors: *United States; *well-logging ; geophysical

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DIALOG File 89: GEOREF - 29-84/Nov (Copr. American Geological Institute)

surveys; applications; economic geology ; interpretation; geothermal energy; exploration; development; hot dry rocks; reservoir rocks; wells
Section Headings: 29 .(ECONOMIC GEOLOGY, ENERGY SOURCES)

1141670 82-61909
Well logs for geothermal development, benefit analysis
Rigby, F. A.; Reardon, P.
Sci. Appl., USA
Society of Professional Well Log Analysts, Houston, TX, USA
SPWLA twentieth annual logging symposium, Tulsa, OK, United States, June 3-6, 1979
Transactions of the SPWLA Annual Logging Symposium 20, Vol. 2, CC1-CC11p., 1979
CODEN: LGSTA6 ISSN: 0081-1718 4 REFS.
Subfile: B
Country of Publ.: United States
Doc Type: SERIAL; CONFERENCE PUBLICATION Bibliographic Level: ANALYTIC
Languages: English
illus., 2 tables
Descriptors: *United States; *well-logging ; geophysical surveys; economic geology; applications ; geothermal energy ; development; analysis; exploration; drilling; techniques; geothermal fields
Section Headings: 29 .(ECONOMIC GEOLOGY, ENERGY SOURCES)

1139762 82-61766
Geothermal studies
Cull, J. P.
BMR, Geol. Geophys., Canberra, A.C.T., AUS
BMR 81; yearbook of the Bureau of Mineral Resources, Geology and Geophysics
Adkins, J. S.(EDITOR)
BMR, Geol. Geophys., Canberra, A.C.T., AUS
BMR; Yearbook of the Bureau of Mineral Resources, Geology & Geophysics 1981, 16-19p., 1982
ISSN: 0158-7285
Subfile: B
Country of Publ.: Australia
Doc Type: SERIAL Bibliographic Level: ANALYTIC
Languages: English
illus., sketch map
Descriptors: *Australia ; economic geology; geophysical surveys ; geothermal energy; heat flow; exploration; programs
Section Headings: 29 .(ECONOMIC GEOLOGY, ENERGY SOURCES)

1139554 82-61977
Geothermal resource exploration
Wollenberg, H. A.
Lawrence Berkeley Lab., Berkeley, CA, USA
Recent trends in hydrogeology
Narasimhan, T. N.(EDITOR)
Lawerence Berkeley Lab., Berkeley, CA, USA
Recent trends in hydrogeology, Berkeley, CA, United States , Feb. 8-9, 1979
Special Paper - Geological Society of America 189, 375-386p., 1982
CODEN: GSAPAZ ISSN: 0072-1077 30 REFS.
Subfile: B
Country of Publ.: United States
Doc Type: SERIAL; CONFERENCE PUBLICATION Bibliographic Level: ANALYTIC
Languages: English
illus., 3 tables, sketch maps
Descriptors: *Basin and Range Province; *ground water ; economic geology; geophysical surveys; surveys; hydrogeology ; geothermal energy; exploration; United States; heat flow; geochemistry; electrical surveys; seismic surveys; gravity surveys; geothermal systems; remote sensing; radioactivity; hot springs
Section Headings: 29 .(ECONOMIC GEOLOGY, ENERGY SOURCES)

1139464 82-61833
Geophysical methods in prospecting for geothermal resources
Keller, G. V.
Colo. Sch. Mines, Dep. Geophys., Golden, CO, USA; Colo. Sch. Mines, USA
Geophysical aspects of the energy problem
Rapolla, A.(EDITOR); Keller, G. V.(EDITOR); Moore, D. J.(EDITOR)
Univ. Naples, Inst. Geol. and Geophys., Naples, ITA
Energy research
Rapolla, A.; Keller, G. V.; Moore, D. J.
Second course held at the School of Geophysics ''Ettore Majorana'' International Centre for Scientific Culture ; Geophysical aspects of the energy problem, Erice, Italy, June 4-18, 1978
Publ: Elsevier Sci. Publ. Co.
1, 51-82p., 1980
ISBN: 0-444-41845-8 21 REFS.
Subfile: B
Country of Publ.: Netherlands
Doc Type: BOOK; CONFERENCE PUBLICATION Bibliographic Level: ANALYTIC
Languages: English
illus., sketch maps
Descriptors: *United States ; economic geology; geophysical surveys ; geothermal energy; seismic surveys; Humboldt County; Pershing County; Washoe County; exploration; production; geothermal systems; California; The Geysers; resistivity; hot dry rocks; Hawaii; Pacific Ocean; seismographs; elastic waves; Imperial Valley; Colorado; San Luis Valley; Basin and Range Province; Nevada ; geophysical methods
Section Headings: 29 .(ECONOMIC GEOLOGY, ENERGY SOURCES)

1136981 82-56941
Geothermal well location in southern Italy; the contribution of geophysical methods
La Torre, P.; Nannini, R.
Boll. Geofis. Teor. Appl. 22: 87, 201-209p., 1980
CODEN: BGTAAE ISSN: 0006-6729 8 REFS.
Subfile: B
Country of Publ.: Italy
Doc Type: SERIAL Bibliographic Level: ANALYTIC
Languages: English Summary Languages: Italian
illus., sketch maps
Descriptors: *Italy ; geophysical surveys; economic geology ; surveys; geothermal energy; Europe; southern Italy; Campi Flegrei region; gravity surveys; magnetic surveys; airborne methods; geophysical methods; electrical surveys; Bouguer anomalies; density; resistivity; magnetic susceptibility; wells; exploration; applications; ring structures
Section Headings: 29 .(ECONOMIC GEOLOGY, ENERGY SOURCES)

1125059 82-47406
Controlled-source audiomagnetotellurics in geothermal exploration
Sandberg, S. K.; Hohmann, G. W.
Univ. Utah, Salt Lake, UT, USA
Technical papers, Fiftieth annual international meeting and exposition
Anonymous
Fiftieth annual international meeting and exposition, Houston, TX, United States, 1980
Technical Papers - Annual International Meeting and Exposition, Society of Exploration Geophysicists 50, 3571-3624p., 1980
21 REFS.
Subfile: B
Country of Publ.: United States
Doc Type: SERIAL; CONFERENCE PUBLICATION Bibliographic Level: ANALYTIC
Languages: English
illus., 2 tables
Latitude: N381500; N385000 Longitude: W1122000; W1133000
Descriptors: *Utah ; geophysical surveys ; magnetotelluric surveys; United States; Roosevelt Hot Springs KGRA; resistivity; two-dimensional models; models; three-dimensional models; controlled-source audiomagnetotelluric methods; geothermal energy
Section Headings: 29 .(ECONOMIC GEOLOGY, ENERGY SOURCES)

1125058 82-45311
In situ determination of heat flow in unconsolidated sediments
Sass, J. H.; Kennelly, J. P., Jr.; Wendt, W. E.; Moses, T. H., Jr.; Ziagos, J. P.
U. S. Geol. Surv., Menlo Park, CA, USA; South Methodist Univ., Dallas, TX, USA
Technical papers, Fiftieth annual international meeting and exposition
Anonymous
Fiftieth annual international meeting and exposition, Houston, TX, United States, 1980
Technical Papers - Annual International Meeting and Exposition, Society of Exploration Geophysicists 50, 3545-3570p., 1980
14 REFS.
Subfile: B
Country of Publ.: United States
Doc Type: SERIAL; CONFERENCE PUBLICATION Bibliographic Level: ANALYTIC
Languages: English
illus., 4 tables, geol. sketch map
Latitude: N404500; N404500 Longitude: W1190500; W1191500
Descriptors: *Nevada ; geophysical surveys ; heat flow; United States; Gerlach; Black Rock Desert; thermal conductivity; exploration; exploitation; geothermal energy; in situ; sediments; unconsolidated materials
Section Headings: 20 .(GEOPHYSICS, APPLIED)

1125023 82-47233
Helium emanometry; an energy exploration guide
Bergquist, L.
West. Syst., USA
Technical papers, Fiftieth annual international meeting and exposition
Anonymous
Fiftieth annual international meeting and exposition, Houston, TX, United States, 1980
Technical Papers - Annual International Meeting and Exposition, Society of Exploration Geophysicists 50, 2567-2578p., 1980
15 REFS.
Subfile: B
Country of Publ.: United States
Doc Type: SERIAL; CONFERENCE PUBLICATION Bibliographic Level: ANALYTIC
Languages: English
illus., sketch maps
Descriptors: *helium; *Texas; *Alaska; *Wyoming ; geochemistry; economic geology ; soils; petroleum; geothermal energy; uranium ores; United States; Amarillo; Pilgrim Springs; exploration; helium gas; helium emanometry ; reservoir rocks; ground methods; geophysical methods; geophysical surveys
Section Headings: 29 .(ECONOMIC GEOLOGY, ENERGY SOURCES)

DIALOG File 89: GEOREF - 29-84/Nov (Copr. American Geological Institute)

1124947 82-45299
Developments in exploration geophysics, 1975-1980
Rice, R. B.; Allen, S. J.; Gant, O. J., Jr.; Hodgson, R. N.; Larson, D. E.; Lindsey, J. P.; Patch, J. R.; LaFehr, T. R.; Pickett, G. R.; Schneider, W. A.; White, J. E.; Roberts, J. C.
Geophys. Syst. Corp., USA; Atl. Richfield. Co., USA
Technical papers, Fiftieth annual international meeting and exposition
Anonymous
Fiftieth annual international meeting and exposition, Houston, TX, United States, 1980
Technical Papers - Annual International Meeting and Exposition, Society of Exploration Geophysicists 50, 1-32p., 1980
20 REFS.
Subfile: B
Country of Publ.: United States
Doc Type: SERIAL; CONFERENCE PUBLICATION Bibliographic Level: ANALYTIC
Languages: English
Descriptors: *geophysical methods ; methods ; applications ; exploration; crust; geothermal energy; magnetic surveys; geophysical surveys; remote sensing; coal; organic residues; petroleum; gravity surveys; seismic surveys; well-logging
Section Headings: 20 .(GEOPHYSICS, APPLIED)

1122207 82-42574
Estimation of heat discharge rates using infrared measurements by a helicopter-borne thermocamera over the geothermal areas of Unzen Volcano, Japan
Yuhara, K.; Ehara, S.; Tagomori, K.
Kyushu Univ., Fac. Eng., Fukuoka, JPN
Geothermal energy; exploration and resources
Cull, J. P.(EDITOR)
Geothermal energy, exploration and resources; a part of the International Union of Geodesy and Geophysics, 17th general assembly, Canberra, Australia, Dec. 1979
Journal of Volcanology and Geothermal Research 9: 1, 99-109p., 1981
CODEN: JVGRDQ ISSN: 0377-0273 7 REFS.
Subfile: B
Country of Publ.: Netherlands
Doc Type: SERIAL; CONFERENCE PUBLICATION Bibliographic Level: ANALYTIC
Languages: English
illus., 4 tables
Latitude: N323000; N333000 Longitude: E1303000; E1293000
Descriptors: *Japan; *volcanology ; economic geology; geophysical surveys; volcanoes ; geothermal energy; remote sensing; heat flow; Unzen; eruptions; heat flux; thermal emission; Kyushu; Asia; infrared surveys; Volcan Unzen
Section Headings: 29 .(ECONOMIC GEOLOGY, ENERGY SOURCES)

1122206 82-42453
Evaluation methods of heat discharge and their applications to the major active volcanoes in Japan
Kagiyama, T.
Univ. Tokyo, Earthquake Res. Inst., Bunkyo-ku, Tokyo 113, JPN
Geothermal energy; exploration and resources
Cull, J. P.(EDITOR)
Geothermal energy, exploration and resources; a part of the International Union of Geodesy and Geophysics, 17th general assembly, Canberra, Australia, Dec. 1979
Journal of Volcanology and Geothermal Research 9: 1, 87-97p., 1981
CODEN: JVGRDQ ISSN: 0377-0273 13 REFS.
Subfile: B
Country of Publ.: Netherlands
Doc Type: SERIAL; CONFERENCE PUBLICATION Bibliographic Level: ANALYTIC
Languages: English
illus., table
Descriptors: *Japan; *volcanology ; geophysical surveys; economic geology; volcanoes ; heat flow; geothermal energy; eruptions; heat flux; fumaroles; equations; Asia
Section Headings: 29 .(ECONOMIC GEOLOGY, ENERGY SOURCES)

1122205 82-42396
Heat flow at standard depth
Cull, J. P.
Bur. Miner. Resour., Canberra, AUS
Geothermal energy; exploration and resources
Cull, J. P.(EDITOR)
Geothermal energy, exploration and resources; a part of the International Union of Geodesy and Geophysics, 17th general assembly, Canberra, Australia, Dec. 1979
J. Volcanol. Geotherm. Res. 9: 1, 77-85p., 1981
CODEN: JVGRDQ ISSN: 0377-0273 14 REFS.
Subfile: B
Country of Publ.: Netherlands
Doc Type: SERIAL; CONFERENCE PUBLICATION Bibliographic Level: ANALYTIC
Languages: English
illus.
Presentation of a method for detecting geothermal anomalies by means of heat flow measurements at shallow depths (for example, 100 meters).
Descriptors: *Australia ; economic geology; geophysical surveys ; geothermal energy; heat flow; depth; crust; shallow depth
Section Headings: 29 .(ECONOMIC GEOLOGY, ENERGY SOURCES)

1122204 82-42569
Geothermal studies in China
Wang Ji-yang; Chen Mo Xiang; Wang Ji-an; Deng Xiao; Wang Jun ; Shen Hsien-chieh; Hsiung Liang-ping; Yan Shu-zhen; Fan Zhi Cheng; Liu Xiu-wen; Huang Ge-shan; Zhang Wen-ren; Shao Hai-hui ; Zhang Rong-yan
Acad. Sin. Beijing, Inst. Geol., Beijing, CHN
Geothermal energy; exploration and resources
Cull, J. P.(EDITOR)
Geothermal energy, exploration and resources; a part of the International Union of Geodesy and Geophysics, 17th general assembly, Canberra, Australia, Dec. 1979
Journal of Volcanology and Geothermal Research 9: 1, 57-76p., 1981
CODEN: JVGRDQ ISSN: 0377-0273 4 REFS.
Subfile: B
Country of Publ.: Netherlands
Doc Type: SERIAL; CONFERENCE PUBLICATION Bibliographic Level: ANALYTIC
Languages: English
illus., 2 tables
Regional geothermal studies. Terrestrial heat flow data from 17 sites. Characteristics of experimental geothermal power plants in service.
Descriptors: *China ; geophysical surveys; economic geology ; heat flow; geothermal energy; continental crust; Asia; exploration; power plants; production; hot springs; thermal waters; geothermal power plants
Section Headings: 29 .(ECONOMIC GEOLOGY, ENERGY SOURCES)

1122201 82-42343
A regional strategy for geothermal exploration with emphasis on gravity and magnetotellurics
Aiken, C. L. V.; Ender, M. E.
Univ. Texas, Cent. Energy Stud., Richardson, TX 75080, USA
Geothermal energy; exploration and resources
Cull, J. P.(EDITOR)
Geothermal energy, exploration and resources; a part of the International Union of Geodesy and Geophysics, 17th general assembly, Canberra, Australia, Dec. 1979
Journal of Volcanology and Geothermal Research 9: 1, 1-27 p., 1981
CODEN: JVGRDQ ISSN: 0377-0273 4 p. REFS.
Subfile: B
Country of Publ.: Netherlands
Doc Type: SERIAL; CONFERENCE PUBLICATION Bibliographic Level: ANALYTIC
Languages: English
illus., sketch map
Programs of geothermal geophysical exploration in Arizona and New Mexico. Results of interpretation of several methods, with emphasis on gravimetric and magnetotelluric methods.
Descriptors: *Southwestern U.S.; *New Mexico; *Arizona ; economic geology; geophysical surveys ; geothermal energy; surveys; magnetic surveys; gravity surveys; Bouguer anomalies; residual anomalies; magnetotelluric surveys; United States; electromagnetic surveys; Colorado Plateau; Basin and Range Province
Section Headings: 29 .(ECONOMIC GEOLOGY, ENERGY SOURCES)

1116497 82-37413
Interpretation of gravity anomalies observed in the Cascade Mountain Province of northern Oregon
Braman, D. E.
Oregon State Univ., Corvallis, OR, USA
unknownp., 1981
Subfile: B
Degree Level: Master's
Country of Publ.: United States
Doc Type: THESIS Bibliographic Level: MONOGRAPHIC
Languages: English
Descriptors: *Oregon; *intrusions ; geophysical surveys; economic geology; plutons ; gravity surveys; geothermal energy; distribution; Columbia River Basalt; United States; Cascade Mountains; Pacific Coast; exploration; Deschutes-Umatilla Plateau; Bouguer anomalies; faults
Section Headings: 29 .(ECONOMIC GEOLOGY, ENERGY SOURCES)

1116493 82-37415
Analysis of aeromagnetic measurements from the central Oregon Cascades
Connard, G. G.
Oregon State Univ., Corvallis, OR, USA
unknownp., 1980
Subfile: B
Degree Level: Master's
Country of Publ.: United States
Doc Type: THESIS Bibliographic Level: MONOGRAPHIC
Languages: English
Descriptors: *Oregon ; geophysical surveys; economic geology ; magnetic surveys; geothermal energy; United States; Cascade Mountains; exploration; Fourier analysis; Holocene; Quaternary; Basin and Range Province; basement
Section Headings: 29 .(ECONOMIC GEOLOGY, ENERGY SOURCES)

1116434 82-37559
Geothermal energy
Hatton, K. S.
N. Mex. INst. Min. & Technol., Bur. Geol., Santa Fe, NM, USA
New Mexico's energy resources '81
Arnold, E. C.(COMPILER); Hill, J. M.(COMPILER)
N. Mex. Inst. Min. & Technol., Bur. Geol., Santa Fe, NM, USA
Annual Report - New Mexico Bureau of Mines and Mineral Resources (Socorro, 1965) 1981, 52-60p., 1981
CODEN: ARNRD2 ISSN: 0160-0532
Subfile: B

(cont. next page)

Country of Publ.: United States
Doc Type: SERIAL Bibliographic Level: ANALYTIC
Languages: English
illus., sketch map
Descriptors: *New Mexico ; economic geology; geophysical surveys ; geothermal energy; seismic surveys; United States ; annual report; distribution; Colorado Plateau; Basin and Range Province; exploration; research
Section Headings: 29 .(ECONOMIC GEOLOGY, ENERGY SOURCES)

1116320 82-37519
A new geothermal anomaly in Nicaragua
Eckstein, Y.
Kent State Univ., Dep. Geol., Kent, OH, USA; Inst. Geol. Sci., GBR
Hydrogeothermal studies; 26th international geological congress
Lavigne, J.(EDITOR); Day, J. B. W.(EDITOR)
BRGM, Serv. Geol. Natl., Orleans, FRA
Hydrogeothermal studies; thermal characteristics and physico-chemical behaviour of underground waters in relation to the components of aquifers; a part of the 26th international geological congress, Paris, France, July 7-17, 1980
Journal of Hydrology 56: 1-2, 163-174p., 1982
CODEN: JHYDA7 ISSN: 0022-1694 12 REFS.
Subfile: B
Country of Publ.: Netherlands
Doc Type: SERIAL; CONFERENCE PUBLICATION Bibliographic Level: ANALYTIC
Languages: English
Note: Kent State Univ., Dep. Geol.; Contrib. No. 192, illus., 24 anal., 1 table, sketch maps
Latitude: N114000; N120000 Longitude: W0855500; W0861500
Descriptors: *Nicaragua ; economic geology; geophysical surveys ; geothermal energy; heat flow; Central America; exploration; reservoir properties; anomalies; thermal waters; geochemistry; hydrochemistry; ground water; temperature
Section Headings: 29 .(ECONOMIC GEOLOGY, ENERGY SOURCES)

1115069 82-37752
Geothermal reconnaissance on the Fort Apache Indian Reservation using electrical methods
Young, C.
N.M. State Univ., Phys. Dep., Las Cruces, NM, USA
Geothermal; energy for the eighties
Berge, C. W.(chairperson)
Phillips Pet. Co., USA
Geothermal Resources Council annual meeting; Geothermal, energy for the eighties, Salt Lake City, UT, United States, Sept. 9-11, 1980
Transactions - Geothermal Resources Council 4, 269-271p., 1980
ISSN: 0193-5933 ISBN: 0-934412-54-5 7 REFS.
Subfile: B
Country of Publ.: United States
Doc Type: SERIAL; CONFERENCE PUBLICATION Bibliographic Level: ANALYTIC
Languages: English
sketch maps
Descriptors: *Arizona ; economic geology; geophysical surveys ; geothermal energy; Earth-current surveys; United States; Fort Apache Indian Reservation; exploration; Springerville; Saint Johns; sounding; heat flow; resistivity
Section Headings: 29 .(ECONOMIC GEOLOGY, ENERGY SOURCES)

1115062 82-37684
The Eastern Hot Dry Rock Target Prospect; a case history
Schubert, C. E.; Maxwell, J. C.; Johnson, W. J.
D'Appolonia Consult. Eng., Pittsburgh, PA, USA; Los Alamos Sci. Lab., Los Alamos, NM, USA
Geothermal; energy for the eighties
Berge, C. W.(chairperson)
Phillips Pet. Co., USA
Geothermal Resources Council annual meeting; Geothermal, energy for the eighties, Salt Lake City, UT, United States, Sept. 9-11, 1980
Transactions - Geothermal Resources Council 4, 241-244p., 1980
ISSN: 0193-5933 ISBN: 0-934412-54-5 1 REFS.
Subfile: B
Country of Publ.: United States
Doc Type: SERIAL; CONFERENCE PUBLICATION Bibliographic Level: ANALYTIC
Languages: English
illus., geol. sketch maps
Descriptors: *Maryland; *Virginia ; economic geology; geophysical surveys ; geothermal energy; magnetic surveys; United States; Smith Island; Assateague Island; Eastern Hot Dry Rock Target Prospect; case studies; hot dry rocks; heat flow; geothermal gradient; airborne methods; geophysical methods; drilling; exploration
Section Headings: 29 .(ECONOMIC GEOLOGY, ENERGY SOURCES)

1115058 82-37649
Exploration model for possible geothermal reservoir, Coso Hot Springs KGRA, Inyo Co., California
Olson, D. M.; Robinson, R. H.
Fugro, Long Beach, CA, USA
Geothermal; energy for the eighties
Berge, C. W.(chairperson)
Phillips Pet. Co., USA
Geothermal Resources Council annual meeting; Geothermal, energy for the eighties, Salt Lake City, UT, United States, Sept. 9-11, 1980
Transactions - Geothermal Resources Council 4, 225-228p.,

(cont. next page)

1980
ISSN: 0193-5933 ISBN: 0-934412-54-5 7 REFS.
Subfile: B
Country of Publ.: United States
Doc Type: SERIAL; CONFERENCE PUBLICATION Bibliographic Level: ANALYTIC
Languages: English
geol. sketch maps
Descriptors: *California ; economic geology; geophysical surveys ; geothermal energy; gravity surveys; United States ; Inyo County; Coso Hot Springs KGRA; exploration; geothermal fields; reservoir rocks; China Lake Naval Weapons Center; Bouguer anomalies
Section Headings: 29 .(ECONOMIC GEOLOGY, ENERGY SOURCES)

1115057 82-37616
A summary of the geology and geophysics of the San Emidio KGRA, Washoe County, Nevada
Mackelprang, C. E.; Moore, J. N.; Ross, H. P.
Univ. Utah Res. Inst., Salt Lake City, UT, USA
Geothermal; energy for the eighties
Berge, C. W.(chairperson)
Phillips Pet. Co., USA
Geothermal Resources Council annual meeting; Geothermal, energy for the eighties, Salt Lake City, UT, United States, Sept. 9-11, 1980
Transactions - Geothermal Resources Council 4, 221-224p., 1980
ISSN: 0193-5933 ISBN: 0-934412-54-5 3 REFS.
Subfile: B
Country of Publ.: United States
Doc Type: SERIAL; CONFERENCE PUBLICATION Bibliographic Level: ANALYTIC
Languages: English
Descriptors: *Nevada ; economic geology; geophysical surveys ; geothermal energy; electrical surveys; Washoe County; United States; San Emidio KGRA; resistivity; drilling; geothermal gradient; reservoir rocks; exploration
Section Headings: 29 .(ECONOMIC GEOLOGY, ENERGY SOURCES)

1115051 82-37448
Hot dry rock geothermal site evaluation, western Snake River plain, Idaho
Arney, B. H.; Beyer, J. H.; Simon, D. B.; Tonani, F. B.; Weiss, R. B.
Los Alamos Sci. Lab., Los Alamos, NM, USA; Harding Lawson Assoc., Novato, CA, USA
Geothermal; energy for the eighties
Berge, C. W.(chairperson)
Phillips Pet. Co., USA
Geothermal Resources Council annual meeting; Geothermal, energy for the eighties, Salt Lake City, UT, United States, Sept. 9-11, 1980
Transactions - Geothermal Resources Council 4, 197-200p., 1980
ISSN: 0193-5933 ISBN: 0-934412-54-5
Subfile: B
Country of Publ.: United States
Doc Type: SERIAL; CONFERENCE PUBLICATION Bibliographic Level: ANALYTIC
Languages: English
illus., sketch map
Descriptors: *Idaho ; economic geology; geophysical surveys ; geothermal energy; Earth-current surveys; United States; Snake River plain; hot dry rocks; site exploration; reservoir rocks; seismic surveys; heat flow; geothermal gradient; thermal waters
Section Headings: 29 .(ECONOMIC GEOLOGY, ENERGY SOURCES)

1115038 82-37455
Remote sensing analysis instrumentation for geothermal exploration
Avera, H. Q.
Bausch Lomb, Rochester, NY, USA
Geothermal; energy for the eighties
Berge, C. W.(chairperson)
Phillips Pet. Co., USA
Geothermal Resources Council annual meeting; Geothermal, energy for the eighties, Salt Lake City, UT, United States, Sept. 9-11, 1980
Transactions - Geothermal Resources Council 4, 145-148p., 1980
ISSN: 0193-5933 ISBN: 0-934412-54-5
Subfile: B
Country of Publ.: United States
Doc Type: SERIAL; CONFERENCE PUBLICATION Bibliographic Level: ANALYTIC
Languages: English
illus.
Descriptors: *geothermal energy; *remote sensing ; exploration; imagery ; exploitation; instruments; automatic data processing; geophysical surveys; computer programs
Section Headings: 29 .(ECONOMIC GEOLOGY, ENERGY SOURCES)

1115020 82-37602
Application of roving bipole-dipole mapping method to the Chingshui geothermal area, Taiwan
Lee, C.; Lee, C.; Cheng, W.
Min. Res. Serv. Organ., ITRI, Taipei, TWN
Geothermal; energy for the eighties
Berge, C. W.(chairperson)
Phillips Pet. Co., USA
Geothermal Resources Council annual meeting; Geothermal, energy for the eighties, Salt Lake City, UT, United States, Sept. 9-11, 1980
Transactions - Geothermal Resources Council 4, 73-76p., 1980

(cont. next page)

ISSN: 0193-5933 ISBN: 0-934412-54-5 9 REFS.
Subfile: B
Country of Publ.: United States
Doc Type: SERIAL; CONFERENCE PUBLICATION Bibliographic Level: ANALYTIC
Languages: English
illus., sketch maps
Descriptors: *Taiwan ; economic geology; geophysical surveys : geothermal energy; electrical surveys; Asia; bipole-dipole arrays; cartography; exploration; anomalies; resistivity; Chingshui; maps; methods
Section Headings: 29 .(ECONOMIC GEOLOGY, ENERGY SOURCES)

1115019 82-37598
Geothermal gradient map of the United States
Kron, A.; Heiken, G.
Los Alamos Sci. Lab., Los Alamos, NM, USA
Geothermal; energy for the eighties
Berge, C. W.(chairperson)
Phillips Pet. Co., USA
Geothermal Resources Council annual meeting; Geothermal, energy for the eighties, Salt Lake City, UT, United States, Sept. 9-11, 1980
Transactions - Geothermal Resources Council 4, 69-71p., 1980
ISSN: 0193-5933 ISBN: 0-934412-54-5 1 REFS.
Subfile: B
Country of Publ.: United States
Doc Type: SERIAL; CONFERENCE PUBLICATION Bibliographic Level: ANALYTIC
Languages: English
sketch map
Descriptors: *United States ; economic geology; geophysical surveys ; geothermal energy; heat flow; maps; geothermal gradient; hot dry rocks; resources; exploration
Section Headings: 29 .(ECONOMIC GEOLOGY, ENERGY SOURCES)

1115009 82-37496
Airborne electromagnetic surveys as a reconnaissance technique for geothermal exploration
Christopherson, K. R.; Long, C. L.; Hoover, D. B.
U. S. Geol. Surv., Denver, CO, USA
Geothermal; energy for the eighties
Berge, C. W.(chairperson)
Phillips Pet. Co., USA
Geothermal Resources Council annual meeting; Geothermal, energy for the eighties, Salt Lake City, UT, United States, Sept. 9-11, 1980
Transactions - Geothermal Resources Council 4, 29-31p., 1980
ISSN: 0193-5933 ISBN: 0-934412-54-5 3 REFS.
Subfile: B
Country of Publ.: United States
Doc Type: SERIAL; CONFERENCE PUBLICATION Bibliographic Level: ANALYTIC
Languages: English
illus., geol. sketch maps
Descriptors: *California; *Nevada ; economic geology; geophysical surveys ; geothermal energy; magnetotelluric surveys; United States; Surprise Valley KGRA; Wabuska KGRA
Section Headings: 29 .(ECONOMIC GEOLOGY, ENERGY SOURCES)

1115006 82-37481
Gravity and thermal models of the Twin Peaks magma system, West-central Utah
Carrier, D. L.; Chapman, D. S.
Union Oil, Geothermal Div., Santa Rosa, CA, USA; Univ. Utah, Dep. Geol. Geophys., Salt Lake City, UT, USA
Geothermal; energy for the eighties
Berge, C. W.(chairperson)
Phillips Pet. Co., USA
Geothermal Resources Council annual meeting; Geothermal, energy for the eighties, Salt Lake City, UT, United States, Sept. 9-11, 1980
Transactions - Geothermal Resources Council 4, 17-20p., 1980
ISSN: 0193-5933 ISBN: 0-934412-54-5 9 REFS.
Subfile: B
Country of Publ.: United States
Doc Type: SERIAL; CONFERENCE PUBLICATION Bibliographic Level: ANALYTIC
Languages: English
illus., sketch map
Descriptors: *Utah ; economic geology; geophysical surveys ; geothermal energy; heat flow; United States; Twin Peaks ; magmas; Black Rock Desert; exploration; Roosevelt Hot Springs KGRA; Cove Fort-Sulphurdale KGRA; Meadow-Hatton KGRA ; volcanism; Tertiary; Cenozoic
Section Headings: 29 .(ECONOMIC GEOLOGY, ENERGY SOURCES)

1114777 82-37397
Two dimensional modeling results of telluric-magnetotelluric data from the Tuscarora area, Elko County, Nevada
Mackelprang, C. E.
25p., 1982
13 REFS.
Subfile: B
Doc Type: REPORT Bibliographic Level: MONOGRAPHIC
Languages: English
Report No.: ESL-63
Availability: Univ. Utah Res. Inst., Earth Sci. Lab., Salt Lake City, UT, United States
Note: Prep. for U. S. Dep. Energy, illus., sketch maps
Descriptors: *Nevada ; geophysical surveys; economic geology : magnetotelluric surveys; geothermal energy; United States; Elko County; two-dimensional models; models; Tuscarora; exploration
Section Headings: 29 .(ECONOMIC GEOLOGY, ENERGY SOURCES)

1114776 82-37396
Interpretation of the dipole-dipole electrical resistivity survey, Tuscarora geothermal area, Elko County, Nevada
Mackelprang, C. E.
16p., 1982
11 REFS.
Subfile: B
Doc Type: REPORT Bibliographic Level: MONOGRAPHIC
Languages: English
Report No.: ESL-72
Availability: Univ. Utah Res. Inst., Earth Sci. Lab., Salt Lake city, UT, United States
Note: Prep. for U. S. Dep. Energy. illus., sketch maps
Descriptors: *Nevada ; geophysical surveys; economic geology ; electrical surveys; geothermal energy; Elko County; United States; Tuscarora; resistivity; exploration
Section Headings: 29 .(ECONOMIC GEOLOGY, ENERGY SOURCES)

1112717 82-37488
Analysis of geological and geophysical logs of two geothermal exploration wells drilled on NMSU land, Las Cruces, New Mexico
Chaturvedi, L.
N.M. State Univ., Dep. Earth Sci. and Civ. Eng., Las Cruces, NM, USA
State-coupled Low Temperature Geothermal Resource Assessment Program, fiscal year 1979; final technical report
Icerman, L.(EDITOR); Starkey, A.(EDITOR); Trentman, N.(EDITOR)
N.M. State Univ., N.M. Energy Inst., Las Cruces, NM, USA
10.1-10.24p., 1980
5 REFS.
Subfile: B
Doc Type: REPORT Bibliographic Level: ANALYTIC
Languages: English
Report No.: DOE/ID/01717-1
Availability: NTIS, Springfield, VA, United States
illus., geol. sketch map
Latitude: N321000; N322000 Longitude: W1064500; W1065000
Descriptors: *New Mexico; *ground water ; economic geology; surveys; geophysical surveys ; geothermal energy; well-logging; Dona Ana County; Santa Fe Group; Soledad Rhyolite; United States; Las Cruces; Las Alturas; geothermal gradient; electrical logging; radioactivity; resistivity; self-potential methods; caliper logging; gamma-ray methods; geophysical methods
Section Headings: 29 .(ECONOMIC GEOLOGY, ENERGY SOURCES)

1103041 82-26784
A resistivity study in the Matsao geothermal area; Yangmingshan, Taipei
Su, F.
Chinese Pet., TWN
Pet. Geol. Taiwan 17, 125-132p., 1980
CODEN: PGTWAU ISSN: 0553-8890 14 REFS.
Subfile: B
Country of Publ.: Taiwan, Province of
Doc Type: SERIAL Bibliographic Level: ANALYTIC
Languages: Chinese Summary Languages: English
In commemoration of Mr. Yu Fan Yang's forty years of service with the petroleum industry. sketch maps
Descriptors: *Taiwan; *ground water ; geophysical surveys; economic geology; hydrogeology; surveys ; electrical surveys; geothermal energy; thermal waters; Asia; resistivity; Matsao geothermal area; Pliocene; Neogene; Tertiary; Cenozoic; Miocene; hot springs; fumaroles; site exploration; computer programs; interpretation; Yangmingshan; anomalies
Section Headings: 29 .(ECONOMIC GEOLOGY, ENERGY SOURCES)

1101791 82-26764
Results of test drilling at Newberry Volcano, Oregon
Sammel, E. A.
U. S. Geol. Surv., Menlo Park, CA, USA
Bulletin - Geothermal Resources Council 10: 11, 3-8p., 1981
CODEN: BGRCDD ISSN: 0160-7782 7 REFS.
Subfile: B
Country of Publ.: United States
Doc Type: SERIAL Bibliographic Level: ANALYTIC
Languages: English
illus., sketch maps
Descriptors: *Oregon ; economic geology; geophysical surveys ; geothermal energy; heat flow; Newberry Volcano; United States; Cascade Range; exploration
Section Headings: 29 .(ECONOMIC GEOLOGY, ENERGY SOURCES)

1096642 82-20834
The application of acoustic televiewer to the characterization of hydraulic fractures in geothermal wells
Keys, W. S.
Raft River well stimulation experiments; geothermal reservoir well stimulation program
Republic Geothermal, Santa Fe Springs, CA, USA; Maurer Engineering 2Houston, TX 3USA; Vetter Research 2Costa Mesa, CA 3USA
A.1-A.11p., 1980
14 REFS.
Subfile: B
Doc Type: REPORT Bibliographic Level: ANALYTIC
Languages: English
Report No.: DOE/AL/10563-T7
Availability: NTIS, Springfield, VA, United States
Latitude: N420000; N423500 Longitude: W1130500; W1134000
Descriptors: *Idaho; *rock mechanics; *well-logging ; economic geology; field studies; acoustical logging :
(cont. next page)

geothermal energy; hydraulic fracturing; instruments; Cassia County; United States; Raft River basin; geophysical surveys; televiewers; exploration; production
Section Headings: 29 .(ECONOMIC GEOLOGY, ENERGY SOURCES)

1096585 82-20808
Conductive thermal modeling of Wyoming geothermal systems
Heasler, H. P.
Univ. Wyo., Dep. Geol. Geophys., Laramie, WY, USA
Geothermal Direct Heat Program; Glenwood Springs technical conference proceedings; Volume 1, Papers presented; State Coupled Geothermal Resource Assessment Program
Ruscetta, C. A.(EDITOR); Foley, D.(EDITOR)
Geothermal energy exploration and resource assessment technical conference, Glenwood Springs, CO, United States, May 4-6, 1981
301-313p., 1981
15 REFS.
Subfile: B
Doc Type: REPORT; CONFERENCE PUBLICATION Bibliographic Level: ANALYTIC
Languages: English
Report No.: DOE/ID/12079-39; ESL-59
Availability: Univ. Utah Res. Inst., Earth Sci. Lab., Salt Lake City, UT, United States
sketch maps
Descriptors: *Wyoming ; economic geology ; geothermal energy; United States; resources; exploration; tectonics; geophysical surveys; models
Section Headings: 29 .(ECONOMIC GEOLOGY, ENERGY SOURCES)

1096582 82-21061
Lineaments perceived on Landsat imagery of central Texas; applications to geothermal resource assessment
Woodruff, C. M.; Caran, S. C.
Tex., Bur. Econ. Geol., Austin, TX, USA
Geothermal Direct Heat Program; Glenwood Springs technical conference proceedings; Volume 1, Papers presented; State Coupled Geothermal Resource Assessment Program
Ruscetta, C. A.(EDITOR); Foley, D.(EDITOR)
Geothermal energy exploration and resource assessment technical conference, Glenwood Springs, CO, United States, May 4-6, 1981
258-270p., 1981
9 REFS.
Subfile: B
Doc Type: REPORT; CONFERENCE PUBLICATION Bibliographic Level: ANALYTIC
Languages: English
Report No.: DOE/ID/12079-39; ESL-59
Availability: Univ. Utah Res. Inst., Earth Sci. Lab., Salt Lake City, UT, United States
sketch maps
Descriptors: *Texas ; economic geology; structural geology ; geophysical surveys ; geothermal energy; tectonics; remote sensing; United States; central Texas; Landsat; lineaments
Section Headings: 29 .(ECONOMIC GEOLOGY, ENERGY SOURCES)

1096578 82-21013
Geothermal exploration methods used in the capital district of New York
Sneeringer, M. R.
Dunn Geosci. Corp., Latham, NY, USA
Geothermal Direct Heat Program; Glenwood Springs technical conference proceedings; Volume 1, Papers presented; State Coupled Geothermal Resource Assessment Program
Ruscetta, C. A.(EDITOR); Foley, D.(EDITOR)
Geothermal energy exploration and resource assessment technical conference, Glenwood Springs, CO, United States, May 4-6, 1981
232-237p., 1981
Subfile: B
Doc Type: REPORT; CONFERENCE PUBLICATION Bibliographic Level: ANALYTIC
Languages: English
Report No.: DOE/ID/12079-39; ESL-59
Availability: Univ. Utah Res. Inst., Earth Sci. Lab., Salt Lake City, UT, United States
Descriptors: *New York ; economic geology ; geothermal energy; United States; exploration; geophysical surveys; geochemistry
Section Headings: 29 .(ECONOMIC GEOLOGY, ENERGY SOURCES)

1096574 82-21055
Geophysical investigations of certain Montana geothermal areas
Wideman, C. J.; Dye, L.; Halvorson, J.; McRae, M.
Mont. Coll. Mines. Sci. Technol., Butte, MT, USA
Geothermal Direct Heat Program; Glenwood Springs technical conference proceedings; Volume 1, Papers presented; State Coupled Geothermal Resource Assessment Program
Ruscetta, C. A.(EDITOR); Foley, D.(EDITOR)
Geothermal energy exploration and resource assessment technical conference, Glenwood Springs, CO, United States, May 4-6, 1981
179-186p., 1981
1 REFS.
Subfile: B
Doc Type: REPORT; CONFERENCE PUBLICATION Bibliographic Level: ANALYTIC
Languages: English
Report No.: DOE/ID/12079-39; ESL-59
Availability: Univ. Utah Res. Inst., Earth Sci. Lab., Salt Lake City, UT, United States
illus., 1 tables, sketch maps
Descriptors: *Montana ; economic geology; geophysical surveys ; geothermal energy; seismic surveys; United States

(cont. next page)

DIALOG File 89: GEOREF - 29-84/Nov (Copr. American Geological Institute)

; springs; thermal waters; tectonics
Section Headings: 29 .(ECONOMIC GEOLOGY, ENERGY SOURCES)

1096570 82-20832
Hawaii Geothermal Resource Assessment Program; 1980 geophysics subprogram
Kauahikawa, J.
Univ. Hawaii, Hawaii Inst. Geophys., Honolulu, HI, USA
Geothermal Direct Heat Program; Glenwood Springs technical conference proceedings; Volume 1, Papers presented; State Coupled Geothermal Resource Assessment Program
Ruscetta, C. A.(EDITOR); Foley, D.(EDITOR)
Geothermal energy exploration and resource assessment technical conference, Glenwood Springs, CO, United States, May 4-6, 1981
105-114p., 1981
Subfile: B
Doc Type: REPORT; CONFERENCE PUBLICATION Bibliographic Level: ANALYTIC
Languages: English
Report No.: DOE/ID/12079-39; ESL-59
Availability: Univ. Utah Res. Inst., Earth Sci. Lab., Salt Lake City, UT, United States
illus.
Descriptors: *Hawaii; *automatic data processing ; economic geology; geophysical surveys ; geothermal energy; electrical surveys; Pacific Ocean; United States; resources ; exploration; resistivity
Section Headings: 29 .(ECONOMIC GEOLOGY, ENERGY SOURCES)

1096422 82-20779
The Baer thermal area in western Iceland; exploration and exploitation
Georgsson, L. S.; Johannesson, H.; Gunnlaugsson, E.
Geothermal energy; the international success story
Edmiston, R. C.(chairperson)
Anadarko Prod. Co., USA
Geothermal Resources Council, 1981 annual meeting ; Geothermal energy; the international success story, Houston, TX, United States, Oct. 25-29, 1981
Transactions - Geothermal Resources Council 5, 511-514p., 1981
ISSN: 0193-5933 ISBN: 0-934412-55-3 3 REFS.
Subfile: B
Country of Publ.: United States
Doc Type: SERIAL; CONFERENCE PUBLICATION Bibliographic Level: ANALYTIC
Languages: English
illus., 1 table, geol. sketch maps
Latitude: N644500; N644500 Longitude: W0211500; W0211500
Descriptors: *Iceland ; economic geology; geophysical surveys ; geothermal energy; electrical surveys; Atlantic Ocean; Europe; Western Iceland; Baer; exploration; exploitation; hot springs; temperature; Borgarnes; Akranes ; drilling; boreholes; resistivity

Section Headings: 29 .(ECONOMIC GEOLOGY, ENERGY SOURCES)

1096399 82-20930
Passive seismic results near the Tuscarora Prospect, Nevada
Nicholl, J. J., Jr.; Lange, A. L.
MicroGeophys. Corp., USA; AMAX Explor., USA
Geothermal energy; the international success story
Edmiston, R. C.(chairperson)
Anadarko Prod. Co., USA
Geothermal Resources Council, 1981 annual meeting ; Geothermal energy; the international success story, Houston, TX, United States, Oct. 25-29, 1981
Transactions - Geothermal Resources Council 5, 197-200p., 1981
ISSN: 0193-5933 ISBN: 0-934412-55-3 5 REFS.
Subfile: B
Country of Publ.: United States
Doc Type: SERIAL; CONFERENCE PUBLICATION Bibliographic Level: ANALYTIC
Languages: English
illus., sketch maps
Latitude: N412230; N413500 Longitude: W1160000; W1161500
Descriptors: *Nevada ; geophysical surveys; economic geology ; seismic surveys; geothermal energy; United States ; Tuscacora; microearthquakes; exploration; Poisson's ratio; elastic constants
Section Headings: 29 .(ECONOMIC GEOLOGY, ENERGY SOURCES)

1096390 82-20728
Huntington Beach Oilfield; an example of border land geothermal resource
Chandler, P. B.
Geosci. Syst. Consult., USA
Geothermal energy; the international success story
Edmiston, R. C.(chairperson)
Anadarko Prod. Co., USA
Geothermal Resources Council, 1981 annual meeting ; Geothermal energy; the international success story, Houston, TX, United States, Oct. 25-29, 1981
Transactions - Geothermal Resources Council 5, 161-164p., 1981
ISSN: 0193-5933 ISBN: 0-934412-55-3 24 REFS.
Subfile: B
Country of Publ.: United States
Doc Type: SERIAL; CONFERENCE PUBLICATION Bibliographic Level: ANALYTIC
Languages: English
Descriptors: *California ; economic geology; geophysical surveys ; geothermal energy; heat flow; United States; Huntington Beach Field; models; oil and gas fields; exploration; resources; continental borderland
Section Headings: 29 .(ECONOMIC GEOLOGY, ENERGY SOURCES)

DIALOG File 89: GEOREF - 29-84/Nov (Copr. American Geological Institute)

1096376 82-20893
Granite Mountain, Nevada, geothermal prospect; a case study
McManness, D.; Quillin, B.; Butler, D.
MicroGeophics Corp., USA
Geothermal energy; the international success story
Edmiston, R. C.(chairperson)
Anadarko Prod. Co., USA
Geothermal Resources Council, 1981 annual meeting ; Geothermal energy; the international success story, Houston, TX, United States, Oct. 25-29, 1981
Transactions - Geothermal Resources Council 5, 107-110p., 1981
ISSN: 0193-5933 ISBN: 0-934412-55-3 4 REFS.
Subfile: B
Country of Publ.: United States
Doc Type: SERIAL; CONFERENCE PUBLICATION Bibliographic Level: ANALYTIC
Languages: English
geol. sketch maps
Descriptors: *Nevada ; economic geology; geophysical surveys ; geothermal energy; surveys; Pershing County; United States; Kyle Hot Springs; Granite Mountain; exploration
Section Headings: 29 .(ECONOMIC GEOLOGY, ENERGY SOURCES)

1096369 82-20788
Usefulness of heat flow data in regional assessment of low temperature geothermal resources with special reference to Nebraska
Gosnold, W. D., Jr.; Eversoll, D. A.
Univ. Nebr., Omaha, NE, USA
Geothermal energy; the international success story
Edmiston, R. C.(chairperson)
Anadarko Prod. Co., USA
Geothermal Resources Council, 1981 annual meeting ; Geothermal energy; the international success story, Houston, TX, United States, Oct. 25-29, 1981
Transactions - Geothermal Resources Council 5, 79-82p., 1981
ISSN: 0193-5933 ISBN: 0-934412-55-3 15 REFS.
Subfile: B
Country of Publ.: United States
Doc Type: SERIAL; CONFERENCE PUBLICATION Bibliographic Level: ANALYTIC
Languages: English
illus., sketch map
Descriptors: *Nebraska ; economic geology; geophysical surveys ; geothermal energy; heat flow; United States; temperature; resources; exploration; methods
Section Headings: 29 .(ECONOMIC GEOLOGY, ENERGY SOURCES)

1096368 82-20778
A resistivity survey on the plate boundaries in the western Reykjanes Peninsula, Iceland
Georgsson, L. S.
Geothermal energy; the international success story
Edmiston, R. C.(chairperson)
Anadarko Prod. Co., USA
Geothermal Resources Council, 1981 annual meeting : Geothermal energy; the international success story, Houston, TX, United States, Oct. 25-29, 1981
Transactions - Geothermal Resources Council 5, 75-78p., 1981
ISSN: 0193-5933 ISBN: 0-934412-55-3 9 REFS.
Subfile: B
Country of Publ.: United States
Doc Type: SERIAL; CONFERENCE PUBLICATION Bibliographic Level: ANALYTIC
Languages: English
illus., sketch maps
Descriptors: *Iceland ; economic geology; geophysical surveys ; geothermal energy; electrical surveys; Atlantic Ocean; Europe; Reykjanes Peninsula; resistivity; exploration; fumaroles; plate boundary
Section Headings: 29 .(ECONOMIC GEOLOGY, ENERGY SOURCES)

1096363 82-20702
Geophysical reconnaissance study of the Hengill high-temperature geothermal area, SW Iceland
Bjornsson, A.; Hersir, G. P.
Geothermal energy; the international success story
Edmiston, R. C.(chairperson)
Anadarko Prod. Co., USA
Geothermal Resources Council, 1981 annual meeting ; Geothermal energy; the international success story, Houston, TX, United States, Oct. 25-29, 1981
Transactions - Geothermal Resources Council 5, 55-58p., 1981
ISSN: 0193-5933 ISBN: 0-934412-55-3 6 REFS.
Subfile: B
Country of Publ.: United States
Doc Type: SERIAL; CONFERENCE PUBLICATION Bibliographic Level: ANALYTIC
Languages: English
sketch maps
Descriptors: *Iceland ; economic geology; geophysical surveys ; geothermal energy; well-logging; Atlantic Ocean; Europe; hot springs; fumaroles; volcanoes; Hengill Volcano; exploration
Section Headings: 29 .(ECONOMIC GEOLOGY, ENERGY SOURCES)

1093884 82-20981
Controlled-source audiomagnetotellurics in geothermal exploration
Sandberg, S. K.; Hohmann, G. W.
Amoco Miner. Co., Englewood, CO, USA; Univ. Utah, USA
Geophysics 47: 1, 101-117p., 1982
CODEN: GPYSA7 ISSN: 0016-8033 20 REFS.
Subfile: B
Country of Publ.: United States
Doc Type: SERIAL Bibliographic Level: ANALYTIC
Languages: English
illus., sketch maps
Latitude: N382500; N383230 Longitude: W1125000; W1130000
Descriptors: *Utah; *geophysical methods ; economic geology ; geophysical surveys; magnetotelluric methods ; geothermal energy; magnetotelluric surveys; applications; Beaver County; exploration; audiomagnetotelluric methods; theoretical studies; field studies; three-dimensional models ; models; mathematical models; controlled sources; United States; Roosevelt Hot Springs KGRA
Section Headings: 29 .(ECONOMIC GEOLOGY, ENERGY SOURCES)

1093399 82-20571
Bipole-dipole interpretation with three-dimensional models (including a field study of Las Alturas, New Mexico)
Hohmann, G. W.; Jiracek, G. R.
Univ. Utah Res. Inst., Earth Sci. Lab, Salt Lake City, UT, USA
20p., 1979
13 REFS.
Subfile: B
Doc Type: REPORT Bibliographic Level: MONOGRAPHIC
Languages: English
Report No.: DOE/ET/28392-29; ESL-20
Availability: Dep. Energy, Div. Geotherm. Energy, United States
illus., sketch maps
Latitude: N321500; N322000 Longitude: W1064000; W1064500
Descriptors: *New Mexico; *geophysical methods ; economic geology; geophysical surveys; electrical methods ; geothermal energy; electrical surveys; interpretation; Dona Ana County; United States; exploration; three-dimensional models; models; bipole-dipole methods; cartography; resistivity; Las Alturas; Tortugas Mountain
Section Headings: 29 .(ECONOMIC GEOLOGY, ENERGY SOURCES)

1090102 82-15164
Heat flow studies and geothermal exploration in western Trans-Pecos Texas
Taylor, B.
Univ. of Texas at El Paso, El Paso, TX, USA
339p., 1981
Subfile: B
Degree Level: Doctoral
Country of Publ.: United States
Doc Type: THESIS Bibliographic Level: MONOGRAPHIC
Languages: English
Availability: Univ. Microfilms
Latitude: N290000; N320000 Longitude: W1010000; W1063000
Descriptors: *Texas ; economic geology; geophysical surveys ; geothermal energy; heat flow; Presidio County; El Paso County; United States; Trans-Pecos; exploration; Great Plains; North America; Basin and Range Province; Rio Grande Rift; transition zones; temperature; geothermal gradient; regional patterns; geophysical maps; maps
Section Headings: 29 .(ECONOMIC GEOLOGY, ENERGY SOURCES)

1088135 82-10484
Hawaii Inst. Geophys., USA
Geophysical reconnaissance of prospective geothermal areas on the Island of Hawaii using electrical methods
Kauahikaua, J.; Mattice, M.
U. S. Geol. Surv., USA
Open-File Report (United States Geological Survey. 1978) 81-1044, 66p., 1981
CODEN: XGROAG ISSN: 0196-1497 37 REFS.
Subfile: B
Country of Publ.: United States
Doc Type: SERIAL; REPORT Bibliographic Level: MONOGRAPHIC
Languages: English
Availability: U. S. Geol. Surv., Open-File Serv. Sect., West. Distrib. Branch, Denver, CO, United States
illus., sketch maps
Latitude: N185500; N201000 Longitude: W1545000; W1560500
Descriptors: *Hawaii; *volcanology ; economic geology; geophysical surveys; volcanoes ; geothermal energy; electrical surveys; Kilauea; Hawaii County; USGS; Pacific Ocean; United States; exploration
Section Headings: 29 .(ECONOMIC GEOLOGY, ENERGY SOURCES)

1086089 82-10746
Suggested geothermal exploration stragtegy for Big Creek hot springs
Struhsacker, D. W.
An analysis of geothermal electric power generation at Big Creek hot springs, Lemhi County, Idaho
Struhsacker, D. W.(EDITOR)
Univ. Utah Res. Inst., Earth Sci. Lab., Salt Lake City, UT, USA
18-33p., 1981
10 REFS.
Subfile: B
Doc Type: REPORT Bibliographic Level: ANALYTIC
Languages: English
Report No.: DOE/10/12079-37; ESL-58
Availability: U. S. Dep. Energy, Div. Geotherm. Energy,
(cont. next page)

United States
Note: With appendix; Geothermal production, well drilling costs.
Descriptors: *Idaho ; economic geology ; geothermal energy ; Lemhi County; United States; exploration; Big Creek hot springs; geophysical surveys
Section Headings: 29 .(ECONOMIC GEOLOGY, ENERGY SOURCES)

1086067 82-10477
Univ. Utah, Dep. Geol. Geophys., USA
Geothermal exploration program, Hill Air Force Base, Davis and Weber counties, Utah
Glenn, W. E.; Chapman, D. S.; Foley, D.; Capuano, R. M.; Cole, D.; Sibbett, B.; Ward, S. H.
Univ. Utah Res. Inst., Earth Sci. Lab., Salt Lake City, UT, USA
77p., 1980
35 REFS.
Subfile: B
Doc Type: REPORT Bibliographic Level: MONOGRAPHIC
Languages: English
Report No.: DOE/ET/28392-42; ESL-34
Availability: U. S. Dep. Energy, Div. Geotherm. Energy, United States
illus., 7 tables, strat. cols., sketch maps
Descriptors: *Utah; *ground water; *hydrology ; economic geology; surveys ; geothermal energy; Weber Richer; Davis County; Weber County; United States; exploration; Hill Air Force Base; Ogden; Wasatch Mountains; mercury; geochemical anomalies; seismic surveys; geophysical surveys; gravity profiles; hydrochemistry
Section Headings: 29 .(ECONOMIC GEOLOGY, ENERGY SOURCES)

1082939 82-05478
Additional audio-magnetotelluric soundings in the Lassen Known Geothermal Resource Area, Plumas and Tehama counties, California
Christopherson, K. R.; Pringle, L.
U. S. Geol. Surv., USA
Open-File Report (United States Geological Survey. 1978) 81-0959, 18p., 1981
CODEN: XGROAG ISSN: 0196-1497 6 REFS.
Subfile: B
Country of Publ.: United States
Doc Type: SERIAL; REPORT Bibliographic Level: MONOGRAPHIC
Languages: English
Availability: U. S. Geol. Surv., Open-File Serv. Sect., West. Distrib. Branch, Denver, CO, United States
2 tables, sketch maps
Latitude: N401000; N402500 Longitude: W1211500; W1214500
Descriptors: *California ; geophysical surveys; economic geology ; magnetotelluric surveys; geothermal energy; Plumas County; Tehama County; USGS; United States; Lassen KGRA; audiomagnetotelluric methods; exploration
Section Headings: 29 .(ECONOMIC GEOLOGY, ENERGY SOURCES)

1082896 82-05475
Radioelement and radiogenic heat distribution in drill holes Mahogany 5-4-1 and Murphy 7-4-1, Idaho
Bunker, C. M.; Bush, C. A.
U. S. Geol. Surv., USA
Open-File Report (United States Geological Survey. 1978) 81-0841, 14p., 1981
CODEN: XGROAG ISSN: 0196-1497 9 REFS.
Subfile: B
Country of Publ.: United States
Doc Type: SERIAL; REPORT Bibliographic Level: MONOGRAPHIC
Languages: English
Availability: U. S. Geol. Surv., Open-File Serv. Sect., West. Distrib. Branch, Denver, CO, United States
illus., 3 tables
Latitude: N424818; N424818 Longitude: W1162418; W1162418
Descriptors: *Idaho; *well-logging ; geophysical surveys; economic geology; radioactivity ; heat flow; geothermal energy; Owyhee County; USGS; United States; Mahogany 5-4-1 ; Murphy 7-4-1; heat sources; exploration
Section Headings: 29 .(ECONOMIC GEOLOGY, ENERGY SOURCES)

1079414 82-05494
Exploration case history of the Monroe KGRA, Sevier County, Utah
Hulen, J. B.; Sandberg, S. M.
Univ. Utah Res. Inst., Earth Sci. Lab., Salt Lake City, UT, USA
82p., 1981
54 REFS.
Subfile: B
Doc Type: REPORT Bibliographic Level: MONOGRAPHIC
Languages: English
Report No.: DOE/ID/12079-22; ESL/49
Availability: Univ. Utah Res. Inst., Earth Sci. Lab., Salt Lake City, UT, United States
illus., 7 tables, strat. cols., geol. sketch maps
Latitude: N383000; N384500 Longitude: W1120000; W1121500
Descriptors: *Utah; *ground water ; economic geology; geophysical surveys; surveys; hydrogeology ; geothermal energy; thermal waters; Sevier County; United States; exploration; geochemistry; magnetic surveys; gravity surveys; electrical surveys; well-logging; springs; travertine; carbonate rocks; hydrothermal alteration; metasomatism; heat flow
Section Headings: 29 .(ECONOMIC GEOLOGY, ENERGY SOURCES)

DIALOG File 89: GEOREF - 29-84/Nov (Copr. American Geological Institute)

1077591 82-05482
Report on geothermal ground noise measurements in Washington State
Crosson, R. S.; Mayers, I. R.
52p., 1972
21 REFS.
Subfile: B
Doc Type: REPORT Bibliographic Level: MONOGRAPHIC
Languages: English
Report No.: 72-1
Availability: Wash., Dep. Nat. Resour., Div. Mines Geol., Olympia, WA, United States
illus., 1 table, sketch maps
Descriptors: *Washington ; economic geology; geophysical surveys ; geothermal energy; seismic surveys; United States ; Columbia Plateau; resources; exploration; reserves
Section Headings: 29 .(ECONOMIC GEOLOGY, ENERGY SOURCES)

1071738 81-56702
The Los Azufres, Michoacan, Mexico, geothermal field
Gutierrez N., A.; Aumento, F.
Com. Fed. Elec., MEX; ELC-Electroconsult, ITA
26th international geological congress, Paris, France, July 7-17, 1980
Int. Geol. Congr. Abstr.--Congr. Geol. Int., Resumes 26, Vol. 3, 1114p., 1980
CODEN: IGABBY
Subfile: B
Country of Publ.: Varies
Doc Type: SERIAL; CONFERENCE PUBLICATION Bibliographic Level: ANALYTIC
Languages: English
Latitude: N180000; N203000 Longitude: W1000000; W1040000
Descriptors: *Mexico ; economic geology; geophysical surveys ; geothermal energy; heat flow; North America; Michoacan; Los Azufres; geothermal fields; exploration; heat sources; volcanic rocks; hydrothermal conditions
Section Headings: 29 .(ECONOMIC GEOLOGY, ENERGY SOURCES)

1071717 81-54752
New geothermal anomalies in Nicaragua, Central America
Eckstein, Y.
Kent State Univ., Kent, OH, USA
26th international geological congress, Paris, France, July 7-17, 1980
Int. Geol. Congr. Abstr.--Congr. Geol. Int., Resumes 26, Vol. 3, 1103p., 1980
CODEN: IGABBY
Subfile: B
Country of Publ.: Varies
Doc Type: SERIAL; CONFERENCE PUBLICATION Bibliographic Level: ANALYTIC
Languages: English
Latitude: N104000; N150000 Longitude: W0830500; W0874000
Descriptors: *Nicaragua; *Central America ; economic geology; hydrogeology; geophysical surveys ; geothermal energy; thermal waters; heat flow; exploration; temperature; reservoir rocks; aquifers; anomalies
Section Headings: 21 .(HYDROGEOLOGY AND HYDROLOGY)

1071032 81-54789
Vertical temperature gradients and the static stability of the bottom water of Lake Baikal
Golubev, V. A.
USSR Acad. Sci., Inst. Earth's Crust, Irkutsk, SUN
Doklady of the Academy of Sciences of the USSR, Earth Science Sections 239: 1-6, 3-5p., 1978
CODEN: DKESA9 ISSN: 0012-494X 12 REFS.
Subfile: B
Country of Publ.: United States
Doc Type: SERIAL Bibliographic Level: ANALYTIC
Languages: English
illus., 1 table, sketch map
Latitude: N520000; N560000 Longitude: E1100000; E1040000
Descriptors: *USSR; *hydrology ; geophysical surveys; economic geology; surveys ; heat flow; geothermal energy; Lake Baikal; Baikal region; geothermal gradient; temperature; exploration; lakes; limnology
Section Headings: 21 .(HYDROGEOLOGY AND HYDROLOGY)

1070981 81-56695
Prospection geothermique haute energie au Mont Dore, Massif Central francais
Geothermal energy exploration; Mont-Dore, Central Massif, France
Gerard, A.; Lopoukhine, M.; Stieltjes, L.; Varet, J.
BRGM, Dep. Geotherm., Orleans, FRA
26th international geological congress, Paris, France, July 7-17, 1980
Int. Geol. Congr. Abstr.--Congr. Geol. Int., Resumes 26, Vol. 3, 1052p., 1980
CODEN: IGABBY
Subfile: B
Country of Publ.: Varies
Doc Type: SERIAL; CONFERENCE PUBLICATION Bibliographic Level: ANALYTIC
Languages: French
Latitude: N451500; N461500 Longitude: E0040000; E0023000
Descriptors: *France ; economic geology ; geothermal energy; Europe; Central Massif; Mont-Dore; Puy-de-Dome; exploration; calderas; heat sources; heat flow; temperature; geophysical surveys
Section Headings: 29 .(ECONOMIC GEOLOGY, ENERGY SOURCES)

DIALOG File 89: GEOREF - 29-84/Nov (Copr. American Geological Institute)

1070903 81-56613
Determination of Curie isotherm from aeromagnetic data in the Imperial Valley, California
Kam, M. N. S.
Univ. of California, Riverside, CA, USA
unknownp., 1980
Subfile: B
Degree Level: Master's
Country of Publ.: United States
Doc Type: THESIS Bibliographic Level: MONOGRAPHIC
Languages: English
Latitude: N320000; N330000 Longitude: W1140000; W1150000
Descriptors: *California; *geophysical methods ; geophysical surveys; magnetic methods; economic geology; tectonophysics ; magnetic surveys; applications; geothermal energy; crust; Imperial County; United States; Curie isotherms; Imperial Valley; exploration; depth; thickness; Salton Sea; Brawley; Pacific Coast
Section Headings: 29 .(ECONOMIC GEOLOGY, ENERGY SOURCES)

1069544 81-56605
Heat-flow measurements in the state of Arkansas
Roy, R. F.; Taylor, B. E.; Pyron, A. J.; Maxwell, J. C.
Univ. Tex., El Paso, TX, USA
LA - Los Alamos Scientific Laboratory 8569, 15p., 1980
CODEN: XSLRAB ISSN: 0362-1774 6 REFS.
Subfile: B
Country of Publ.: United States
Doc Type: SERIAL; REPORT Bibliographic Level: MONOGRAPHIC
Languages: English
Availability: NTIS, Springfield, VA, United States
Note: Final report, illus., 2 tables
Descriptors: *Arkansas ; geophysical surveys; economic geology ; heat flow; geothermal energy; United States; geothermal gradient; exploration
Section Headings: 29 .(ECONOMIC GEOLOGY, ENERGY SOURCES)

1066502 81-51898
Controlled-source electromagnetic survey at Soda Lakes geothermal area, Nevada
Stark, M.; Wilt, M.; Haught, J. R.; Goldstein, N.
Lawrence Berkeley Lab., Berkeley, CA, USA
LBL (Lawrence Berkeley Laboratory, Energy and Environment Division) 11221, 93p., 1980
CODEN: LBLLDH ISSN: 0195-721X 3 REFS.
Subfile: B
Country of Publ.: United States
Doc Type: SERIAL; REPORT Bibliographic Level: MONOGRAPHIC
Languages: English
Availability: NTIS, Springfield, VA, United States
illus., tables
Latitude: N393000; N400000 Longitude: W1181500; W1184500
Descriptors: *Nevada ; geophysical surveys; economic geology ; electromagnetic surveys; geothermal energy; Churchill County; United States; Soda Lakes; resistivity; Carson Sink; exploration; interpretation; resources
Section Headings: 29 .(ECONOMIC GEOLOGY, ENERGY SOURCES)

1066501 81-51897
Geothermal exploration assessment and interpretation, upper Klamath Lake area, Klamath Basin, Oregon
Stark, M.; Goldstein, N. E.; Wollenberg, H. A.
Lawrence Berkeley Lab., Berkeley, CA, USA
LBL (Lawrence Berkeley Laboratory, Energy and Environment Division) 10140, 84p., 1980
CODEN: LBLLDH ISSN: 0195-721X 135 REFS.
Subfile: B
Country of Publ.: United States
Doc Type: SERIAL; REPORT Bibliographic Level: MONOGRAPHIC
Languages: English
Availability: NTIS, Springfield, VA, United States
illus., sketch maps
Latitude: N422000; N423000 Longitude: W1213000; W1222000
Descriptors: *Oregon; *ground water ; geophysical surveys; surveys; economic geology ; geothermal energy; Klamath County; United States; Klamath Basin; geochemistry; electrical surveys; resistivity; gravity surveys; magnetic surveys; magnetotelluric surveys; airborne methods; geophysical methods; geothermal gradient; Spence Mountain; Round Lake; Long Lake; Whiteline Reservoir; electrical conductivity; exploration
Section Headings: 29 .(ECONOMIC GEOLOGY, ENERGY SOURCES)

1065923 81-51983
Interpretation of self-potential survey results from the East Mesa geothermal field, California
Corwin, R. F.; DeMoully, G. T.; Harding, R. S., Jr.; Morrison, H. F.
Univ. Calif., Eng. Geosci., Berkeley, CA, USA
JGR. Journal of Geophysical Research. B 86: 3, 1841-1848p., 1981
ISSN: 0196-6936 26 REFS.
Subfile: B
Country of Publ.: United States
Doc Type: SERIAL Bibliographic Level: ANALYTIC
Languages: English
illus., sketch maps
Latitude: N324500; N325000 Longitude: W1151000; W1152000
Descriptors: *California; *geophysical methods ; economic geology; geophysical surveys; electrical methods ; geothermal energy; electrical surveys; interpretation; Imperial County; United States; Southern California; East Mesa; geothermal fields; Imperial Valley; self-potential methods; anomalies; exploration
Section Headings: 29 .(ECONOMIC GEOLOGY, ENERGY SOURCES)

1064072 81-52166
A microearthquake survey at the Ngawha geothermal field, New Zealand
Robinson, R.
Dep. Sci. and Ind. Res., Geophys. Div., Wellington, NZL
Geophysics 46: 10, 1467-1468p., 1981
CODEN: GPYSA7 ISSN: 0016-8033 4 REFS.
Subfile: B
Country of Publ.: United States
Doc Type: SERIAL Bibliographic Level: ANALYTIC
Languages: English
sketch maps
Latitude: S353000; S350000 Longitude: E1742000; E1733000
Descriptors: *New Zealand; *geophysical methods; *seismology ; economic geology; seismic methods; microearthquakes ; geothermal energy; applications; detection; Australasia; North Island; Ngawha; Ngawha geothermal field; geothermal fields; seismicity; exploration; passive methods; seismic surveys; geophysical surveys
Section Headings: 29 .(ECONOMIC GEOLOGY, ENERGY SOURCES)

1062301 81-52002
Magnetotelluric prospection of the Mont Dore area
Dupis, A.; Marie, P.; Petiau, G.
Advances in European geothermal research; proceedings of the Second international seminar on the results of EC geothermal energy research
Strub, A. S.(EDITOR); Ungemach, P.(EDITOR)
Advances in European geothermal research; Second international seminar on the results of EC geothermal energy research, Strasbourg, France, Mar. 4-6, 1980
Publ: D. Reidel Publ. Co.
935-943p., 1980
Subfile: B
Country of Publ.: Netherlands
Doc Type: BOOK; CONFERENCE PUBLICATION Bibliographic Level: ANALYTIC
Languages: French Summary Languages: English
illus., sketch maps
Descriptors: *France ; economic geology; geophysical surveys ; geothermal energy; magnetotelluric surveys; Europe; Mont-Dore; exploration; reservoir rocks; heat sources; calderas
Section Headings: 29 .(ECONOMIC GEOLOGY, ENERGY SOURCES)

1062300 81-52091
Some results of very low frequency magneto-telluric survey in the Mont Dore area (MI 5 Ex and harmonic solutions)
Malerque, G.
Advances in European geothermal research; proceedings of the Second international seminar on the results of EC geothermal energy research
Strub, A. S.(EDITOR); Ungemach, P.(EDITOR)
Advances in European geothermal research; Second international seminar on the results of EC geothermal energy research, Strasbourg, France, Mar. 4-6, 1980
Publ: D. Reidel Publ. Co.
921-934p., 1980
Subfile: B
Country of Publ.: Netherlands
Doc Type: BOOK; CONFERENCE PUBLICATION Bibliographic Level: ANALYTIC
Languages: English
illus., sect., geol. sketch maps
Descriptors: *France ; economic geology; geophysical surveys ; geothermal energy; magnetotelluric surveys; Europe; Mont-Dore; exploration; reservoir rocks; thermal waters; electrical conductivity; volcanism; heat flow; anomalies; resistivity; convection
Section Headings: 29 .(ECONOMIC GEOLOGY, ENERGY SOURCES)

1062299 81-51948
Magnetotelluric measurements and geomagnetic depth sounding in the area of the Urach geothermal anomaly
Berktold, A.; Kemmerle, K.; Neurieder, P.
Advances in European geothermal research; proceedings of the Second international seminar on the results of EC geothermal energy research
Strub, A. S.(EDITOR); Ungemach, P.(EDITOR)
Advances in European geothermal research; Second international seminar on the results of EC geothermal energy research, Strasbourg, France, Mar. 4-6, 1980
Publ: D. Reidel Publ. Co.
911-920p., 1980
1 REFS.
Subfile: B
Country of Publ.: Netherlands
Doc Type: BOOK; CONFERENCE PUBLICATION Bibliographic Level: ANALYTIC
Languages: English
illus., sketch map
Latitude: N482000; N484000 Longitude: E0093000; E0090000
Descriptors: *West Germany ; economic geology; geophysical surveys ; geothermal energy; magnetotelluric surveys; Germany; Europe; Swabian Alb; Urach; volcanic zones; reservoir rocks; exploration; geothermal gradient; electrical conductivity; anomalies; fractures; thermal waters; sounding
Section Headings: 29 .(ECONOMIC GEOLOGY, ENERGY SOURCES)

1062296 81-52129
Use of the differential magnetic sounding for studying the geothermal potential resources in the Rhein Graben
Mosnier, J.; Babour, K.
Advances in European geothermal research; proceedings of the Second international seminar on the results of EC geothermal energy research

(cont. next page)

DIALOG File 89: GEOREF - 29-84/Nov (Copr. American Geological Institute)

energy research
Strub, A. S.(EDITOR); Ungemach, P.(EDITOR)
Advances in European geothermal research; Second international seminar on the results of EC geothermal energy research, Strasbourg, France, Mar. 4-6, 1980
Publ: D. Reidel Publ. Co.
884-892p., 1980
Subfile: B
Country of Publ.: Netherlands
Doc Type: BOOK; CONFERENCE PUBLICATION Bibliographic Level: ANALYTIC
Languages: English Summary Languages: French
illus., sect., geol. sketch maps
Latitude: N480000; N490000 Longitude: E0080000; E0070000
Descriptors: *France; *West Germany ; economic geology; geophysical surveys ; geothermal energy; surveys; Europe; Germany; magnetotelluric surveys; magnetic anomalies; heat flow; reservoir rocks; exploration; Rhine Graben; Strasbourg; magnetic surveys; sounding; resistivity; conductivity
Section Headings: 29 .(ECONOMIC GEOLOGY, ENERGY SOURCES)

1062295 81-52135
Magnetic survey in the Travale geothermal field, Italy
Napoleone, G.; Poggiali, G.; Ripepe, M.; Savino, D.
Advances in European geothermal research; proceedings of the Second international seminar on the results of EC geothermal energy research
Strub, A. S.(EDITOR); Ungemach, P.(EDITOR)
Advances in European geothermal research; Second international seminar on the results of EC geothermal energy research, Strasbourg, France, Mar. 4-6, 1980
Publ: D. Reidel Publ. Co.
875-883p., 1980
12 REFS.
Subfile: B
Country of Publ.: Netherlands
Doc Type: BOOK; CONFERENCE PUBLICATION Bibliographic Level: ANALYTIC
Languages: English
illus., block diag., sketch maps
Latitude: N430500; N431500 Longitude: E0110700; E0110000
Descriptors: *Italy ; economic geology; geophysical surveys ; geothermal energy; magnetic surveys; Europe; magnetic anomalies; Travale; geothermal fields; exploration ; reservoir rocks; structural controls; crust; faults; temperature; Boccheggiano; Radicondoli; Tuscany
Section Headings: 29 .(ECONOMIC GEOLOGY, ENERGY SOURCES)

1062292 81-52147
Dipole-dipole study of the Travale geothermal field
Patella, D.; Quarto, R.; Tramacere, A.
Advances in European geothermal research; proceedings of the Second international seminar on the results of EC geothermal energy research
Strub, A. S.(EDITOR); Ungemach, P.(EDITOR)
Advances in European geothermal research; Second international seminar on the results of EC geothermal energy research, Strasbourg, France, Mar. 4-6, 1980
Publ: D. Reidel Publ. Co.
833-842p., 1980
8 REFS.
Subfile: B
Country of Publ.: Netherlands
Doc Type: BOOK; CONFERENCE PUBLICATION Bibliographic Level: ANALYTIC
Languages: English
illus., sects., sketch maps
Latitude: N424500; N431500 Longitude: E0113000; E0110000
Descriptors: *Italy ; economic geology; geophysical surveys ; geothermal energy; electromagnetic surveys; Europe; Travale Geothermal Field; Tuscany; exploration; resistivity; dipolar-dipole method; reservoir rocks; thermal waters; geothermal gradient; faults; structural controls
Section Headings: 29 .(ECONOMIC GEOLOGY, ENERGY SOURCES)

1062291 81-51942
Application of D.C. dipolar methods in the upper Rhinegraben
Baudu, R.; Bernard, J.; Georgel, J. M.; Griveau, P.; Rugo, R.
Advances in European geothermal research; proceedings of the Second international seminar on the results of EC geothermal energy research
Strub, A. S.(EDITOR); Ungemach, P.(EDITOR)
Advances in European geothermal research; Second international seminar on the results of EC geothermal energy research, Strasbourg, France, Mar. 4-6, 1980
Publ: D. Reidel Publ. Co.
823-832p., 1980
Subfile: B
Country of Publ.: Netherlands
Doc Type: BOOK; CONFERENCE PUBLICATION Bibliographic Level: ANALYTIC
Languages: English
illus., sketch maps
Latitude: N485000; N490000 Longitude: E0080000; E0074500
Descriptors: *France ; economic geology; geophysical surveys ; geothermal energy; electromagnetic surveys; Europe; Rhine Graben; geothermal gradient; anomalies; resistivity; dipolar method; electrical conductivity; exploration; temperature; instruments; techniques
Section Headings: 29 .(ECONOMIC GEOLOGY, ENERGY SOURCES)

DIALOG File 89: GEOREF - 29-84/Nov (Copr. American Geological Institute)

1062281 81-52201
Investigation of the microseismic noise of the geothermal anomaly at Torre Alfina (Italy)
Steinwachs, M.
Advances in European geothermal research; proceedings of the Second international seminar on the results of EC geothermal energy research
Strub, A. S.(EDITOR); Ungemach, P.(EDITOR)
Advances in European geothermal research; Second international seminar on the results of EC geothermal energy research, Strasbourg, France, Mar. 4-6, 1980
Publ: D. Reidel Publ. Co.
648-653p., 1980
8 REFS.
Subfile: B
Country of Publ.: Netherlands
Doc Type: BOOK; CONFERENCE PUBLICATION Bibliographic Level: ANALYTIC
Languages: English
illus., sketch map
Descriptors: *Italy; *seismology ; economic geology; geophysical surveys; microseisms ; geothermal energy; seismic surveys; anomalies; Europe; exploration; geothermal gradient; Torre Alfina; noise; heat flow; reservoir rocks; thermal waters; conceptual models
Section Headings: 29 .(ECONOMIC GEOLOGY, ENERGY SOURCES)

1062280 81-52013
Etudes sismiques sur la caldera du Mont Dore
Seismic studies of the Mont-Dore Caldera
Ferrandes, R.; Gerard, A.; Muraour, P.; Peragallo, J.; Petiau, G.
Advances in European geothermal research; proceedings of the Second international seminar on the results of EC geothermal energy research
Strub, A. S.(EDITOR); Ungemach, P.(EDITOR)
Advances in European geothermal research; Second international seminar on the results of EC geothermal energy research, Strasbourg, France, Mar. 4-6, 1980
Publ: D. Reidel Publ. Co.
632-647p., 1980
Subfile: B
Country of Publ.: Netherlands
Doc Type: BOOK; CONFERENCE PUBLICATION Bibliographic Level: ANALYTIC
Languages: French
illus., 3 tables, sketch maps
Descriptors: *France ; economic geology; geophysical surveys ; geothermal energy; seismic surveys; Europe; Mont-Dore; refraction; reflection; reservoir rocks; exploration
Section Headings: 29 .(ECONOMIC GEOLOGY, ENERGY SOURCES)

1062279 81-52138
Identification of 3 D bodies by Moho reflected waves application to the Mont Dore area
Nercessian, A.; Hirn, A.
Advances in European geothermal research; proceedings of the Second international seminar on the results of EC geothermal energy research
Strub, A. S.(EDITOR); Ungemach, P.(EDITOR)
Advances in European geothermal research; Second international seminar on the results of EC geothermal energy research, Strasbourg, France, Mar. 4-6, 1980
Publ: D. Reidel Publ. Co.
622-631p., 1980
6 REFS.
Subfile: B
Country of Publ.: Netherlands
Doc Type: BOOK; CONFERENCE PUBLICATION Bibliographic Level: ANALYTIC
Languages: English
illus., geol. sketch maps
Descriptors: *France; *seismology ; economic geology; geophysical surveys; crust ; geothermal energy; seismic surveys; Mohorovicic discontinuity; Europe; Mont-Dore; geothermal fields; reflection; massifs; velocity; exploration; genesis; inverse problem; three-dimensional models; models; residuals; anomalies; body waves
Section Headings: 29 .(ECONOMIC GEOLOGY, ENERGY SOURCES)

1062278 81-51971
V p V s ratio and its changes in the Travale geothermal field
Casertano, L.; Oliveri del Castillo, A.
Advances in European geothermal research; proceedings of the Second international seminar on the results of EC geothermal energy research
Strub, A. S.(EDITOR); Ungemach, P.(EDITOR)
Advances in European geothermal research; Second international seminar on the results of EC geothermal energy research, Strasbourg, France, Mar. 4-6, 1980
Publ: D. Reidel Publ. Co.
614-621p., 1980
12 REFS.
Subfile: B
Country of Publ.: Netherlands
Doc Type: BOOK; CONFERENCE PUBLICATION Bibliographic Level: ANALYTIC
Languages: English
illus., sects., geol. sketch map
Latitude: N430000; N433000 Longitude: E0113000; E0103000
Descriptors: *Italy; *seismology ; economic geology; geophysical surveys; explosions ; geothermal energy; seismic surveys; velocity structure; Europe; Travale
(cont. next page)

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geothermal field; velocity; exploration; reservoir rocks; body waves; P-T conditions; instruments; fractures; grabens; Montagnola Senese Hills; reflection
Section Headings: 29 .(ECONOMIC GEOLOGY, ENERGY SOURCES)

1062276 81-52120
Combined reflection and refraction measurements for investigating the geothermal anomaly of Urach
Meissner, R.; Bartelsen, H.; Krey, T.; Schmoll, J.
Advances in European geothermal research; proceedings of the Second international seminar on the results of EC geothermal energy research
Strub, A. S.(EDITOR); Ungemach, P.(EDITOR)
Advances in European geothermal research; Second international seminar on the results of EC geothermal energy research, Strasbourg, France, Mar. 4-6, 1980
Publ: D. Reidel Publ. Co.
587-602p., 1980
9 REFS.
Subfile: B
Country of Publ.: Netherlands
Doc Type: BOOK; CONFERENCE PUBLICATION Bibliographic Level: ANALYTIC
Languages: English
illus., sketch map
Latitude: N474500; N491500 Longitude: E0110000; E0080000
Descriptors: *West Germany ; economic geology; geophysical surveys ; geothermal energy; seismic surveys; Germany; Europe; Urach; reflection; refraction; geothermal gradient ; anomalies; crust; velocity; exploration; P-T conditions ; seismograms
Section Headings: 29 .(ECONOMIC GEOLOGY, ENERGY SOURCES)

1062275 81-52061
Structural study of the Urach area by deep refraction seismics
Jentsch, M.; Bamford, D.; Emter, D.; Prodehl, C.
Advances in European geothermal research; proceedings of the Second international seminar on the results of EC geothermal energy research
Strub, A. S.(EDITOR); Ungemach, P.(EDITOR)
Advances in European geothermal research; Second international seminar on the results of EC geothermal energy research, Strasbourg, France, Mar. 4-6, 1980
Publ: D. Reidel Publ. Co.
576-586p., 1980
Subfile: B
Country of Publ.: Netherlands
Doc Type: BOOK; CONFERENCE PUBLICATION Bibliographic Level: ANALYTIC
Languages: English
illus., 1 table, sketch maps
Latitude: N474500; N491500 Longitude: E0110000; E0080000
Descriptors: *West Germany; *automatic data processing ; economic geology; geophysical surveys ; geothermal energy; heat flow; seismic surveys; Germany; Europe; Urach; deep seismic sounding; refraction; geothermal gradient; anomalies; exploration; basement; heat sources
Section Headings: 29 .(ECONOMIC GEOLOGY, ENERGY SOURCES)

1062267 81-52012
Temperature and heat flow patterns of Italy
Fanelli, M.; Rossi, A.; Salomone, M.; Taffi, L.
Advances in European geothermal research; proceedings of the Second international seminar on the results of EC geothermal energy research
Strub, A. S.(EDITOR); Ungemach, P.(EDITOR)
Advances in European geothermal research; Second international seminar on the results of EC geothermal energy research, Strasbourg, France, Mar. 4-6, 1980
Publ: D. Reidel Publ. Co.
506-515p., 1980
15 REFS.
Subfile: B
Country of Publ.: Netherlands
Doc Type: BOOK; CONFERENCE PUBLICATION Bibliographic Level: ANALYTIC
Languages: English
sketch maps
Latitude: N363000; N473000 Longitude: E0190000; E0063000
Descriptors: *Italy ; economic geology; geophysical surveys ; geothermal energy; heat flow; Europe; temperature; reservoir rocks; exploration; thermal conductivity; wells; boreholes; maps
Section Headings: 29 .(ECONOMIC GEOLOGY, ENERGY SOURCES)

1062265 81-51935
Geothermal trends of Denmark
Balling, N.; Kristiansen, J. I.; Poulsen, K. D.; Saxov, S.
Advances in European geothermal research; proceedings of the Second international seminar on the results of EC geothermal energy research
Strub, A. S.(EDITOR); Ungemach, P.(EDITOR)
Advances in European geothermal research; Second international seminar on the results of EC geothermal energy research, Strasbourg, France, Mar. 4-6, 1980
Publ: D. Reidel Publ. Co.
485-495p., 1980
7 REFS.
Subfile: B
Country of Publ.: Netherlands
Doc Type: BOOK; CONFERENCE PUBLICATION Bibliographic Level: ANALYTIC
Languages: English
illus., sketch map
Latitude: N541500; N580000 Longitude: E0130000; E0080000
Descriptors: *Denmark ; economic geology; geophysical surveys ; geothermal energy; heat flow; Europe;

(cont. next page)

exploration; temperature; boreholes; thermal conductivity; mathematical models; models; measurement; reliability; reservoir rocks; geothermal gradient
Section Headings: 29 .(ECONOMIC GEOLOGY, ENERGY SOURCES)

1062264 81-52220
A critical study of heat flow data in France
Vasseur, G.
Advances in European geothermal research; proceedings of the Second international seminar on the results of EC geothermal energy research
Strub, A. S.(EDITOR); Ungemach, P.(EDITOR)
Advances in European geothermal research; Second international seminar on the results of EC geothermal energy research, Strasbourg, France, Mar. 4-6, 1980
Publ: D. Reidel Publ. Co.
474-484p., 1980
5 REFS.
Subfile: B
Country of Publ.: Netherlands
Doc Type: BOOK; CONFERENCE PUBLICATION Bibliographic Level: ANALYTIC
Languages: English
illus., sketch maps
Latitude: N423000; N510000 Longitude: E0083000; W0050000
Descriptors: *France ; economic geology; geophysical surveys ; geothermal energy; heat flow; Europe; wells; measurement; reliability; exploration; boreholes; temperature; thermal conductivity; statistical analysis; paleoclimatology; reservoir rocks
Section Headings: 29 .(ECONOMIC GEOLOGY, ENERGY SOURCES)

1062263 81-52024
Terrestrial heat flow in France
Gable, R.
Advances in European geothermal research; proceedings of the Second international seminar on the results of EC geothermal energy research
Strub, A. S.(EDITOR); Ungemach, P.(EDITOR)
Advances in European geothermal research; Second international seminar on the results of EC geothermal energy research, Strasbourg, France, Mar. 4-6, 1980
Publ: D. Reidel Publ. Co.
466-473p., 1980
9 REFS.
Subfile: B
Country of Publ.: Netherlands
Doc Type: BOOK; CONFERENCE PUBLICATION Bibliographic Level: ANALYTIC
Languages: English
illus., sketch maps
Latitude: N423000; N510000 Longitude: E0083000; W0050000
Descriptors: *France ; economic geology; geophysical surveys ; geothermal energy; heat flow; Europe; grabens; radioactivity; geothermal gradient; exploration; anomalies
Section Headings: 29 .(ECONOMIC GEOLOGY, ENERGY SOURCES)

1062262 81-52230
Exploration and interpretation of the SW England geothermal anomaly
Wheildon, J.; Francis, M. F.; Ellis, J. R. L.; Thomas-Betts, A.
Advances in European geothermal research; proceedings of the Second international seminar on the results of EC geothermal energy research
Strub, A. S.(EDITOR); Ungemach, P.(EDITOR)
Advances in European geothermal research; Second international seminar on the results of EC geothermal energy research, Strasbourg, France, Mar. 4-6, 1980
Publ: D. Reidel Publ. Co.
456-465p., 1980
6 REFS.
Subfile: B
Country of Publ.: Netherlands
Doc Type: BOOK; CONFERENCE PUBLICATION Bibliographic Level: ANALYTIC
Languages: English
illus., 1 table, sketch map
Descriptors: *England ; economic geology; geophysical surveys ; geothermal energy; heat flow; Europe; anomalies; southwestern England; exploration; granites; heat sources; thermal conductivity; Cornubian Batholith; mathematical models; models; Carnmellis Pluton; Cornwall; Devonshire; Somerset
Section Headings: 29 .(ECONOMIC GEOLOGY, ENERGY SOURCES)

1061489 81-52148
First results of the application of the dipole electrical sounding method in the geothermal area of Travale-Radicondoli (Tuscany)
Patella, D.; Rossi, A.; Tramacere, A.
Geothermics 8: 2, 111-134p., 1979
CODEN: GTMCAT ISSN: 0375-6505 24 REFS.
Subfile: B
Country of Publ.: International
Doc Type: SERIAL Bibliographic Level: ANALYTIC
Languages: English
illus., 2 tables
Descriptors: *Italy ; economic geology; geophysical surveys ; geothermal energy; electrical surveys; Europe; Tuscany; Travale; Radicondoli; sounding; temperature; exploration
Section Headings: 29 .(ECONOMIC GEOLOGY, ENERGY SOURCES)

1061458 81-52040
Precision gravity studies at Cerro Prieto
Grannell, R. B.; Tarman, D. W.; Clover, R. C.; Leggewie, R. M.; Goldstein, N. E.; Chase, D. S.; Eppink, J.
Calif. State Univ., Long Beach, CA, USA; Calif. State Polytech. Univ., Pomona, CA, USA
Proceedings of the First symposium on the Cerro Prieto geothermal field; Part II
Anonymous
First symposium on the Cerro Prieto geothermal field; Part II, San Diego, CA, United States, Sept. 20-22, 1978
Geothermics 9: 1-2, 89-99p., 1980
CODEN: GTMCAT ISSN: 0375-6505 9 REFS.
Subfile: B
Country of Publ.: International
Doc Type: SERIAL; CONFERENCE PUBLICATION Bibliographic Level: ANALYTIC
Languages: English
illus., 1 table
Descriptors: *Mexico ; economic geology; geophysical surveys ; geothermal energy; gravity surveys; North America ; exploration; Cerro Prieto
Section Headings: 29 .(ECONOMIC GEOLOGY, ENERGY SOURCES)

1061455 81-52026
Referenced magnetotellurics at Cerro Prieto
Gamble, T. D.; Goubau, W. M.; Goldstein, N. E.; Clarke, J.
Univ. Calif., Lawrence Berkeley Lab., Berkeley, CA, USA
Proceedings of the First symposium on the Cerro Prieto geothermal field; Part II
Anonymous
First symposium on the Cerro Prieto geothermal field; Part II, San Diego, CA, United States, Sept. 20-22, 1978
Geothermics 9: 1-2, 49-63p., 1980
CODEN: GTMCAT ISSN: 0375-6505 12 REFS.
Subfile: B
Country of Publ.: International
Doc Type: SERIAL; CONFERENCE PUBLICATION Bibliographic Level: ANALYTIC
Languages: English
illus.
Descriptors: *Mexico ; economic geology; geophysical surveys ; geothermal energy; magnetotelluric surveys; North America; Cerro Prieto; exploration
Section Headings: 29 .(ECONOMIC GEOLOGY, ENERGY SOURCES)

1061454 81-51984
Self-potential studies at the Cerro Prieto geothermal field
Corwin, R. F.; Morrison, H. F.; Diaz C., S.; Rodriguez B., J.
Univ. Calif., Eng. Geosci., Berkeley, CA, USA
Proceedings of the First symposium on the Cerro Prieto geothermal field; Part II
Anonymous
First symposium on the Cerro Prieto geothermal field; Part II, San Diego, CA, United States, Sept. 20-22, 1978
Geothermics 9: 1-2, 39-47p., 1980
CODEN: GTMCAT ISSN: 0375-6505 5 REFS.
Subfile: B
Country of Publ.: International
Doc Type: SERIAL; CONFERENCE PUBLICATION Bibliographic Level: ANALYTIC
Languages: English
illus.
Descriptors: *Mexico ; economic geology; geophysical surveys ; geothermal energy; electrical surveys; North America; Cerro Prieto; self-potential methods; anomalies; exploration
Section Headings: 29 .(ECONOMIC GEOLOGY, ENERGY SOURCES)

1061453 81-51997
CFE self-potential survey northwest of Cerro Prieto
Diaz C., S.
Proceedings of the First symposium on the Cerro Prieto geothermal field; Part II
Anonymous
First symposium on the Cerro Prieto geothermal field; Part II, San Diego, CA, United States, Sept. 20-22, 1978
Geothermics 9: 1-2, 27-37p., 1980
CODEN: GTMCAT ISSN: 0375-6505 7 REFS.
Subfile: B
Country of Publ.: International
Doc Type: SERIAL; CONFERENCE PUBLICATION Bibliographic Level: ANALYTIC
Languages: English
illus.
Descriptors: *Mexico ; economic geology; geophysical surveys ; geothermal energy; electrical surveys; North America; self-potential methods; exploration; Cerro Prieto
Section Headings: 29 .(ECONOMIC GEOLOGY, ENERGY SOURCES)

1061452 81-52235
LBL resistivity studies at Cerro Prieto
Wilt, M. J.; Goldstein, N. E.; Razo M., A.
Univ. Calif., Lawrence Berkeley Lab., Earth Sci. Div., Berkeley, CA, USA
Proceedings of the First symposium on the Cerro Prieto geothermal field; Part II
Anonymous
First symposium on the Cerro Prieto geothermal field; Part II, San Diego, CA, United States, Sept. 20-22, 1978
Geothermics 9: 1-2, 15-26p., 1980
CODEN: GTMCAT ISSN: 0375-6505 10 REFS.
Subfile: B
Country of Publ.: International
Doc Type: SERIAL; CONFERENCE PUBLICATION Bibliographic

(cont. next page)

Level: ANALYTIC
Languages: English
illus.
Descriptors: *Mexico ; economic geology; geophysical surveys ; geothermal energy; electrical surveys; North America; resistivity; exploration; Cerro Prieto
Section Headings: 29 .(ECONOMIC GEOLOGY, ENERGY SOURCES)

1060750 81-46226
Geothermal ground measurements for a better understanding of infrared images regarding prospection of hyperthermal areas
Kappelmeyer, O.
Bundesanst. Geowiss. und Rohst., Hanover, DEU
Sciences de la Terre et mesures
Earth sciences and measurements
Anonymous
Sciences de la Terre et mesures; colloque international organise pour le jubile scientifique du Professeur Jean Goquel , Orleans, France, May 5-6, 1977
Fr., Bur. Rech. Geol. Minieres, Mem. 91, 303p., 1978
CODEN: FRGMA4 ISSN: 0071-8246
Subfile: B
Country of Publ.: France
Doc Type: SERIAL; CONFERENCE PUBLICATION Bibliographic Level: ANALYTIC
Languages: English
Note: With discussion,
Latitude: N385500; N392500 Longitude: E0264000; E0255000
Descriptors: *Greece ; economic geology; geophysical surveys ; geothermal energy; heat flow; Europe; Lesbos; Greek Aegean Islands; exploration; ground methods; geophysical methods; temperature; heat flux; geothermal gradient; anomalies; infrared methods; remote sensing; imagery
Section Headings: 29 .(ECONOMIC GEOLOGY, ENERGY SOURCES)

1050620 81-40254
Exploration for energy includes heat
Blackwell, D. G.
South. Method. Univ., Geothermal Lab., Dallas, TX, USA
Geotimes 26: 1, 21-23p., 1981
CODEN: GEOTAJ ISSN: 0016-8556
Subfile: B
Country of Publ.: United States
Doc Type: SERIAL Bibliographic Level: ANALYTIC
Languages: English
Descriptors: *symposia; *heat flow; *well-logging; *geothermal energy ; geophysical surveys; measurement; techniques; exploration ; report; energy sources; geothermal gradient; temperature
Section Headings: 29 .(ECONOMIC GEOLOGY, ENERGY SOURCES)

1046117 81-34281
Structure of the Presidio Bolson area, Texas, interpreted from gravity data
Mraz, J. R.; Keller, G. R.
Univ. Tex. Austin, Geol. Dep., Austin, TX, USA
Geological Circular - Texas, University, Bureau of Economic Geology 80-13, 20p., 1980
CODEN: TEGCA3 ISSN: 0082-3309 29 REFS.
Subfile: B
Country of Publ.: United States
Doc Type: SERIAL Bibliographic Level: MONOGRAPHIC
Languages: English
illus., tables, sketch maps
Latitude: N291500; N303000 Longitude: W1040000; W1050000
Descriptors: *Texas ; economic geology; geophysical surveys ; geothermal energy; gravity surveys; Presidio County; Bliss Sandstone; United States; Bouguer anomalies; Ruidosa; Presidio Bolson; exploration; Presidio Graben; magnetic surveys; Cambrian; Paleozoic; Ordovician; Mesozoic; Phanerozoic
Section Headings: 29 .(ECONOMIC GEOLOGY, ENERGY SOURCES)

1043481 81-34328
Application of aerial remote sensing to the study of geothermal resources in the desertic north of Chile and environmental pollution in Santiago, Chile
Araya F., M.
Cook, J. J.(chairperson); Rudin, F. M.(chairperson)
Fourteenth international symposium on remote sensing of environment, San Jose, Costa Rica, April 23-30, 1980
Proceedings of the International Symposium on Remote Sensing of Environment 14, 761-762p., 1980
CODEN: PISEDM
Subfile: B
Country of Publ.: International
Doc Type: SERIAL; CONFERENCE PUBLICATION Bibliographic Level: ANALYTIC
Languages: English
Descriptors: *Chile ; economic geology; environmental geology; geophysical surveys ; geothermal energy; pollution ; remote sensing; South America; Santiago; applications; exploration; resources
Section Headings: 29 .(ECONOMIC GEOLOGY, ENERGY SOURCES)

1043480 81-34356
Remote sensing techniques for identification and evaluation of geothermal areas
Del Rio, L.; Pascaud, P. N.; Camacho, S.; Galvan, N.
Cook, J. J.(chairperson); Rudin, F. M.(chairperson)
Fourteenth international symposium on remote sensing of environment, San Jose, Costa Rica, April 23-30, 1980
(cont. next page)

DIALOG File 89: GEOREF - 29-84/Nov (Copr. American Geological Institute)

Proceedings of the International Symposium on Remote Sensing of Environment 14, 731-742p., 1980
CODEN: PISEDM 25 REFS.
Subfile: B
Country of Publ.: International
Doc Type: SERIAL; CONFERENCE PUBLICATION Bibliographic Level: ANALYTIC
Languages: English
illus., tables, plates
Descriptors: *Mexico ; economic geology; geophysical surveys ; geothermal energy; remote sensing; North America; exploration; Landsat; imagery; structure
Section Headings: 29 .(ECONOMIC GEOLOGY, ENERGY SOURCES)

1037014 81-24154
Heat flow mapping at Roosevelt Hot Springs, Utah as a geothermal exploration method
Wilson, W. R.; Chapman, D. S.
Univ. Utah, Dep. Geol. and Geophys., Salt Lake City, Utah, USA
Society of Exploration Geophysicists, 48th annual meeting, San Francisco, Calif., United States, Oct. 29-Nov. 2, 1978
Soc. Explor. Geophys., Annu. Int. Meet., Abstr. 48, 109p., 1978
CODEN: SGAMB7
Subfile: B
Country of Publ.: United States
Doc Type: SERIAL; CONFERENCE PUBLICATION Bibliographic Level: ANALYTIC
Languages: English
Latitude: N382000; N383500 Longitude: W1124500; W1130000
Descriptors: *Utah ; geophysical surveys; economic geology ; heat flow; geothermal energy; Beaver County; United States; Roosevelt Hot Springs KGRA; known geothermal resource areas; springs; hot springs; thermal waters; exploration; temperature; Basin and Range Province; geophysical maps; maps
Section Headings: 29 .(ECONOMIC GEOLOGY, ENERGY SOURCES)

1037013 81-24008
Dipole-dipole resistivity survey of a portion of the Coso Hot Springs KGRA, Inyo County, California
Fox, R. C.; Ross, H. P.; Wright, P. M.
Univ. Utah Res. Inst., Salt Lake City, Utah, USA
Society of Exploration Geophysicists, 48th annual meeting, San Francisco, Calif., United States, Oct. 29-Nov. 2, 1978
Soc. Explor. Geophys., Annu. Int. Meet., Abstr. 48, 109p., 1978
CODEN: SGAMB7
Subfile: B
Country of Publ.: United States
Doc Type: SERIAL; CONFERENCE PUBLICATION Bibliographic Level: ANALYTIC
Languages: English
Latitude: N355000; N361000 Longitude: W1173000; W1180000
Descriptors: *California ; economic geology; geophysical surveys ; geothermal energy; electrical surveys; Inyo County; United States; Central California; Coso Hot Springs KGRA; thermal waters; springs; hot springs; known geothermal resource areas; resistivity; dipole-dipole arrays ; exploration
Section Headings: 29 .(ECONOMIC GEOLOGY, ENERGY SOURCES)

1037012 81-24055
Shallo-Temp surveys; a rapid reconnaissance technique for geothermal prospects
LeShack, L. A.; Lewis, J. E.; O'Hara, N. W.; Chang, D. C.
LeShack Assoc., Silver Spring, Md., USA; McGill Univ., CAN
Society of Exploration Geophysicists, 48th annual meeting, San Francisco, Calif., United States, Oct. 29-Nov. 2, 1978
Soc. Explor. Geophys., Annu. Int. Meet., Abstr. 48, 108-109p., 1978
CODEN: SGAMB7
Subfile: B
Country of Publ.: United States
Doc Type: SERIAL; CONFERENCE PUBLICATION Bibliographic Level: ANALYTIC
Languages: English
Latitude: N354500; N380000 Longitude: W1173000; W1190000
Descriptors: *California; *geophysical methods ; economic geology; geophysical surveys; geothermal energy; heat flow; techniques; Inyo County; Mono County; United States; Coso Hot Springs KGRA; Long Valley; temperature; soil sampling; thermal waters; springs; hot springs; known geothermal resource areas; Central California; exploration
Section Headings: 29 .(ECONOMIC GEOLOGY, ENERGY SOURCES)

1037010 81-24079
Geothermal exploration of the Agua de Pau Massif, San Miguel, Azores, Portugal
Meidav, T.
40 Brookside Ave., Berkeley, Calif., USA
Society of Exploration Geophysicists, 48th annual meeting, San Francisco, Calif., United States, Oct. 29-Nov. 2, 1978
Soc. Explor. Geophys., Annu. Int. Meet., Abstr. 48, 107-108p., 1978
CODEN: SGAMB7
Subfile: B
Country of Publ.: United States
Doc Type: SERIAL; CONFERENCE PUBLICATION Bibliographic Level: ANALYTIC
Languages: English
Latitude: N370000; N400000 Longitude: W0250000; W0310000
Descriptors: *Azores; *geophysical methods ; economic geology; methods ; geothermal energy; applications; Atlantic Ocean; San Miguel Island; Agua de Pau; electrical surveys; geophysical surveys; resistivity; microearthquakes ; seismic methods; passive methods; electrical methods;

(cont. next page)

DIALOG File 89: GEOREF - 29-84/Nov (Copr. American Geological Institute)

exploration
Section Headings: 29 .(ECONOMIC GEOLOGY, ENERGY SOURCES)

1037006 81-24150
Magnetotelluric investigations at the Roosevelt Hot Springs KGRA and Mineral Mountains, Utah
Wannamaker, P.
Univ. Utah, Dep. Geol. and Geophys., Salt Lake City, Utah, USA
Society of Exploration Geophysicists, 48th annual meeting, San Francisco, Calif., United States, Oct. 29-Nov. 2, 1978
Soc. Explor. Geophys., Annu. Int. Meet., Abstr. 48, 106p., 1978
CODEN: SGAMB7
Subfile: B
Country of Publ.: United States
Doc Type: SERIAL; CONFERENCE PUBLICATION Bibliographic Level: ANALYTIC
Languages: English
Latitude: N382000; N383500 Longitude: W1124500; W1130000
Descriptors: *Utah; *geophysical methods ; economic geology ; geophysical surveys; magnetotelluric methods ; geothermal energy; magnetotelluric surveys; interpretation; Beaver County; United States; Mineral Mountains; Roosevelt Hot Springs; exploration; theoretical studies; mathematical models; models; one-dimensional models; two-dimensional models; three-dimensional models; springs; hot springs; thermal waters; known geothermal resource areas; Basin and Range Province
Section Headings: 29 .(ECONOMIC GEOLOGY, ENERGY SOURCES)

1036784 81-23907
Electrical resistivity survey and evaluation of the Glass Buttes geothermal anomaly, Lake County, Oregon
Hull, D. A.
Oreg. Dep. Geol. Miner. Ind., Portland, OR, USA
25p., 1976
14 REFS.
Subfile: B
Doc Type: REPORT; MAP Bibliographic Level: MONOGRAPHIC
Languages: English
Report No.: O-76-1
Availability: Oreg., Dep. Geol. Mines. Ind., Portland, OR, United States
illus., tables; 1:29,528; geophys. surv. maps
Latitude: N433000; N433000 Longitude: W1200000; W1200000
Descriptors: *Oregon; *ground water ; geophysical surveys; surveys ; electrical surveys; Lake County; United States; Columbia Plateau; geophysical survey maps; resistivity; Glass Buttes; anomalies; geothermal energy; exploration; geothermal gradient
Section Headings: 29 .(ECONOMIC GEOLOGY, ENERGY SOURCES)

1036780 81-22175
Geophysical logs, Old Maid Flat 1, Clackamas County, Oregon
Anonymous
2p., 1978
Subfile: B
Doc Type: REPORT Bibliographic Level: MONOGRAPHIC
Languages: English
Report No.: O-78-6
Availability: Oreg., Dep. Geol. Miner. Ind., Portland, OR, United States
Note: Contains 6 well log data sheets, illus.
Latitude: N445500; N452500 Longitude: W1214500; W1225500
Descriptors: *Oregon; *well-logging ; geophysical surveys; interpretation ; data; Clackamas County; United States; Columbia Plateau; Old Maid Flat 1; exploration; geothermal energy
Section Headings: 20 .(GEOPHYSICS, APPLIED)

1035903 81-23911
Near-surface hydrothermal regime of the Lassen known geothermal resource area, California
Mase, C. W.; Sass, J. H.; Lachenbruch, A. H.
Open-File Report (United States Geological Survey. 1978) 80-1230, 31p., 1980
CODEN: XGROAG ISSN: 0196-1497
Subfile: B
Country of Publ.: United States
Doc Type: SERIAL; REPORT Bibliographic Level: MONOGRAPHIC
Languages: English
Availability: U. S. Geol. Surv., Open-File Serv. Sect., Branch Distrib., Denver, CO, United States
illus., table, sketch maps
Latitude: N401500; N404500 Longitude: W1211500; W1214500
Descriptors: *California ; economic geology; geophysical surveys ; geothermal energy; heat flow; Shasta County; United States; Mount Lassen; Lassen KGRA; exploration; temperature; geothermal gradient; thermal conductivity; thermal waters
Section Headings: 29 .(ECONOMIC GEOLOGY, ENERGY SOURCES)

1031205 81-18953
Contribution of geophysics in geothermal exploration of Banten
Akil, I.; Alhamid, I.; Razali, J.; Pekar, L.
Regional conference on the geology and mineral resources of Southeast Asia
Wiryosujono, S.(EDITOR); Sudradjat, A.(EDITOR)
Regional conference on the geology and mineral resources of Southeast Asia, Jakarta, Indonesia, Aug. 4-8, 1975
Publ: Indones. Assoc. Geol.
185-199p., 1978

(cont. next page)

Subfile: B
Country of Publ.: Indonesia
Doc Type: BOOK; CONFERENCE PUBLICATION Bibliographic Level: ANALYTIC
Languages: English
illus., sects., geol. sketch maps
Latitude: S113000; N063000 Longitude: E1413000; E0950000
Descriptors: *Indonesia ; economic geology ; geothermal energy; Asia; Java; Banten; geophysical surveys; gravity surveys; electrical surveys; resources; exploration
Section Headings: 29 .(ECONOMIC GEOLOGY, ENERGY SOURCES)

1030226 81-19048
Present day knowledge of the Parbati Valley geothermal field
Gupta, M. L.; Kumar, R.; Singh, S. B.
Proceedings of the Seminar on the development and utilization of geothermal energy resources
Bhalla, M. S.(EDITOR); Gupta, M. L.(EDITOR)
Seminar on the development and utilization of geothermal energy resources, Hyderabad, India, Jan. 6-7, 1977
Geoviews 6: 1-4, III83-III99p., 1979
11 REFS.
Subfile: B
Country of Publ.: India
Doc Type: SERIAL; CONFERENCE PUBLICATION Bibliographic Level: ANALYTIC
Languages: English
illus., sketch map
Latitude: N220000; N260000 Longitude: E0780000; E0740000
Descriptors: *India; *Himalayas ; economic geology; geophysical surveys ; geothermal energy; heat flow; Asia; Parbati Valley; geothermal fields; exploration; hot springs ; thermal waters; Himachal Pradesh
Section Headings: 29 .(ECONOMIC GEOLOGY, ENERGY SOURCES)

1030224 81-19081
A review of geological, geochemical and thermal exploration in the Sohna Valley, Dist. Gurgaon, (Haryana)
Krishnaswamy, V. S.; Shanker, R.; Jangi, B. L.
Proceedings of the Seminar on the development and utilization of geothermal energy resources
Bhalla, M. S.(EDITOR); Gupta, M. L.(EDITOR)
Seminar on the development and utilization of geothermal energy resources, Hyderabad, India, Jan. 6-7, 1977
Geoviews 6: 1-4, III47-III63p., 1979
4 REFS.
Subfile: B
Country of Publ.: India
Doc Type: SERIAL; CONFERENCE PUBLICATION Bibliographic Level: ANALYTIC
Languages: English
sects., table, sketch maps
Latitude: N280000; N300000 Longitude: E0772000; E0770000
Descriptors: *India ; geophysical surveys; economic geology ; heat flow; geothermal energy; Asia; Sohna Valley ; Haryana; exploration; structural controls; resources; temperature; thermal waters; hot springs
Section Headings: 29 .(ECONOMIC GEOLOGY, ENERGY SOURCES)

1030222 81-18979
A review of geophysical exploration for evaluating the geothermal resource potential of the Sohna Valley, Haryana
Bhanumurthy, Y. R.; Krishnaswamy, V. S.; Mall, R. P.
Proceedings of the Seminar on the development and utilization of geothermal energy resources
Bhalla, M. S.(EDITOR); Gupta, M. L.(EDITOR)
Seminar on the development and utilization of geothermal energy resources, Hyderabad, India, Jan. 6-7, 1977
Geoviews 6: 1-4, III1-III22p., 1979
6 REFS.
Subfile: B
Country of Publ.: India
Doc Type: SERIAL; CONFERENCE PUBLICATION Bibliographic Level: ANALYTIC
Languages: English
illus., sects., sketch maps
Latitude: N280000; N290000 Longitude: E0771500; E0770000
Descriptors: *India ; geophysical surveys; economic geology ; surveys; geothermal energy; exploration; resources; Sohna Valley; Haryana; Asia; thermal waters; structural controls; gravity surveys; magnetic surveys; seismic surveys
Section Headings: 29 .(ECONOMIC GEOLOGY, ENERGY SOURCES)

1030221 81-19130
Application of radiometric techniques in investigation of geothermal energy resources
Rao, V. V.; Ghosh, P. C.; Bhalla, N. S.
Proceedings of the Seminar on the development and utilization of geothermal energy resources
Bhalla, M. S.(EDITOR); Gupta, M. L.(EDITOR)
Seminar on the development and utilization of geothermal energy resources, Hyderabad, India, Jan. 6-7, 1977
Geoviews 6: 1-4, II37-II62p., 1979
11 REFS.
Subfile: B
Country of Publ.: India
Doc Type: SERIAL; CONFERENCE PUBLICATION Bibliographic Level: ANALYTIC
Languages: English
tables, sketch maps
Latitude: N224500; N225000 Longitude: E0733000; E0732500
Descriptors: *India ; economic geology; geophysical surveys ; geothermal energy; radioactivity surveys; resources; Asia; thermal waters; hot springs; springs; exploration
Section Headings: 29 .(ECONOMIC GEOLOGY, ENERGY SOURCES)

DIALOG File 89: GEOREF - 29-84/Nov (Copr. American Geological Institute)

1030220 81-19050
Geophysical exploration and assessment of power potential of Puga geothermal field
Gupta, M. L.; Sharma, S. R.; Singh, S. B.; Drolia, R. K.
Proceedings of the Seminar on the development and utilization of geothermal energy resources
Bhalla, M. S.(EDITOR); Gupta, M. L.(EDITOR)
Seminar on the development and utilization of geothermal energy resources, Hyderabad, India, Jan. 6-7, 1977
Geoviews 6: 1-4, II23-II36p., 1979
16 REFS.
Subfile: B
Country of Publ.: India
Doc Type: SERIAL; CONFERENCE PUBLICATION Bibliographic Level: ANALYTIC
Languages: English
sect., geol. sketch map
Latitude: N320000; N350000 Longitude: E0790000; E0750000
Descriptors: *India ; geophysical surveys; economic geology ; heat flow; geothermal energy; exploration; geothermal fields; Puga; springs; hot springs; Asia; thermal waters
Section Headings: 29 .(ECONOMIC GEOLOGY, ENERGY SOURCES)

1030210 81-18939
Proceedings of the Seminar on the development and utilization of geothermal energy resources
Bhalla, M. S.(EDITOR); Gupta, M. L.(EDITOR)
Seminar on the development and utilization of geothermal energy resources, Hyderabad, India, Jan. 6-7, 1977
Geoviews 6: 1-4, 236p., 1979
Subfile: B
Country of Publ.: India
Doc Type: SERIAL; CONFERENCE PUBLICATION Bibliographic Level: MONOGRAPHIC
Languages: English
Note: Individual articles cited separately, illus., tables, geol. sketch maps
Descriptors: *symposia; *India ; economic geology ; geothermal energy; Asia; resources; exploration; thermal waters; geophysical surveys; hot springs
Section Headings: 29 .(ECONOMIC GEOLOGY, ENERGY SOURCES)

1029840 81-16846
Interpretation and graphic representation of resistivity data using a curve plotter connected to a computer
Onodera, S.; Fukuda, M.; Sasaki, Y.
Butsuri-Tanko 33: 3, 10-20p., 1980
CODEN: BTANAF ISSN: 0521-9191 4 REFS.
Subfile: B
Country of Publ.: Japan
Doc Type: SERIAL Bibliographic Level: ANALYTIC
Languages: English Summary Languages: Japanese
illus., tables, sketch map
Descriptors: *Japan; *automatic data processing; *geophysical methods ; geophysical surveys; electrical methods ; electrical surveys; resistivity; computers; interpretation; techniques; simulation; graphic display; well-logging; exploration; geothermal energy; applications; geothermal fields; Asia; methods; data analysis
Section Headings: 20 .(GEOPHYSICS, APPLIED)

1028066 81-19137
Osobennosti bureniya skvazhin na peregretyye vody (iz opyta razvedki Pauzhetskogo mestorozhdeniya)
Drilling wells in superheated waters; from exploration tests of the Pauzhet Deposit
Samoylenko, P. I.; Drozdov, A. V.
Izucheniye i ispol'zovaniye geotermal'nykh resursov v vulkanicheskikh oblastyakh
Alad'yev, I. T.(EDITOR); Sugrobov, V. M.(EDITOR)
Publ: Izd. Nauka
101-106p., 1979
Subfile: B
Country of Publ.: Union of Soviet Socialist Republics
Doc Type: BOOK Bibliographic Level: ANALYTIC
Languages: Russian
illus.
Descriptors: *USSR; *well-logging ; geophysical surveys; techniques; economic geology ; boreholes; geothermal energy ; Pauzhet Deposit; Kamchatka Peninsula; thermal waters; exploration
Section Headings: 29 .(ECONOMIC GEOLOGY, ENERGY SOURCES)

1028064 81-18959
K metodike poiskov i razvedki yestestvennykh podzemnykh kotlov v kachestve effektivnogo istochnika geotermal'noy energii
Methods of prospecting and exploration of natural ground-water basins as effective sources of geothermal energy
Amirkhanov, K. I.; Kurbanov, M. K.; Kasparov, S. A.; Omarov, M. A.; Kadyrov, G. A.
Izucheniye i ispol'zovaniye geotermal'nykh resursov v vulkanicheskikh oblastyakh
Alad'yev, I. T.(EDITOR); Sugrobov, V. M.(EDITOR)
Publ: Izd. Nauka
88-95p., 1979
Subfile: B
Country of Publ.: Union of Soviet Socialist Republics
Doc Type: BOOK Bibliographic Level: ANALYTIC
Languages: Russian
sketch map
Latitude: N410000; N450000 Longitude: E0470000; E0460000
Descriptors: *USSR; *ground water ; economic geology; geophysical surveys; surveys ; geothermal energy; heat flow ; Dagestan; geothermal gradient; regional patterns;
(cont. next page)

methods; exploration
Section Headings: 29 .(ECONOMIC GEOLOGY, ENERGY SOURCES)

1027426 81-16094
Geology and geothermics of the Island of Milos
Fytikas, M.; Marinelli, G.
Proceedings of the International congress on thermal waters, geothermal energy and vulcanism of the Mediterranean area; geothermal energy; Volume 1
Augustithis, S. S.(president)
International congress on thermal waters, geothermal energy and vulcanism of the Mediterranean area; geothermal energy, Athens, Greece, Oct. 1976
Publ: Natl. Tech. Univ.
516-524p., 1976
Subfile: B
Country of Publ.: Greece
Doc Type: BOOK; CONFERENCE PUBLICATION Bibliographic Level: ANALYTIC
Languages: English
Note: Contains information derived from a doctoral dissertation by Fytikas, M.,
Latitude: N360000; N360000 Longitude: E0240000; E0240000
Descriptors: *Greece; *absolute age ; areal geology; dates ; economic geology; geophysical surveys; volcanology ; Milos Island; glaucophane; geothermal energy; electrical surveys; Europe; Cyclades Group; Aegean Sea; Mediterranean Sea; amphibole group; chain silicates; silicates; K/Ar; Alpine Orogeny; genesis; fumaroles; hot springs; springs; thermal waters; exploration; volcanism; neotectonics; island arcs; plate tectonics; Holocene; Quaternary; African Plate; Aegean Plate; Aegean volcanic arc
Section Headings: 13 .(AREAL GEOLOGY, GENERAL)

1027419 81-16843
The use of M.T.-5-E.X. magnetotelluric in geothermal exploration
Muse, L. M.; Ten Dam, A.
Gen. Electromagn. Prospect., Santa Rosa, Calif., USA; Tectonic Resour., USA
Proceedings of the International congress on thermal waters, geothermal energy and vulcanism of the Mediterranean area; geothermal energy; Volume 1
Augustithis, S. S.(president)
International congress on thermal waters, geothermal energy and vulcanism of the Mediterranean area; geothermal energy, Athens, Greece, Oct. 1976
Publ: Natl. Tech. Univ.
439-444p., 1976
2 REFS.
Subfile: B
Country of Publ.: Greece
Doc Type: BOOK; CONFERENCE PUBLICATION Bibliographic Level: ANALYTIC
Languages: English
Latitude: N363000; N473000 Longitude: E0190000; E0063000
Descriptors: *geophysical methods; *geothermal energy; *automatic data processing; *Italy; *Guadeloupe ; magnetotelluric methods; exploration; geophysical surveys ; applications; instruments; magnetotelluric surveys; geothermal exploration; computer programs; resistivity; interpretation; exponential solutions; Europe; Travale; Tuscany; carbonate rocks; geothermal fields; Torre Alfina; Guadelupe
Section Headings: 20 .(GEOPHYSICS, APPLIED)

1027418 81-16842
Preliminary geothermal gradient and heat flow values for northern Egypt and Gulf of Suez from oil well data
Morgan, P.; Blackwell, D. D.; Farris, J. C.; Boulos, F. K.; Salib, P. G.
South. Meth. Univ., Dep. Geol. Sci., Dallas, Tex., USA
Proceedings of the International congress on thermal waters, geothermal energy and vulcanism of the Mediterranean area; geothermal energy; Volume 1
Augustithis, S. S.(president)
International congress on thermal waters, geothermal energy and vulcanism of the Mediterranean area; geothermal energy, Athens, Greece, Oct. 1976
Publ: Natl. Tech. Univ.
424-438p., 1976
20 REFS.
Subfile: B
Country of Publ.: Greece
Doc Type: BOOK; CONFERENCE PUBLICATION Bibliographic Level: ANALYTIC
Languages: English
illus., strat. col.
Latitude: N220000; N320000 Longitude: E0353000; E0250000
Descriptors: *Egypt ; economic geology; geophysical surveys ; geothermal energy; heat flow; Africa; Gulf of Suez; geothermal gradient; exploration; neotectonics; measurement; genesis; structural controls; hot springs; springs; thermal waters; thermal conductivity; Mesozoic; Phanerozoic; Tertiary; Cenozoic; sedimentary rocks; histograms
Section Headings: 20 .(GEOPHYSICS, APPLIED)

1027413 81-16834
Computing methodologies for monitoring the thermal trend of volcanic areas
Lo Giudice, E.; Tonelli, A. M.
Proceedings of the International congress on thermal waters, geothermal energy and vulcanism of the Mediterranean area; geothermal energy; Volume 1
Augustithis, S. S.(president)
International congress on thermal waters, geothermal energy and vulcanism of the Mediterranean area; geothermal energy,
(cont. next page)

Athens, Greece, Oct. 1976
Publ: Natl. Tech. Univ.
354-364p., 1976
5 REFS.
Subfile: B
Country of Publ.: Greece
Doc Type: BOOK; CONFERENCE PUBLICATION Bibliographic Level: ANALYTIC
Languages: English
Note: Contribution of the Working Group for Remote Sensing Applications in Volcanic Areas (I.A.V.C.E.I.), illus.
Latitude: N380000; N380000 Longitude: E0150000; E0150000
Descriptors: *Italy; *automatic data processing ; geophysical surveys; economic geology; volcanology ; heat flow; geothermal energy; remote sensing; Vulcano; Europe; exploration; volcanoes; Holocene; Quaternary; methods; infrared surveys; seepage; geologic hazards; geothermal gradient; Mediterranean Sea; Tyrrhenian Sea
Section Headings: 20 .(GEOPHYSICS, APPLIED)

1027409 81-19069
The use of satellite data for monitoring zones of possible geothermal interest
Kaminsky, H.; Tonelli, A. M.
Proceedings of the International congress on thermal waters, geothermal energy and vulcanism of the Mediterranean area; geothermal energy; Volume 1
Augustithis, S. S.(president)
International congress on thermal waters, geothermal energy and vulcanism of the Mediterranean area; geothermal energy, Athens, Greece, Oct. 1976
Publ: Natl. Tech. Univ.
286-299p., 1976
9 REFS.
Subfile: B
Country of Publ.: Greece
Doc Type: BOOK; CONFERENCE PUBLICATION Bibliographic Level: ANALYTIC
Languages: English
illus.
Latitude: N363000; N473000 Longitude: E0190000; E0063000
Descriptors: *Italy; *hydrology : economic geology; hydrogeology; surveys; geophysical surveys ; geothermal energy; heat flow; Europe; exploration; infrared surveys; remote sensing; applications; energy sources; anomalies; regional patterns; thermal waters; satellite methods; geophysical methods; Nimbus; thermograms
Section Headings: 29 .(ECONOMIC GEOLOGY, ENERGY SOURCES)

1027397 81-16461
Contribution of geophysical surveying in the discovery of Cesano geothermal field, northern Latium, central Italy
Cameli, G. M.; Mouton, J.; Toro, B.
Proceedings of the International congress on thermal waters, geothermal energy and vulcanism of the Mediterranean area; geothermal energy; Volume 1
Augustithis, S. S.(president)
International congress on thermal waters, geothermal energy and vulcanism of the Mediterranean area; geothermal energy, Athens, Greece, Oct. 1976
Publ: Natl. Tech. Univ.
130-143p., 1976
Subfile: B
Country of Publ.: Greece
Doc Type: BOOK; CONFERENCE PUBLICATION Bibliographic Level: ANALYTIC
Languages: English
sketch maps, sect.
Latitude: N410000; N410000 Longitude: E0120000; E0120000
Descriptors: *Italy ; geophysical surveys; economic geology ; surveys; geothermal energy; Europe; gravity anomalies; Bouguer anomalies; maps; Earth-current surveys; temperature; geothermal gradient; electrical logging; well-logging; calibration; volcanic rocks; sedimentary rocks; magnetic surveys; Cretaceous; Mesozoic; limestone; carbonate rocks; reservoir rocks; thermal waters; Cesano Geothermal area; exploration; Sabatini Mountains
Section Headings: 18 .(GEOPHYSICS, SOLID EARTH)

1027392 81-16443
Geothermal research in western Campania, southern Italy; a revised interpretation of the Qualiano-Parete Structure
Baldi, P.; Cameli, G. M.; D'Argenio, B.; Oliveri del Castillo, A.; Pescatore, T.; Puxeddu, M.; Rossi, A.; Toro, B.
Proceedings of the International congress on thermal waters, geothermal energy and vulcanism of the Mediterranean area; geothermal energy; Volume 1
Augustithis, S. S.(president)
International congress on thermal waters, geothermal energy and vulcanism of the Mediterranean area; geothermal energy, Athens, Greece, Oct. 1976
Publ: Natl. Tech. Univ.
56-70p., 1976
16 REFS.
Subfile: B
Country of Publ.: Greece
Doc Type: BOOK; CONFERENCE PUBLICATION Bibliographic Level: ANALYTIC
Languages: English
illus., geol. sect., geol. sketch map
Latitude: N410000; N410000 Longitude: E0140000; E0130000
Descriptors: *Italy; *ground water ; geophysical surveys; surveys; structural geology ; neotectonics; Europe; electrical logging; well-logging; magnetic anomalies; gravity anomalies; tectonics; evolution; Apennines; tectonophysics; geothermal energy; exploration; Campania; vertical tectonics; grabens; Parete; horsts; buried features; genesis; thermal waters; monoclines; folds; models; carbonate rocks; displacements; economic geology
(cont. next page)

Section Headings: 18 .(GEOPHYSICS, SOLID EARTH)

1027390 81-16433
Geophysical reconnaissance of Los Humeros Caldera, Mexico
Alvarez, R.; Morrison, H. F.
Univ. Calif., Dep. Eng. Geosci., Berkeley, Calif., USA
Proceedings of the International congress on thermal waters, geothermal energy and vulcanism of the Mediterranean area; geothermal energy; Volume 1
Augustithis, S. S.(president)
International congress on thermal waters, geothermal energy and vulcanism of the Mediterranean area; geothermal energy, Athens, Greece, Oct. 1976
Publ: Natl. Tech. Univ.
29-42p., 1976
5 REFS.
Subfile: B
Country of Publ.: Greece
Doc Type: BOOK; CONFERENCE PUBLICATION Bibliographic Level: ANALYTIC
Languages: English
illus., sketch map
Latitude: N194000; N194000 Longitude: W0972500; W0972500
Descriptors: *Mexico ; geophysical surveys ; electrical logging; North America; well-logging; Los Humeros Caldera; Mexican volcanic belt; geothermal energy; volcanology; volcanism; fumaroles; tectonics; faults; magnetic anomalies; magnetic surveys; remote sensing; satellites; exploration; Monte Nuevo Fault; Zaragoza Fault
Section Headings: 18 .(GEOPHYSICS, SOLID EARTH)

1027389 81-16997
Etude geothermique preliminaire du NE espagnol
A preliminary geothermal study of northeastern Spain
Albert-Beltran, J. F.
Proceedings of the International congress on thermal waters, geothermal energy and vulcanism of the Mediterranean area; geothermal energy; Volume 1
Augustithis, S. S.(president)
International congress on thermal waters, geothermal energy and vulcanism of the Mediterranean area; geothermal energy, Athens, Greece, Oct. 1976
Publ: Natl. Tech. Univ.
17-28p., 1976
9 REFS.
Subfile: B
Country of Publ.: Greece
Doc Type: BOOK; CONFERENCE PUBLICATION Bibliographic Level: ANALYTIC
Languages: French
tables
Latitude: N403000; N423000 Longitude: E0033000; E0000000
Descriptors: *Spain ; hydrogeology; economic geology ; thermal waters; geothermal energy; Europe; genesis; seismicity; epicenters; Pyrenees; Maladeta Massif; granodiorite; granite-granodiorite family; Andorra Massif; intrusions; Pliocene; Neogene; Tertiary; Cenozoic; volcanism; volcanology; geochemistry; chemical composition; albite-anorthite system; ion exchange; geothermal gradient; heat flow; geophysical surveys; Catalonia; electrical logging; well-logging; Gerona; tectonics; regional patterns; fracture zones; faults; exploration; areal geology
Section Headings: 21 .(HYDROGEOLOGY AND HYDROLOGY)

1024903 81-12376
A study on the detection of reflection events in a complex geothermal areas
Ishii, Y.; Tsumuraya, Y.
J. Min. Metall. Inst. Jap. 96: 1107, 301-306p., 1980
ISSN: 0369-4194 6 REFS.
Subfile: B
Country of Publ.: Japan
Doc Type: SERIAL Bibliographic Level: ANALYTIC
Languages: Japanese Summary Languages: English
illus.
Latitude: N300000; N450000 Longitude: E1470000; E1290000
Descriptors: *Japan; *geophysical methods ; geophysical surveys; economic geology; seismic methods ; seismic surveys; geothermal energy; interpretation; Asia; exploration; reflection; stacking methods
Section Headings: 20 .(GEOPHYSICS, APPLIED)

1022906 81-14201
Contribution to the study of the deep lithospheric profiles; ''deep'' reflecting horizons in Larderello-Travale geothermal field
Batini, F.; Burgassi, P. D.; Cameli, G. M.; Nicolich, R.; Squarci, P.
Atti del 69 o Congresso della Societa Geologica Italiana sul tema recenti sviluppi della ricerca geologica finalizzata
69 o Congresso della Societa Geologica Italiana; Recenti sviluppi della ricerca geologica finalizzata, Perugia, Italy , Oct. 2-4, 1978
Soc. Geol. Ital., Mem. 19, 477-484p., 1978
CODEN: MSGLAH ISSN: 0375-9857
Subfile: B
Country of Publ.: Italy
Doc Type: SERIAL; CONFERENCE PUBLICATION Bibliographic Level: ANALYTIC
Languages: English
illus., sects., geol. sketch maps
Latitude: N425500; N433000 Longitude: E0111500; E0010300
Descriptors: *Italy ; economic geology; geophysical surveys ; geothermal energy; seismic surveys; Europe; Larderello-Travale geothermal field; geothermal fields; tectonics; exploration; deep-seated structures
Section Headings: 29 .(ECONOMIC GEOLOGY, ENERGY SOURCES)

DIALOG File 89: GEOREF - 29-84/Nov (Copr. American Geological Institute)

1022905 81-14258
Structural setting of the Larderello-Travale geothermal region
Gianelli, G.; Puxeddu, M.; Squarci, P.
Atti del 69 o Congresso della Societa Geologica Italiana sul tema recenti sviluppi della ricerca geologica finalizzata
69 o Congresso della Societa Geologica Italiana; Recenti sviluppi della ricerca geologica finalizzata, Perugia, Italy , Oct. 2-4, 1978
Soc. Geol. Ital., Mem. 19, 469-476p., 1978
CODEN: MSGLAH ISSN: 0375-9857 20 REFS.
Subfile: B
Country of Publ.: Italy
Doc Type: SERIAL; CONFERENCE PUBLICATION Bibliographic Level: ANALYTIC
Languages: English Summary Languages: Italian
illus., charts, geol. sketch map
Latitude: N425500; N433000 Longitude: E0111500; E0103000
Descriptors: *Italy ; economic geology; geophysical surveys ; geothermal energy; seismic surveys; Europe; geothermal fields; intrusions; granite; granite-granodiorite family; lithostratigraphy; tectonics; deep-seated structures; southern Tuscany; Larderello-Travale geothermal field; exploration
Section Headings: 29 .(ECONOMIC GEOLOGY, ENERGY SOURCES)

1015559 81-05017
Geothermal reconnaissance by electrical methods in eastern Arizona
Young, C. T.
N.M. State Univ., Phys. Dep., Las Cruces, N.M., USA
American Geophysical Union; 1980 spring annual meeting, Toronto, Ont., Canada, May 22-27, 1980
Eos (Am. Geophys. Union, Trans.) 61: 17, 365p., 1980
CODEN: EOSTAJ ISSN: 0096-3941
Subfile: B
Country of Publ.: United States
Doc Type: SERIAL; CONFERENCE PUBLICATION Bibliographic Level: ANALYTIC
Languages: English
Latitude: N333000; N341000 Longitude: W1093000; W1095000
Descriptors: *Arizona ; economic geology; geophysical surveys ; geothermal energy; electrical surveys; Apache County; United States; White Mountains; exploration; resistivity; Earth-current surveys; Schlumberger methods; crust
Section Headings: 29 .(ECONOMIC GEOLOGY, ENERGY SOURCES)

1015558 81-02518
Magnetotelluric study of the Zuni HDR prospect and Jemez Lineament
Ander, M.; Laughlin, A. W.; Furgerson, R.; Foster, J.; Strangway, D.
Los Alamos Sci. Lab., Los Alamos, N.M., USA; Argonaut Enterp., USA
American Geophysical Union; 1980 spring annual meeting, Toronto, Ont., Canada, May 22-27, 1980
Eos (Am. Geophys. Union, Trans.) 61: 17, 365p., 1980
CODEN: EOSTAJ ISSN: 0096-3941
Subfile: B
Country of Publ.: United States
Doc Type: SERIAL; CONFERENCE PUBLICATION Bibliographic Level: ANALYTIC
Languages: English
Latitude: N345000; N352000 Longitude: W1083500; W1090500
Descriptors: *New Mexico; *Colorado Plateau ; tectonophysics; geophysical surveys; economic geology ; crust; magnetotelluric surveys; geothermal energy; McKinley County; Valencia County; United States; Zuni Indian Reservation; dry hot rocks; Jemez Lineament; lineaments; structure; deep-seated structures; electrical conductivity; exploration
Section Headings: 18 .(GEOPHYSICS, SOLID EARTH)

1012887 81-04828
Reconnaissance electrical surveys in the Coso Range, California
Jackson, D. B.; O'Donnell, J. E.
U. S. Geol. Surv., Denver, Colo., USA
Coso geothermal area
Bacon, C. R.(EDITOR); Duffield, W. A.(EDITOR)
J. Geophys. Res. 85: B5, 2502-2516p., 1980
CODEN: JGREA2 ISSN: 0148-0227 35 REFS.
Subfile: B
Country of Publ.: United States
Doc Type: SERIAL Bibliographic Level: ANALYTIC
Languages: English
illus., geol. sketch map
Latitude: N354500; N361500 Longitude: W1173000; W1180000
Descriptors: *California ; geophysical surveys; economic geology ; electrical surveys; geothermal energy; Inyo County; United States; Coso Range; Coso Hot Springs; geothermal systems; direct-current methods; Earth-current surveys; audiomagnetotelluric methods; exploration; resistivity; sounding
Section Headings: 29 .(ECONOMIC GEOLOGY, ENERGY SOURCES)

1012885 81-04984
Observations of a direct current concentration on the eastern Sierran Front; evidence for shallow crustal conductors on the eastern Sierran Front and beneath the Coso Range
Towle, J. N.
U. S. Geol. Surv., Denver, Colo., USA
Coso geothermal area
Bacon, C. R.(EDITOR); Duffield, W. A.(EDITOR)
J. Geophys. Res. 85: B5, 2484-2490p., 1980

(cont. next page)

DIALOG File 89: GEOREF - 29-84/Nov (Copr. American Geological Institute)

CODEN: JGREA2 ISSN: 0148-0227 13 REFS.
Subfile: B
Country of Publ.: United States
Doc Type: SERIAL Bibliographic Level: ANALYTIC
Languages: English
illus., table, sketch maps
Latitude: N354500; N361500 Longitude: W1173000; W1180000
Descriptors: *California; *Western U.S. ; geophysical surveys; economic geology; tectonophysics ; magnetic surveys; geothermal energy; crust; Inyo County; United States; Coso Range; Coso Hot Springs; geothermal systems; Sierra Nevada; Sierran Front; upper mantle; mantle; electrical conductivity; induction; resistivity; magnetometric resistivity methods; exploration; direct-current methods
Section Headings: 29 .(ECONOMIC GEOLOGY, ENERGY SOURCES)

1010833 80-52358
Moderate-temperature geothermal resource potential of the northern Atlantic Coastal Plain
Lambiase, J. J.; Dashevsky, S. S.; Costain, J. K.; Gleason, R. J.; McClung, W. S.
Va. Polytech. Inst. and State Univ., Dep. Geol. Sci., Blacksburg, Va., USA
Geology (Boulder) 8: 9, 447-449p., 1980
CODEN: GLGYBA ISSN: 0091-7613 12 REFS.
Subfile: B
Country of Publ.: United States
Doc Type: SERIAL Bibliographic Level: ANALYTIC
Languages: English
illus., sketch maps
Latitude: N330000; N420000 Longitude: W0730000; W0790000
Descriptors: *Atlantic Coastal Plain; *Eastern U.S. ; economic geology; hydrogeology; geophysical surveys ; geothermal energy; thermal waters; heat flow; North America ; Northern Atlantic Coastal Plain; possibilities; temperature; geothermal gradient; exploration; well-logging ; electrical logging; United States
Section Headings: 29 .(ECONOMIC GEOLOGY, ENERGY SOURCES)

1004854 80-47175
Detailed gravity and aeromagnetic surveys of the Cove Fort-Sulphurdale KGRA and vicinity, Millard and Beaver counties, Utah
Cook, K. L.; Serpa, L. F.; Pe, W.
Univ. Utah., Dep. Geol. and Geophys., Salt Lake City, Utah, USA
88p., 1980
88 REFS.
Subfile: B
Doc Type: REPORT Bibliographic Level: MONOGRAPHIC
Languages: English
Report No.: IDO/DOE/ET/28392-30
Availability: U. S. Dep. Energy, Div. Geothermal Energy, United States
illus., tables, geol. sketch map
Latitude: N381500; N384500 Longitude: W1123000; W1124500
Descriptors: *Utah ; economic geology; geophysical surveys ; geothermal energy; surveys; Millard County; Beaver County; United States; Cove Fort; Sulphurdale; gravity surveys; Bouguer anomalies; magnetic anomalies; resources; exploration; grabens; fault zones; geophysical profiles; magnetic surveys; Tushar Mountains; Pavant Mountains
Section Headings: 29 .(ECONOMIC GEOLOGY, ENERGY SOURCES)

1004853 80-47204
Detailed gravity and aeromagnetic surveys in the Black Rock Desert area, Utah
Serpa, L. F.; Cook, K. L.
Univ. Utah, Dep. Geol. and Geophys., Salt Lake City, Utah, USA
210p., 1980
33 REFS.
Subfile: B
Doc Type: REPORT Bibliographic Level: MONOGRAPHIC
Languages: English
Report No.: IDO/DOE/ET/28392/39
Availability: U. S. Dep. Energy, Div. Geothermal Energy, United States
illus., tables, sketch maps
Latitude: N384500; N391500 Longitude: W1121500; W1124500
Descriptors: *Utah; *automatic data processing ; economic geology; geophysical surveys ; geothermal energy; surveys; Millard County; United States; Black Rock Desert; gravity surveys; magnetic surveys; Bouguer anomalies; magnetic anomalies; resources; exploration; geophysical methods; thermal waters; hot springs; Meadow; Hatton; Pavant Mountains; airborne methods
Section Headings: 29 .(ECONOMIC GEOLOGY, ENERGY SOURCES)

1004167 80-45009
Formation evaluation concepts for geothermal resources
Ehring, T. W.; Lusk, L. A.; Grubb, J. M.; Johnson, R. B.; DeVries, M. R.; Fertl, W. H.
Dresser Ind., Inc., Dresser Atlas Div., Houston, Tex., USA
Nineteenth annual logging symposium, El Paso, Tex., United States, June 13-16, 1978
Soc. Prof. Well Log Anal., Annu. Logging Symp., Trans. 19, 14 p.p., 1978
CODEN: LGSTA6
Subfile: B
Country of Publ.: United States
Doc Type: SERIAL; CONFERENCE PUBLICATION Bibliographic Level: ANALYTIC
Languages: English
illus., tables, sects., geol. sketch maps
Latitude: N323000; N420000 Longitude: W1141500; W1243000
Descriptors: *California; *well-logging; *geothermal energy
(cont. next page)

DIALOG File 89: GEOREF - 29-84/Nov (Copr. American Geological Institute)

; geophysical surveys; interpretation; exploration ; formation tests; United States; techniques; wells; data; equations
Section Headings: 20 .(GEOPHYSICS, APPLIED)

1002642 80-47174
Telluric profiles and location map for Vulcan Hot Springs known geothermal resource area, Idaho
Christopherson, K. R.; Senterfit, R. M.; Dalati, M.
U. S. Geol. Surv., Open-File Rep. 80-518, 4p., 1980
CODEN: XGROAG
Subfile: B
Country of Publ.: United States
Doc Type: SERIAL; REPORT Bibliographic Level: MONOGRAPHIC
Languages: English
Availability: U. S. Geol. Surv., Open-File Serv. Sect., Branch Distrib., Denver, Colo., United States
illus., sketch map
Latitude: N443000; N444000 Longitude: W1153500; W1154500
Descriptors: *Idaho; *Rocky Mountains ; economic geology; hydrogeology; geophysical surveys ; geothermal energy; springs; Earth-current surveys; Valley County; United States; Vulcan Hot Springs; known geothermal resource areas; hot springs; exploration; North America; KGRA
Section Headings: 29 .(ECONOMIC GEOLOGY, ENERGY SOURCES)

1000629 80-42140
Evaluation of Baltazor Known Geothermal Resources Area, Nevada
Isherwood, W. F.; Mabey, D. R.
U. S. Geol. Surv., Menlo Park, Calif., USA
Proceedings of the ENEL-ERDA workshop on geothermal resource assessment and reservoir engineering, Larderello
Anonymous
The ENEL-ERDA workshop on geothermal resource assessment and reservoir engineering, Larderello, Italy, Sept. 12-16, 1977
Geothermics 7: 2-4, 221-229p., 1978
CODEN: GTMCAT ISSN: 0375-6505 9 REFS.
Subfile: B
Country of Publ.: International
Doc Type: SERIAL; CONFERENCE PUBLICATION Bibliographic Level: ANALYTIC
Languages: English
geol. sketch maps
Descriptors: *Nevada ; economic geology; geophysical surveys ; geothermal energy; gravity surveys; United States ; resources; Baltazor KGRA; magnetic surveys; electrical surveys; Western U.S.; hydrogeology; ground water; thermal waters; hot springs; aquifers; exploration
Section Headings: 29 .(ECONOMIC GEOLOGY, ENERGY SOURCES)

1000624 80-42093
Assessment of geothermal potential of central and southern Tuscany
Cataldi, R.; Lazzorotto, A.; Muffler, P.; Squarci, P.; Stefani, G.
U. S. Geol. Surv., Menlo Park, Calif., USA
Proceedings of the ENEL-ERDA workshop on geothermal resource assessment and reservoir engineering, Larderello
Anonymous
The ENEL-ERDA workshop on geothermal resource assessment and reservoir engineering, Larderello, Italy, Sept. 12-16, 1977
Geothermics 7: 2-4, 91-131p., 1978
CODEN: GTMCAT ISSN: 0375-6505 13 REFS.
Subfile: B
Country of Publ.: International
Doc Type: SERIAL; CONFERENCE PUBLICATION Bibliographic Level: ANALYTIC
Languages: English
illus., tables, sects., geol. sketch maps
Latitude: N420000; N441000 Longitude: E0120000; E0100000
Descriptors: *Italy ; economic geology; geophysical surveys ; geothermal energy; gravity surveys; Europe; Tuscany; resources; geologic thermometry; thermal waters; heat flow; Jurassic; Mesozoic; Triassic; porosity; temperature; exploration
Section Headings: 29 .(ECONOMIC GEOLOGY, ENERGY SOURCES)

1000602 80-42102
Seismic noise measurements in the Mt. Amiata geothermal area, Italy
Del Pezzo, E.; Guerra, I.; Luongo, G.; Scarpa, R.
Geothermics 4: 1-4, 40-43p., 1975
CODEN: GTMCAT ISSN: 0375-6505 11 REFS.
Subfile: B
Country of Publ.: International
Doc Type: SERIAL Bibliographic Level: ANALYTIC
Languages: English
illus., geol. sketch map
Latitude: N363000; N473000 Longitude: E0190000; E0063000
Descriptors: *Italy ; geophysical surveys; economic geology ; seismic surveys; geothermal energy; Europe; Mount Amiata; noise; mathematical models; models; exploration; anomalies; resources; thermal waters
Section Headings: 29 .(ECONOMIC GEOLOGY, ENERGY SOURCES)

1000596 80-42124
Interpretation of gravity surveys in Grass and Buena Vista Valleys, Nevada
Goldstein, N. E.; Paulsson, B.
Univ. Calif., Lawrence Berkeley Lab., Berkeley, Calif., USA
(cont. next page)

DIALOG File 89: GEOREF - 29-84/Nov (Copr. American Geological Institute)

Geothermics 7: 1, 29-50p., 1978
CODEN: GTMCAT ISSN: 0375-6505 17 REFS.
Subfile: B
Country of Publ.: International
Doc Type: SERIAL Bibliographic Level: ANALYTIC
Languages: English
illus., sects., geol. sketch maps
Latitude: N380000; N400000 Longitude: W1180000; W1200000
Descriptors: *Nevada ; geophysical surveys; economic geology ; gravity surveys; geothermal energy; United States ; Grass Valley; Buena Vista Valley; Bouguer anomalies; basement; faults; seismic surveys; exploration; resources; thermal conductivity; resistivity; electrical surveys
Section Headings: 29 .(ECONOMIC GEOLOGY, ENERGY SOURCES)

999772 80-42097
Ground radon survey of a geothermal area in Hawaii
Cox, M. E.
Hawaii Inst. Geophys., Honolulu, Hawaii, USA
Geophys. Res. Lett. 7: 4, 283-286p., 1980
CODEN: GPRLAJ ISSN: 0094-8276 20 REFS.
Subfile: B
Country of Publ.: United States
Doc Type: SERIAL Bibliographic Level: ANALYTIC
Languages: English
Note: Hawaii Inst. Geophys.; Contrib. No. 988, sketch maps
Latitude: N190000; N193500 Longitude: W1545000; W1552500
Descriptors: *Hawaii; *geophysical methods; *isotopes; *radon ; economic geology; geophysical surveys; radioactivity methods ; geothermal energy; radioactivity surveys; techniques; Rn-222; Pacific Ocean; United States; Kilauea; Puna; Pahoa; exploration; ground methods; emanations; gases; Rn-220
Section Headings: 29 .(ECONOMIC GEOLOGY, ENERGY SOURCES)

996266 80-36602
Preliminary petrographic and geophysical interpretations of the exploratory geothermal drill hole and core, Redstone, New Hampshire
Hoag, R. B., Jr.; Stewart, G. W.
Univ. N.H., Dep. Earth Sci., Durham, N.H., USA
121p., 1977
Subfile: B
Doc Type: REPORT Bibliographic Level: MONOGRAPHIC
Languages: English
Report No.: COO-2720-1
Availability: NTIS, Springfield, Va., United States
Note: Individual papers are cited separately herein, illus., tables, sketch maps
Latitude: N440000; N442000 Longitude: W0712500; W0714500
Descriptors: *New Hampshire ; economic geology ; geothermal energy; uranium; Carroll County; Conway Granite; United States; Redstone; exploration; petrography; cores; granite; granite-granodiorite family; igneous rocks; volcanic rocks; plutonic rocks; syenite; syenite family; lamprophyre; lamprophyre and carbonatite family; radioactivity; heat flow; geophysical surveys; ore deposits ; lithology; temperature; veins; White Mountain; North Conway
Section Headings: 26 .(ECONOMIC GEOLOGY, GENERAL & MINING)

995689 80-37095
Detailed gravity and aeromagnetic surveys in the Black Rock Desert area, Utah
Serpa, L. F.; Cook, K. L.
Univ. Utah, Dep. Geol. and Geophys., Salt Lake City, Utah, USA
Society of Exploration Geophysicists, 49th annual international meeting, New Orleans, La., United States, Nov. 4-8, 1979
Soc. Explor. Geophys., Annu. Int. Meet., Abstr. 49, 106-107p., 1979
CODEN: SGAMB7
Subfile: B
Country of Publ.: United States
Doc Type: SERIAL; CONFERENCE PUBLICATION Bibliographic Level: ANALYTIC
Languages: English
Latitude: N384000; N385000 Longitude: W1124500; W1131000
Descriptors: *Utah; *Basin and Range Province ; economic geology; geophysical surveys ; geothermal energy; surveys; Millard County; exploration; structure; United States; Black Rock Desert; gravity surveys; magnetic surveys; airborne methods; geophysical methods; magnetic anomalies; gravity anomalies; faults; springs; thermal waters; hot springs
Section Headings: 29 .(ECONOMIC GEOLOGY, ENERGY SOURCES)

995688 80-36994
Inversion of self-potential data from Cerro Prieto geothermal field, Mexico
Fitterman, D. V.; Corwin, R. F.
U. S. Geol. Surv., Denver, Colo., USA; Univ. Calif., USA
Society of Exploration Geophysicists, 49th annual international meeting, New Orleans, La., United States, Nov. 4-8, 1979
Soc. Explor. Geophys., Annu. Int. Meet., Abstr. 49, 106p., 1979
CODEN: SGAMB7
Subfile: B
Country of Publ.: United States
Doc Type: SERIAL; CONFERENCE PUBLICATION Bibliographic Level: ANALYTIC
Languages: English
Latitude: N320000; N324000 Longitude: W1150000; W1160000
Descriptors: *Mexico; *geophysical methods ; economic geology; geophysical surveys; electrical methods ; geothermal energy; electrical surveys; interpretation;
(cont. next page)

exploration; North America; Baja California; Cerro Prieto; geothermal fields; self-potential methods; inverse problem; theoretical studies; mathematical models; models
Section Headings: 29 .(ECONOMIC GEOLOGY, ENERGY SOURCES)

995686 80-36979
Induced-polarization measurements at Roosevelt Hot Springs thermal area, Utah
Chu, J. J.; Sill, W. R.; Ward, S. H.
Univ. Utah, Dep. Geol. and Geophys., Salt Lake City, Utah, USA
Society of Exploration Geophysicists, 49th annual international meeting, New Orleans, La., United States, Nov. 4-8, 1979
Soc. Explor. Geophys., Annu. Int. Meet., Abstr. 49, 105p., 1979
CODEN: SGAMB7
Subfile: B
Country of Publ.: United States
Doc Type: SERIAL; CONFERENCE PUBLICATION Bibliographic Level: ANALYTIC
Languages: English
Latitude: N382000; N383500 Longitude: W1125000; W1130000
Descriptors: *Utah; *Basin and Range Province; *geophysical methods ; economic geology; geophysical surveys; electrical methods ; geothermal energy; electrical surveys; induced polarization; Beaver County; exploration; United States; Roosevelt Hot Springs; mathematical models; models; springs ; hot springs; thermal waters
Section Headings: 29 .(ECONOMIC GEOLOGY, ENERGY SOURCES)

995685 80-36952
Sonic log waveforms from a geothermal well in Brazoria County, Texas
Backus, M. M.; Castagna, J.; Gregory, A. R.
Univ. Tex. at Austin, USA
Society of Exploration Geophysicists, 49th annual international meeting, New Orleans, La., United States, Nov. 4-8, 1979
Soc. Explor. Geophys., Annu. Int. Meet., Abstr. 49, 105p., 1979
CODEN: SGAMB7
Subfile: B
Country of Publ.: United States
Doc Type: SERIAL; CONFERENCE PUBLICATION Bibliographic Level: ANALYTIC
Languages: English
Latitude: N284000; N293000 Longitude: W0945500; W0955500
Descriptors: *Texas; *Gulf Coastal Plain; *well-logging ; economic geology; geophysical surveys; acoustical logging ; geothermal energy; interpretation; Brazoria County; exploration; United States; North America; waveforms; spectral analysis; elastic waves; P-waves
Section Headings: 29 .(ECONOMIC GEOLOGY, ENERGY SOURCES)

995683 80-37121
Two- and three-dimensional magnetotelluric modeling with applications to crustal structure and reservoir assessment at the Roosevelt Hot Springs KGRA, Utah
Wannamaker, P. E.; Hohmann, G. W.; Sill, W. R.; Ward, S. H.
Univ. Utah, Dep. Geol. and Geophys., Salt Lake City, Utah, USA
Society of Exploration Geophysicists, 49th annual international meeting, New Orleans, La., United States, Nov. 4-8, 1979
Soc. Explor. Geophys., Annu. Int. Meet., Abstr. 49, 104p., 1979
CODEN: SGAMB7
Subfile: B
Country of Publ.: United States
Doc Type: SERIAL; CONFERENCE PUBLICATION Bibliographic Level: ANALYTIC
Languages: English
Latitude: N382000; N383500 Longitude: W1125000; W1130000
Descriptors: *Utah; *Basin and Range Province; *geophysical methods ; economic geology; geophysical surveys; magnetotelluric methods; tectonophysics ; geothermal energy; magnetotelluric surveys; interpretation; crust; Beaver County; exploration; United States; structure; Roosevelt Hot Springs; hot springs; springs; thermal waters; mathematical models; models; two-dimensional models; three-dimensional models; theoretical studies; reservoir rocks
Section Headings: 29 .(ECONOMIC GEOLOGY, ENERGY SOURCES)

995682 80-36957
Stacking and interval velocities in the lower and upper crust by a special reflection seismic survey in the region of the Urach geothermal anomaly
Bartelsen, H.; Meissner, R.; Krey, T.; Schmoll, J.
Prakla-Seismos, Hanover, DEU
Society of Exploration Geophysicists, 49th annual international meeting, New Orleans, La., United States, Nov. 4-8, 1979
Soc. Explor. Geophys., Annu. Int. Meet., Abstr. 49, 104p., 1979
CODEN: SGAMB7
Subfile: B
Country of Publ.: United States
Doc Type: SERIAL; CONFERENCE PUBLICATION Bibliographic Level: ANALYTIC
Languages: English
Latitude: N471500; N500000 Longitude: E0134500; E0063000
Descriptors: *West Germany; *Germany; *geophysical methods; *seismology ; economic geology; geophysical surveys; seismic methods; crust ; geothermal energy; seismic surveys ; interpretation; P-waves; exploration; Europe; Urach;

(cont. next page)

elastic waves; velocity; stacking
Section Headings: 29 .(ECONOMIC GEOLOGY, ENERGY SOURCES)

995681 80-35021
A comparison of electromagnetic and magnetotelluric surveys
Morrison, H. F.; Goldstein, N. F.; Hoversten, G. M.; Wilt, M.; Mozley, E.
Univ. Calif., Eng. Geosci., Berkeley, Calif., USA
Society of Exploration Geophysicists, 49th annual international meeting, New Orleans, La., United States, Nov. 4-8, 1979
Soc. Explor. Geophys., Annu. Int. Meet., Abstr. , 49, 103-104p., 1979
CODEN: SGAMB7
Subfile: B
Country of Publ.: United States
Doc Type: SERIAL; CONFERENCE PUBLICATION Bibliographic Level: ANALYTIC
Languages: English
Latitude: N452500; N452500 Longitude: W1214000; W1214000
Descriptors: *Oregon; *geophysical methods; *Pacific Coast ; geophysical surveys; methods; economic geology ; surveys; interpretation; geothermal energy; Clackamas County; Hood River County; exploration; Mount Hood; United States; electromagnetic surveys; magnetotelluric surveys; magnetotelluric methods; electromagnetic methods
Section Headings: 20 .(GEOPHYSICS, APPLIED)

995679 80-37125
Resistivity studies at the Cerro Prieto geothermal field, Baja California, Mexico
Wilt, M.; Goldstein, N. E.
Lawrence Berkeley Lab., Berkeley, Calif., USA
Society of Exploration Geophysicists, 49th annual international meeting, New Orleans, La., United States, Nov. 4-8, 1979
Soc. Explor. Geophys., Annu. Int. Meet., Abstr. 49, 102-103p., 1979
CODEN: SGAMB7
Subfile: B
Country of Publ.: United States
Doc Type: SERIAL; CONFERENCE PUBLICATION Bibliographic Level: ANALYTIC
Languages: English
Latitude: N320000; N324000 Longitude: W1150000; W1160000
Descriptors: *Mexico; *geophysical methods ; economic geology; geophysical surveys; electrical methods ; geothermal energy; electrical surveys; resistivity; exploration; North America; Baja California; Cerro Prieto; geothermal fields; dipole-dipole arrays; Schlumberger methods; direct-current methods
Section Headings: 29 .(ECONOMIC GEOLOGY, ENERGY SOURCES)

995678 80-37059
Geophysical evaluation of the Las Alturas Estates, New Mexico geothermal prospect
Morgan, P.; Swanberg, C. A.; Dicey, T.; Chaturvedi, L.; Jiracek, G. R.
N.M. State Univ., Earth Sci. and Phys., Las Cruces, N.M., USA; Univ. N.M., USA
Society of Exploration Geophysicists, 49th annual international meeting, New Orleans, La., United States, Nov. 4-8, 1979
Soc. Explor. Geophys., Annu. Int. Meet., Abstr. 49, 102p., 1979
CODEN: SGAMB7
Subfile: B
Country of Publ.: United States
Doc Type: SERIAL; CONFERENCE PUBLICATION Bibliographic Level: ANALYTIC
Languages: English
Latitude: N320000; N330000 Longitude: W1062000; W1070000
Descriptors: *New Mexico; *geophysical methods ; economic geology; geophysical surveys; electrical methods ; geothermal energy; electrical surveys; resistivity; exploration; United States; Las Alturas Estates; Dona Ana County; thermal waters; heat flow; geothermal gradient
Section Headings: 29 .(ECONOMIC GEOLOGY, ENERGY SOURCES)

995676 80-37134
Deep Schlumberger soundings for geothermal exploration at INEL, Snake River plain, Idaho
Zohdy, A. A. R.; Bisdorf, R. J.
U. S. Geol. Surv., Denver, Colo., USA
Society of Exploration Geophysicists, 49th annual international meeting, New Orleans, La., United States, Nov. 4-8, 1979
Soc. Explor. Geophys., Annu. Int. Meet., Abstr. 49, 101-102p., 1979
CODEN: SGAMB7
Subfile: B
Country of Publ.: United States
Doc Type: SERIAL; CONFERENCE PUBLICATION Bibliographic Level: ANALYTIC
Languages: English
Latitude: N432500; N435500 Longitude: W1123500; W1132000
Descriptors: *Idaho; *geophysical methods ; economic geology; geophysical surveys; electrical methods ; geothermal energy; electrical surveys; resistivity; Butte County; Bingham County; Jefferson County; exploration; United States; Snake River plain; Idaho National Engineering Laboratory; Schlumberger methods; deep sounding
Section Headings: 29 .(ECONOMIC GEOLOGY, ENERGY SOURCES)

DIALOG File 89: GEOREF - 29-84/Nov (Copr. American Geological Institute)

995675 80-35049
3-D DC resistivity inversion using alpha centers
Petrick, W. R.; Sill, W. R.; Ward, S. H.
Univ. Utah, Dep. Geol. and Geophys., Salt Lake City, Utah, USA
Society of Exploration Geophysicists, 49th annual international meeting, New Orleans, La., United States, Nov. 4-8, 1979
Soc. Explor. Geophys., Annu. Int. Meet., Abstr. 49, 101p., 1979
CODEN: SGAMB7
Subfile: B
Country of Publ.: United States
Doc Type: SERIAL; CONFERENCE PUBLICATION Bibliographic Level: ANALYTIC
Languages: English
Descriptors: *geothermal energy; *metals; *geophysical methods; *mineral exploration; *automatic data processing ; exploration; electrical methods; geophysical surveys ; resistivity; sulfides; ore deposits; three-dimensional models; models; inverse problem; alpha centers; computer programs; electrical conductivity
Section Headings: 20 .(GEOPHYSICS, APPLIED)

995605 80-35139
Deep resistivities under Tucson, Arizona from a magnetotelluric sounding
Wojniak, W. S.; Sumner, J. S.
Univ. Ariz., Dep. Geosci., Tucson, Ariz., USA
Society of Exploration Geophysicists, 49th annual international meeting, New Orleans, La., United States, Nov. 4-8, 1979
Soc. Explor. Geophys., Annu. Int. Meet., Abstr. 49, 70p., 1979
CODEN: SGAMB7
Subfile: B
Country of Publ.: United States
Doc Type: SERIAL; CONFERENCE PUBLICATION Bibliographic Level: ANALYTIC
Languages: English
Latitude: N321000; N322500 Longitude: W1105000; W1110500
Descriptors: *Arizona ; geophysical surveys ; magnetotelluric surveys; Pima County; United States; Tucson ; electrical properties; resistivity; low-velocity zones; upper mantle; mantle; crust; possibilities; geothermal energy; petroleum
Section Headings: 20 .(GEOPHYSICS, APPLIED)

995603 80-36939
The investigation of anomalous magnetization in the Raft River valley, Idaho
Anderson, L. A.; Mabey, D. R.
U. S. Geol. Surv., Denver, Colo., USA
Society of Exploration Geophysicists, 49th annual international meeting, New Orleans, La., United States, Nov. 4-8, 1979
Soc. Explor. Geophys., Annu. Int. Meet., Abstr. 49, 69p., 1979
CODEN: SGAMB7
Subfile: B
Country of Publ.: United States
Doc Type: SERIAL; CONFERENCE PUBLICATION Bibliographic Level: ANALYTIC
Languages: English
Latitude: N420000; N424000 Longitude: W1130000; W1135000
Descriptors: *Idaho ; economic geology; geophysical surveys ; geothermal energy; magnetic surveys; Cassia County; United States; Raft River basin; ground methods; geophysical methods; magnetic anomalies; exploration; gravel; clastic sediments; magnetic properties; paleomagnetism; magnetic susceptibility; isothermal remanent magnetization; remanent magnetization
Section Headings: 29 .(ECONOMIC GEOLOGY, ENERGY SOURCES)

988980 80-31938
Inversion of combined geophysical data for determination of structure beneath the Imperial Valley geothermal region; final report, 1 September 1976 - 31 August 1977
Savino, J. M.; Rodi, W. L.; Goff, R. C.; Jordan, T. H.; Alexander, J. H.; Lambert, D. G.
Syst., Sci. and Software, La Jolla, Calif., USA
82p., 1977
23 REFS.
Subfile: B
Doc Type: REPORT Bibliographic Level: MONOGRAPHIC
Languages: English
Report No.: SAN-1313-1; SSS-R-78-3412
Availability: NTIS, Springfield, Va., United States
illus., sketch maps
Latitude: N324000; N333000 Longitude: W1151500; W1161500
Descriptors: *California ; economic geology ; geothermal energy; Imperial County; United States; Imperial Valley; geophysical surveys; sediments; thickness; gravity surveys; seismic surveys; mathematical models; models; Salton Basin ; Salton Trough; exploration
Section Headings: 29 .(ECONOMIC GEOLOGY, ENERGY SOURCES)

987543 80-31993
Magnetotelluric soundings across the Pemberton volcanic belt, British Columbia
Dragert, H.; Law, L. K.; Sule, P. O.
Pac. Geosci. Cent., Sidney, B.C., CAN; Univ. B.C., CAN
Can. J. Earth Sci. 17: 2, 161-167p., 1980
CODEN: CJESAP ISSN: 0008-4077 23 REFS.
Subfile: B
Country of Publ.: Canada

(cont. next page)

DIALOG File 89: GEOREF - 29-84/Nov (Copr. American Geological Institute)

Doc Type: SERIAL Bibliographic Level: ANALYTIC
Languages: English Summary Languages: French
Note: Can., Earth Phys. Branch; Contrib. No. 830, illus., sketch map
Latitude: N490000; N510000 Longitude: W1210000; W1250000
Descriptors: *British Columbia; *Canada ; economic geology; geophysical surveys; tectonophysics ; geothermal energy; magnetotelluric surveys; crust; Canadian Cordillera; Meager Creek; Pemberton volcanic belt; exploration; structure; electrical conductivity; volcanic belts; plutons; intrusions; Miocene; Neogene; Tertiary
Section Headings: 29 .(ECONOMIC GEOLOGY, ENERGY SOURCES)

987014 80-29831
Low-altitute aeromagnetic survey of a portion of the Coso Hot Springs KGRA; Inyo County, California
Fox, R. C.
17p., 1978
9 REFS.
Subfile: B
Doc Type: REPORT; MAP Bibliographic Level: MONOGRAPHIC
Languages: English
Report No.: IDO-1601-2
Availability: NTIS, Springfield, Va., United States
illus., tables, sketch maps: 1:59,055; magn. surv. maps
Latitude: N360000; N370000 Longitude: W1160000; W1180000
Descriptors: *California ; geophysical surveys; economic geology ; magnetic survey maps; geothermal energy; Inyo County; United States; Coso Hot Springs KGRA; maps; magnetic surveys; airborne methods; geophysical methods; anomalies; exploration; structure
Section Headings: 20 .(GEOPHYSICS, APPLIED)

986485 80-27301
Reconnaissance geophysics in the Clifton and Gillard geothermal areas, SE Arizona
Klein, D.; Long, C.; Christopherson, K.; Boler, F.
U. S. Geol. Surv., Open-File Rep. 80-325, 21p., 1980
CODEN: XGROAG
Subfile: B
Country of Publ.: United States
Doc Type: SERIAL; REPORT Bibliographic Level: MONOGRAPHIC
Languages: English
Availability: U. S. Geol. Surv., Open-File Serv. Sect., Branch Distrib., Denver, Colo., United States
Latitude: N323000; N343000 Longitude: W1090300; W1093000
Descriptors: *Arizona; *Southwestern U.S. ; economic geology; geophysical surveys ; geothermal energy; surveys; Greenlee County; United States; Clifton; Gillard; exploration
Section Headings: 29 .(ECONOMIC GEOLOGY, ENERGY SOURCES)

986198 80-27279
Geothermal studies and exploration in Oregon
Bowen, R. G.; Blackwell, D. D.; Hull, D.
65p., 1975
Subfile: B
Doc Type: REPORT Bibliographic Level: MONOGRAPHIC
Languages: English
Availability: Oreg. Dep. Geol. and Miner. Ind., Portland, Oreg., United States
Note: Draft final report includes reprints, illus., tables, sketch maps
Descriptors: *Oregon ; economic geology; geophysical surveys ; geothermal energy; heat flow; United States; exploration; anomalies; boreholes; temperature; geothermal gradient; Cow Hollow; Willow Creek; Jacobsen Gulch; Trout Creek; Coyote Buttes; Glass Buttes
Section Headings: 29 .(ECONOMIC GEOLOGY, ENERGY SOURCES)

986155 80-27356
Geophysical exploration of geothermal resources in the eastern United States
Anonymous
Evaluation and targeting of geothermal energy resources in the southeastern United States; progress report, October 1, 1978-March 30, 1979
Costain, J. K.; Glover, L., III; Sinha, A. K.
C.4-C.12p., 1978
Subfile: B
Doc Type: REPORT Bibliographic Level: ANALYTIC
Languages: English
Report No.: VPI-SU-5648-5
Availability: NTIS, Springfield, Va., United States
illus., sketch maps
Latitude: N310000; N420000 Longitude: W0750000; W0850000
Descriptors: *Atlantic Coastal Plain; *Eastern U.S.; *Virginia; *North Carolina; *Delaware; *New Jersey; *South Carolina ; economic geology; hydrogeology; geophysical surveys ; geothermal energy; thermal waters; heat flow; North America; exploration; resources; United States; heat sources; radioactivity; magnetic surveys; gravity surveys; hot springs; temperature
Section Headings: 29 .(ECONOMIC GEOLOGY, ENERGY SOURCES)

985913 80-24746
Geothermal gradients and heat flow
Costain, J. K.; Perry, L. D.; Dunbar, J. A.
Evaluation and targeting of geothermal energy resources in the southeastern United States; progress report, July 1-September 30, 1977
Costain, J. K.; Glover, L., III; Sinha, A. K.
C2-C14p., 1977

(cont. next page)

DIALOG File 89: GEOREF - 29-84/Nov (Copr. American Geological Institute)

Subfile: B
Doc Type: REPORT Bibliographic Level: ANALYTIC
Languages: English
Report No.: VPI-SU-5103-5
Availability: NTIS, Springfield, Va., United States
illus., tables, sketch maps
Latitude: N250000; N380000 Longitude: W0750000; W0900000
Descriptors: *Eastern U.S. ; geophysical surveys ; heat flow; United States; southeastern United States; geothermal gradient; geothermal energy; possibilities; resources; exploration
Section Headings: 18 .(GEOPHYSICS, SOLID EARTH)

983263 80-27336
Evaluation of intermediate-period seismic waves as a geothermal exploration tool
Daniel, R. G.
Stanford Univ., Stanford, Calif., USA
unknownp., 1979
Subfile: B
Degree Level: Doctoral
Country of Publ.: United States
Doc Type: THESIS Bibliographic Level: MONOGRAPHIC
Languages: English
Latitude: N441000; N450000 Longitude: W1100000; W1110000
Descriptors: *Wyoming; *seismology; *geothermal energy ; geophysical surveys; experimental studies; exploration ; seismic surveys; Rayleigh waves; methods; United States; Yellowstone caldera; velocity; Uganda; Africa
Section Headings: 29 .(ECONOMIC GEOLOGY, ENERGY SOURCES)

982810 80-24708
Velocity structure to 3,000-meter depth at the Idaho National Engineering Laboratory, eastern Snake River plain
Ackermann, H. D.
U. S. Geol. Surv., Denver, Colo., USA
American Geophysical Union; 1979 fall annual meeting, San Francisco, Calif., United States, Dec. 3-7, 1979
Eos (Am. Geophys. Union, Trans.) 60: 46, 942p., 1979
CODEN: EOSTAJ ISSN: 0096-3941
Subfile: B
Country of Publ.: United States
Doc Type: SERIAL; CONFERENCE PUBLICATION Bibliographic Level: ANALYTIC
Languages: English
Latitude: N433000; N440000 Longitude: W1124500; W1132000
Descriptors: *Idaho; *seismology; *Western Interior ; crust ; geophysical surveys; economic geology ; seismic surveys; velocity structure; geothermal energy; Butte County; United States; Snake River plain; Yellowstone National Park; Wyoming; reflection methods; seismic methods; refraction methods; North America; 1978; Arco; Idaho National Engineering Laboratory; exploration; well-logging; tuff; pyroclastics and glasses; rhyodacite; andesite-rhyolite family; structure
Section Headings: 18 .(GEOPHYSICS, SOLID EARTH)

981851 80-22529
Bulk density and magnetization measurements near the Coso Range, California
Plouff, D.; Isherwood, W. F.; Bacon, C. R.; Duffield, W. A.; Van Buren, H. M.
U. S. Geol. Surv., Open-File Rep. 80-61, 6p., 1980
CODEN: XGROAG
Subfile: B
Country of Publ.: United States
Doc Type: SERIAL; REPORT Bibliographic Level: MONOGRAPHIC
Languages: English
Availability: U. S. Geol. Surv., Open-File Serv. Sect., Branch Distrib., Denver, Colo., United States
illus.
Latitude: N354500; N361500 Longitude: W1173000; W1180000
Descriptors: *California ; economic geology; geophysical surveys ; geothermal energy; surveys; Inyo County; United States; Coso Range; gravity surveys; density; magnetic surveys; exploration
Section Headings: 29 .(ECONOMIC GEOLOGY, ENERGY SOURCES)

980421 80-22538
Aquarius Mountain area, Arizona; a possible HDR prospect
West, F. G.; Laughlin, A. W.
Los Alamos Sci. Lab., Los Alamos, N.M., USA
Los Alamos Sci. Lab., [Rep.] LA-7804-MS, 11p., 1979
CODEN: LASLCA 64 REFS.
Subfile: B
Country of Publ.: United States
Doc Type: SERIAL; REPORT Bibliographic Level: MONOGRAPHIC
Languages: English
Availability: NTIS, Springfield, Va., United States
illus., sketch maps
Latitude: N344000; N354000 Longitude: W1123000; W1142000
Descriptors: *Arizona ; economic geology; geophysical surveys ; geothermal energy; surveys; United States; Aquarius Mountain; dry hot rocks; exploration; gravity surveys; electromagnetic surveys; seismic surveys; magnetic surveys; airborne methods; geophysical methods; heat flow
Section Headings: 29 .(ECONOMIC GEOLOGY, ENERGY SOURCES)

976729 80-17527
Mineral resources of the Du Noir Addition, Washakie Wilderness, Fremont County, Wyoming
Prostka, H. J.; Antweiler, J. C.; Bieniewski, C. L.
U. S. Geol. Surv., U. S. Bur. Mines, USA
U. S. Geol. Surv., Bull. 1472, 35p., 1979
CODEN: XGLBAF
Subfile: B
Country of Publ.: United States

(cont. next page)

DIALOG File 89: GEOREF - 29-84/Nov (Copr. American Geological Institute)

Doc Type: SERIAL Bibliographic Level: MONOGRAPHIC
Languages: English
Note: With a section on aeromagnetic survey by Kleinkopf, M. D.: studies related to wilderness, study areas; supersedes Open-file report 74-133,
Latitude: N423000; N440000 Longitude: W1073000; W1100500
Descriptors: *Wyoming; *Rocky Mountains ; economic geology ; mineral resources; Fremont County; United States; Absaroka volcanic field; Washakie Wilderness; Du Noir Addition; magnetic surveys; geophysical surveys; airborne methods; geophysical methods; volcanism; pyroclastics; clastic rocks; Eocene; Paleogene; Tertiary; Du Noir Anticline; anticlines; folds; mineral exploration; energy sources; geothermal energy; North America
Section Headings: 26 .(ECONOMIC GEOLOGY, GENERAL & MINING)

Surface self-potential distributions as indicators of subsurface geothermal activity
Morrison, H. F.(investigator)
U. S. Geol. Surv., Prof. Pap. 1150, 198-199p., 1979
CODEN: XGPPA9
Subfile: B
Country of Publ.: United States
Doc Type: SERIAL Bibliographic Level: ANALYTIC
Languages: English
Descriptors: *geothermal energy; *geophysical methods; *automatic data processing ; exploration; electrical methods ; geophysical surveys ; self-potential methods; computer programs
Section Headings: 29 .(ECONOMIC GEOLOGY, ENERGY SOURCES)

972162 80-13460
Reconnaissance geophysics of a known geothermal resource area, Weiser, Idaho, and Vale, Oregon
Long, C. L.; Kaufmann, H. E.
U. S. Geol. Surv., Denver, Colo., USA
Geophysics 45: 2, 312-322p., 1980
CODEN: GPYSA7 ISSN: 0016-8033 7 REFS.
Subfile: B
Country of Publ.: United States
Doc Type: SERIAL Bibliographic Level: ANALYTIC
Languages: English
illus., geol. sketch map
Latitude: N434500; N443000 Longitude: W1163000; W1173000
Descriptors: *Idaho; *Oregon ; geophysical surveys; economic geology ; electrical surveys; geothermal energy; Washington County; Malheur County; United States; Weiser KGRA; Vale KGRA; springs; hot springs; thermal waters; audiomagnetotelluric methods; Earth-current surveys; magnetotelluric surveys; exploration; electromagnetic field; resistivity
Section Headings: 29 .(ECONOMIC GEOLOGY, ENERGY SOURCES)

967406 80-09587
3-D Q -1 model of Coso Hot Springs, KGRA
Young, C. Y.; Ward, R. W.
Univ. Tex. at Dallas, Cent. Energy Stud., Richardson, Tex., USA
American Geophysical Union; 1979 spring annual meeting, Washington, D.C., United States, May 28-June 1, 1979
Eos (Am. Geophys. Union, Trans.) 60: 18, 398p., 1979
CODEN: EOSTAJ ISSN: 0096-3941
Subfile: B
Country of Publ.: United States
Doc Type: SERIAL; CONFERENCE PUBLICATION Bibliographic Level: ANALYTIC
Languages: English
Latitude: N323000; N420000 Longitude: W1141500; W1243000
Descriptors: *California; *Pacific Coast ; economic geology ; hydrogeology; geophysical surveys ; geothermal energy; springs; seismic surveys; thermal waters; United States; Coso Hot Springs KGRA; hot springs; elastic waves; P-waves; teleseismic signals; three-dimensional models; models; Q; seismology; attenuation; anomalies; crust; upper mantle; mantle; exploration; passive methods; geothermal systems
Section Headings: 29 .(ECONOMIC GEOLOGY, ENERGY SOURCES)

965597 80-09547
Geothermal fields of Taupo volcanic zone, New Zealand
Panda, P. K.
Geoviews 5: 1-2, 51-86p., 1979
122 REFS.
Subfile: B
Country of Publ.: India
Doc Type: SERIAL Bibliographic Level: ANALYTIC
Languages: English
illus., tables, geol. sketch maps
Latitude: S393000; S373000 Longitude: E1773000; E1750000
Descriptors: *New Zealand ; economic geology ; geothermal energy; Australasia; Taupo volcanic zone; North Island; geothermal fields; areal geology; petrology; volcanism; geophysical surveys; tectonics; gravity surveys; Bouguer anomalies; magnetic surveys; resistivity; volcanic rocks; exploration; methods; seismic surveys; geochemistry; electrical surveys
Section Headings: 29 .(ECONOMIC GEOLOGY, ENERGY SOURCES)

964080 80-08412
Geotechnical aspects of resource location
Lindsay, D. R.
Shell Oil Co., Houston, Tex., USA
Geothermal environmental seminar, '78
Tucker, F. L.(EDITOR); Tanner, L. R.(EDITOR)
Geothermal environmental seminar; '78, Sacramento, Calif.,
(cont. next page)

United States, May 9-11, 1978
Publ: Environ. Syst. and Serv.
98-103p., 1978
24 REFS.
Subfile: B
Country of Publ.: United States
Doc Type: BOOK; CONFERENCE PUBLICATION Bibliographic Level: ANALYTIC
Languages: English
sketch maps
Latitude: N323000; N420000 Longitude: W1141500; W1243000
Descriptors: *California ; geophysical surveys ; surveys; geothermal energy; United States; gravity anomalies; The Geysers; Clear Lake; chemical composition; ground water; fumaroles; heat flow; resistivity; models; microseisms; techniques; resources; exploration; electrical surveys; gravity surveys
Section Headings: 22 .(ENGINEERING & ENVIRONMENTAL GEOLOGY)

963097 80-05650
Developments in upper Gulf Coast of Texas in 1978
Hartzell, S. P.; Trautman, T. A.
Amoco Prod. Co., Houston, Tex., USA
Am. Assoc. Pet. Geol., Bull. 63: 8, 1223-1232p., 1979
CODEN: AAPGBS ISSN: 0149-1423 1 REFS.
Subfile: B
Country of Publ.: United States
Doc Type: SERIAL Bibliographic Level: ANALYTIC
Languages: English
illus., tables, sketch map
Latitude: N280000; N320000 Longitude: W0930000; W0973000
Descriptors: *Texas; *Gulf Coastal Plain; *Gulf of Mexico ; economic geology ; petroleum; natural gas; oil and gas fields; exploration; drilling; production; data; discoveries; United States; North America; Cretaceous; Mesozoic; Oligocene; Paleogene; Tertiary; Cenozoic; onshore; offshore; seismic surveys; geophysical surveys; geothermal energy
Section Headings: 29 .(ECONOMIC GEOLOGY, ENERGY SOURCES)

961584 80-05614
Study of the applicability of the geochemistry of gases in geothermal prospection
D'Amore, F.
Seminar on geothermal energy
Anonymous
Seminar on geothermal energy, Brussels, Belgium, Dec. 6-8, 1977
Publ: Commission European Communities, Dir. Gen., Sci. and Tech. Info. and Info. Manage.
441-453p., 1977
12 REFS.
Subfile: B
Country of Publ.: Luxembourg
Doc Type: BOOK; CONFERENCE PUBLICATION Bibliographic Level: ANALYTIC
Languages: English
illus., tables
Descriptors: *heat flow; *thermal waters; *geothermal energy ; geothermal gradient; geochemistry; exploration ; measurement; methods; hydrogeology; geophysical surveys; thermodynamics; mathematical models; models; oxygen; fugacity; Larderello; Italy; Europe; sulfur; gases
Section Headings: 29 .(ECONOMIC GEOLOGY, ENERGY SOURCES)

961555 80-05574
Shallow magmatic reservoirs as heat source of geothermal systems; preliminary interpretation of data available for the Neapolitan active volcanic areas
Barberi, F.; Innocenti, F.; Luongo, G.; Nunziata, C.; Rapolla, A.
Seminar on geothermal energy; first results of projects funded by the European communities
Anonymous
Seminar on geothermal energy, Brussels, Belgium, Dec. 6-8, 1977
Publ: Comm. Eur. Communities
19-37p., 1977
16 REFS.
Subfile: B
Country of Publ.: Luxembourg
Doc Type: BOOK; CONFERENCE PUBLICATION Bibliographic Level: ANALYTIC
Languages: English
illus., sketch maps
Latitude: N400000; N440000 Longitude: E0170000; E0100000
Descriptors: *Italy; *magmas ; economic geology; temperature ; geothermal energy; Europe; heat flow; heat sources; exploration; geophysical surveys; Apennines; Mesozoic; Phanerozoic; thermal anomalies; Naples
Section Headings: 29 .(ECONOMIC GEOLOGY, ENERGY SOURCES)

961221 80-04112
Megnetotelluric studies in Grass Valley, Nevada
Morrison, H. F.; Lee, K. H.; Oppliger, G.; Dey, A.
Univ. Calif., Lawrence Berkeley Lab., Berkeley, Calif., USA
Lawrence Berkeley Lab., [Rep.], LBL 8646, 50p., 1979
22 REFS.
Subfile: B
Country of Publ.: United States
Doc Type: SERIAL; REPORT Bibliographic Level: MONOGRAPHIC
Languages: English
Report No.: UC-666
Availability: NTIS, Springfield, Va., United States
Note: With appendix (110 pages), illus., table, geol. sketch map
Latitude: N402800; N404500 Longitude: W1173000; W1175200
Descriptors: *Nevada ; geophysical surveys ;

(cont. next page)

magnetotelluric surveys; United States; Grass Valley; resistivity; instruments; magnetometers; Leach hot springs; interpretation; mathematical models; models; geothermal systems; geothermal energy; exploration; hot springs; geophysical methods
Section Headings: 20 .(GEOPHYSICS, APPLIED)

960237 80-01649
Evaluation of intermediate-period seismic waves as a geothermal exploration tool
Daniel, R. G.
Stanford Univ., Stanford, Calif., USA
143p., 1979
Subfile: B
Degree Level: Doctoral
Country of Publ.: United States
Doc Type: THESIS Bibliographic Level: MONOGRAPHIC
Languages: English
Availability: Univ. Microfilms
Latitude: N441000; N450000 Longitude: W1095000; W1110500
Descriptors: *Wyoming; *Rocky Mountains; *seismology; *geophysical methods ; economic geology; geophysical surveys ; crust; seismic methods ; geothermal energy; seismic surveys; low-velocity zones; applications; Park County; Teton County; United States; Yellowstone National Park; exploration; elastic waves; upper mantle; mantle; field studies; recording; seismometers; S-waves; Rayleigh waves; teleseismic signals; earthquakes; passive methods; velocity; partial melting; North America; intermediate-period waves
Section Headings: 20 .(GEOPHYSICS, APPLIED)

959736 80-02698
Comments on ''Exploration methods for hot dry rock''
Solomon, S. C.
Mass. Inst. Technol., Cambridge, Mass., USA
Los Alamos Sci. Lab., [Rep.] 6659, 53-54p., 1977
CODEN: LASLCA 1 REFS.
Subfile: B
Country of Publ.: United States
Doc Type: SERIAL; REPORT Bibliographic Level: ANALYTIC
Languages: English
Report No.: UC-666
Availability: NTIS, Springfield, Va., United States
Descriptors: *geothermal energy ; exploration ; methods; hot dry rocks; geophysical surveys; site exploration; seismic surveys
Section Headings: 29 .(ECONOMIC GEOLOGY, ENERGY SOURCES)

959728 80-02636
Residual Bouguer gravity anomaly analysis of Arizona and hot dry rock exploration
Aiken, C.
Tex. Christ. Univ., Ft. Worth, Tex., USA
Los Alamos Sci. Lab., [Rep.] 6659, 28-31p., 1977
CODEN: LASLCA
Subfile: B
Country of Publ.: United States
Doc Type: SERIAL; REPORT Bibliographic Level: ANALYTIC
Languages: English
Report No.: UC-666
Availability: NTIS, Springfield, Va., United States
illus.
Latitude: N311500; N370000 Longitude: W1090000; W1150000
Descriptors: *Arizona ; economic geology; geophysical surveys ; geothermal energy; gravity surveys; United States ; Bouguer anomalies; gravity anomalies; interpretation; exploration; hot dry rocks
Section Headings: 29 .(ECONOMIC GEOLOGY, ENERGY SOURCES)

952183 79-36375
Toward assessing the geothermal potential of the Jemez Mountains volcanic complex; a telluric-magnetotelluric survey
Hermance, J. F.
Los Alamos Sci. Lab., [Rep.] 7656, 86p., 1979
CODEN: LASLCA
Subfile: B
Country of Publ.: United States
Doc Type: SERIAL; REPORT Bibliographic Level: MONOGRAPHIC
Languages: English
Availability: NTIS, Springfield, Va., United States
illus., tables, sketch maps
Latitude: N350000; N370000 Longitude: W1043000; W1083000
Descriptors: *New Mexico ; economic geology; geophysical surveys ; geothermal energy; magnetotelluric surveys; Sandoval County; United States; Jemez Mountains; exploration; possibilities; interpretation; volcanic rocks; igneous rocks
Section Headings: 29 .(ECONOMIC GEOLOGY, ENERGY SOURCES)

952180 79-36398
A time domain survey of the Los Alamos region, New Mexico
Williston, McNeil and Associates, Lakewood, Colo., USA
Los Alamos Sci. Lab., [Rep.] 7657, 32p., 1979
CODEN: LASLCA
Subfile: B
Country of Publ.: United States
Doc Type: SERIAL; REPORT; MAP Bibliographic Level: MONOGRAPHIC
Languages: English
Availability: NTIS, Springfield, Va., United States
illus., tables; 1:24,000; electromagn. surv. maps
Latitude: N354700; N355700 Longitude: W1061000; W1022230
Descriptors: *New Mexico ; economic geology; geophysical surveys ; geothermal energy; electromagnetic surveys; Los Alamos County; United States; Los Alamos; time-domain analysis; resistivity; exploration; maps; electromagnetic

(cont. next page)

DIALOG File 89: GEOREF - 29-84/Nov (Copr. American Geological Institute)

survey maps; temperature; thermal waters; depth
Section Headings: 29 .(ECONOMIC GEOLOGY, ENERGY SOURCES)

950153 79-34624
Seismic array noise studies at Roosevelt Hot Springs, Utah geothermal area
Douze, E. J.; Laster, S. J.
Univ. Tulsa, Earth Sci. Dep., Tulsa, Okla., USA
Geophysics 44: 9, 1570-1583p., 1979
CODEN: GPYSA7 ISSN: 0016-8033 10 REFS.
Subfile: B
Country of Publ.: United States
Doc Type: SERIAL Bibliographic Level: ANALYTIC
Languages: English
illus., sketch map
Latitude: N382000; N383500 Longitude: W1125000; W1130000
Descriptors: *Utah; *geophysical methods ; geophysical surveys; economic geology; seismic methods ; seismic surveys; geothermal energy; interpretation; Beaver County; United States; Roosevelt Hot Springs; KGRA; techniques; noise; arrays; seismometers; theoretical studies; mathematical models; models; exploration; geothermal systems; thermal waters; springs; hot springs
Section Headings: 20 .(GEOPHYSICS, APPLIED)

950127 79-34369
Structure of the lower East Rift Zone of Kilauea Volcano, Hawaii, from seismic and gravity data
Broyles, M.; Suyenaga, W.; Furumoto, A. S.
Hawaii Inst. Geophys., Honolulu, Hawaii, USA
J. Volcanol. Geotherm. Res. 5: 3-4, 317-336p., 1979
CODEN: JVGRDQ ISSN: 0377-0273 24 REFS.
Subfile: B
Country of Publ.: Netherlands
Doc Type: SERIAL Bibliographic Level: ANALYTIC
Languages: English
Note: Hawaii Inst. Geophys.; Contrib. No. 934, illus., tables, sketch maps
Latitude: N191500; N192500 Longitude: W1550500; W1552000
Descriptors: *Hawaii; *volcanology; *intrusions; *magmas ; geophysical surveys; volcanoes; dikes; properties ; seismic surveys; Kilauea; distribution; magma chambers; Pacific Ocean; United States; East Rift Zone; structure; refraction methods; seismic methods; anomalies; 1976; 1977 ; lava; rift zones; geothermal systems; geothermal energy; exploration; Bouguer anomalies
Section Headings: 18 .(GEOPHYSICS, SOLID EARTH)

947453 79-31211
Papers of the Fifty-third annual conference and exhibition of the Society of Petroleum Engineers of AIME
Anonymous
Fifty-third annual conference and exhibition of the Society of Petroleum Engineers of AIME, Houston, Tex., United States , October 1-3, 1978
Soc. Pet. Eng. AIME, Annu. Fall Tech. Conf. Exhib., Pap. 53 , 1400p., 1978
Subfile: B
Country of Publ.: United States
Doc Type: SERIAL; CONFERENCE PUBLICATION Bibliographic Level: MONOGRAPHIC
Languages: English
Note: Selected papers cited separately; SPE7400-7499, SPE7500-SPE7609, illus., tables, sects.
Latitude: N180000; N720000 Longitude: W0670000; E1700000
Descriptors: *symposia; *well-logging; *rock mechanics ; engineering geology; acoustical logging; experimental studies ; petroleum engineering; boreholes; anisotropy; United States; geophysical surveys; seismic surveys; economic geology; petroleum; natural gas; exploration; hydrogeology; ground water; shorelines; hydraulics; geothermal energy; equations; fractures
Section Headings: 22 .(ENGINEERING & ENVIRONMENTAL GEOLOGY)

941179 79-26299
Magnetic and gravity surveys; Surigao geothermal field
Aguila, L. G.
Philipp. Comm. Volcanol., COMVOL Newsl. 9: 5-6, 7p., 1977
CODEN: COLEDM ISSN: 0115-1215 8 REFS.
Subfile: B
Country of Publ.: Philippines
Doc Type: SERIAL Bibliographic Level: MONOGRAPHIC
Languages: English
sketch maps
Latitude: N092000; N094500 Longitude: E1254000; E1252500
Descriptors: *Philippine Islands ; geophysical surveys; economic geology ; surveys; geothermal energy; Asia; Surigao Field; magnetic surveys; gravity surveys; geothermal fields; exploration
Section Headings: 29 .(ECONOMIC GEOLOGY, ENERGY SOURCES)

940719 79-26323
The Hawaii Geothermal Project; summary report of phase I
Shupe, J. W.(director)
Univ. Hawaii, Hawaii Geotherm. Proj., Hawaii, USA
Publ: Univ. Hawaii
155p., 1975
50 REFS.
Subfile: B
Country of Publ.: United States
Doc Type: BOOK Bibliographic Level: MONOGRAPHIC
Languages: English
illus., tables, geol. sketch maps
Latitude: N190000; N283000 Longitude: W1550000; W1790000
Descriptors: *Hawaii ; economic geology; geophysical surveys ; geothermal energy; surveys; Pacific Ocean;

(cont. next page)

United States; magnetic surveys; equations; engineering geology; models; management; drilling; exploration; electrical surveys; anomalies; sounding; resistivity; gravity surveys; temperature; geochemistry
Section Headings: 29 .(ECONOMIC GEOLOGY, ENERGY SOURCES)

939814 79-22219
Gravity and ground magnetic surveys of the Thermo Hot Springs KGRA region, Beaver County, Utah
Sawyer, R. F.
Univ. of Utah, Salt Lake City, Utah, USA
unknownp., 1977
Subfile: B
Degree Level: Master's
Country of Publ.: United States
Doc Type: THESIS Bibliographic Level: MONOGRAPHIC
Languages: English
Latitude: N382000; N383000 Longitude: W1130000; W1131000
Descriptors: *Utah; *Western U.S.; *geophysical methods ; geophysical surveys; economic geology; methods ; surveys; geothermal energy; interpretation; Beaver County; United States; Thermo Hot Springs KGRA; gravity surveys; magnetic surveys; ground methods; Milford; Bouguer anomalies; geophysical maps; maps; faults; gravity methods; magnetic methods; structure; thermal waters; springs; hot springs; geothermal systems; exploration
Section Headings: 20 .(GEOPHYSICS, APPLIED)

939687 79-23537
Geothermal investigation of the lake district, Ethiopia
McEuen, R. B.; Abakoyas, J.
San Diego State Univ., Dep. Geol. Sci., San Diego, Calif., USA
Geothermal; state of the art, transactions; Volume 1
Anonymous
Geothermal Resources Council annual meeting, San Diego, Calif., United States, May 9-11, 1977
Publ: Geothermal Resour. Counc.
208-210p., 1977
1 REFS.
Subfile: B
Country of Publ.: United States
Doc Type: BOOK; CONFERENCE PUBLICATION Bibliographic Level: ANALYTIC
Languages: English
plate, sketch map
Latitude: N070000; N090000 Longitude: E0410000; E0430000
Descriptors: *Ethiopia ; economic geology; geophysical surveys ; geothermal energy; surveys; Africa; exploration; Lake Langano; resistivity; gravity surveys; resources; distribution; controls; structural controls; faults; Red Sea Rift; rift zones; Gulf of Aden Rift; Ethiopian Rift; electrical surveys
Section Headings: 29 .(ECONOMIC GEOLOGY, ENERGY SOURCES)

939685 79-23533
Lake bottom thermal gradient survey at Clear Lake and Mono Lake, California
Martin, R. C.; Welday, E. E.
Calif. State Lands Div., Long Beach, Calif., USA
Geothermal; state of the art, transactions; Volume 1
Anonymous
Geothermal Resources Council annual meeting, San Diego, Calif., United States, May 9-11, 1977
Publ: Geothermal Resour. Counc.
201-203p., 1977
Subfile: B
Country of Publ.: United States
Doc Type: BOOK; CONFERENCE PUBLICATION Bibliographic Level: ANALYTIC
Languages: English
illus., sketch maps
Latitude: N385500; N391000 Longitude: W1224000; W1225500
Descriptors: *California ; geophysical surveys; economic geology ; heat flow; geothermal energy; United States; Mono Lake; Clear Lake; geothermal gradient; exploration; geophysical methods; anomalies
Section Headings: 29 .(ECONOMIC GEOLOGY, ENERGY SOURCES)

939684 79-23531
The Geysers geothermal reservoir properties from seismological data
Majer, E.; McEvilly, T. V.
Univ. Calif., Dep. Geol. and Geophys., Berkeley, Calif., USA
Geothermal; state of the art, transactions; Volume 1
Anonymous
Geothermal Resources Council annual meeting, San Diego, Calif., United States, May 9-11, 1977
Publ: Geothermal Resour. Counc.
199p., 1977
Subfile: B
Country of Publ.: United States
Doc Type: BOOK; CONFERENCE PUBLICATION Bibliographic Level: ANALYTIC
Languages: English
illus., sketch map
Latitude: N384000; N385000 Longitude: W1224500; W1230000
Descriptors: *California ; economic geology; geophysical surveys ; geothermal energy; seismic surveys; United States ; The Geysers; aquifers; properties; seismic methods; geophysical methods; refraction; exploration; anomalies
Section Headings: 29 .(ECONOMIC GEOLOGY, ENERGY SOURCES)

DIALOG File 89: GEOREF - 29-84/Nov (Copr. American Geological Institute)

939669 79-23472
Electrical investigations in the Guanacaste geothermal area (Costa Rica)
Furgerson, R. B.; Afonso L., P. S.
Argonaut Enterp., Denver, Colo., USA
Geothermal; state of the art, transactions; Volume 1
Anonymous
Geothermal Resources Council annual meeting, San Diego, Calif., United States, May 9-11, 1977
Publ: Geothermal Resour. Counc.
99-100p., 1977
Subfile: B
Country of Publ.: United States
Doc Type: BOOK; CONFERENCE PUBLICATION Bibliographic Level: ANALYTIC
Languages: English
illus.
Descriptors: *Costa Rica : economic geology; geophysical surveys : geothermal energy; electrical surveys; Central America; Guanacaste; exploration; electrical methods; geophysical methods; resistivity; volcanoes; basement
Section Headings: 29 .(ECONOMIC GEOLOGY, ENERGY SOURCES)

939664 79-23459
Seismic reflection investigations in a geothermal area
Denlinger, R. P.; Kovach, R. L.
Stanford Univ., Dep. Geophys., Stanford, Calif., USA
Geothermal; state of the art, transactions; Volume 1
Anonymous
Geothermal Resources Council annual meeting, San Diego, Calif., United States, May 9-11, 1977
Publ: Geothermal Resour. Counc.
77-78p., 1977
Subfile: B
Country of Publ.: United States
Doc Type: BOOK; CONFERENCE PUBLICATION Bibliographic Level: ANALYTIC
Languages: English
Latitude: N384000; N385000 Longitude: W1224500; W1230000
Descriptors: *California : economic geology; geophysical surveys ; geothermal energy; seismic surveys; Sonoma County : United States; geysers; reflection; exploration; techniques; Vibroseis; The Geysers
Section Headings: 29 .(ECONOMIC GEOLOGY, ENERGY SOURCES)

939660 79-23450
Exploration of the Guanacaste, Costa Rica, geothermal system
Corrales, M. F.; Koenig, J. B.; Kuwada, J. T.
Geotherm Ex., Berkeley, Calif., USA; Rogers Eng., USA
Geothermal; state of the art, transactions; Volume 1
Anonymous
Geothermal Resources Council annual meeting, San Diego, Calif., United States, May 9-11, 1977
Publ: Geothermal Resour. Counc.
57-58p., 1977
Subfile: B
Country of Publ.: United States
Doc Type: BOOK; CONFERENCE PUBLICATION Bibliographic Level: ANALYTIC
Languages: English
Descriptors: *Costa Rica : economic geology; geophysical surveys ; geothermal energy; heat flow; Central America; Guanacaste; exploration; Rincon de la Vieja; Miravalles; Cordillera de Guanacaste; geothermal gradient; temperature
Section Headings: 29 .(ECONOMIC GEOLOGY, ENERGY SOURCES)

939653 79-23441
Interpretation of geothermal gradient and heat flow data for Basin and Range geothermal systems
Blackwell, D. D.; Chapman, D. S.
South. Methodist Univ., Dallas, Tex., USA; Univ. Utah, USA
Geothermal; state of the art, transactions; Volume 1
Anonymous
Geothermal Resources Council annual meeting, San Diego, Calif., United States, May 9-11, 1977
Publ: Geothermal Resour. Counc.
19-20p., 1977
Subfile: B
Country of Publ.: United States
Doc Type: BOOK; CONFERENCE PUBLICATION Bibliographic Level: ANALYTIC
Languages: English
illus.
Descriptors: *Basin and Range Province : economic geology; geophysical surveys ; geothermal energy; heat flow; geothermal gradient; interpretation; models; United States; exploration; anomalies; distribution; hot springs; patterns
Section Headings: 29 .(ECONOMIC GEOLOGY, ENERGY SOURCES)

939652 79-23442
Heat flow and geothermal gradient exploration of geothermal areas in the Cordillera de Guanacaste of Costa Rica
Blackwell, D. D.; Granados G., E.; Koenig, J. B.
South. Methodist Univ., Dallas, Tex., USA; Geothermax, USA
Geothermal; state of the art, transactions; Volume 1
Anonymous
Geothermal Resources Council annual meeting, San Diego, Calif., United States, May 9-11, 1977
Publ: Geothermal Resour. Counc.
17-18p., 1977
Subfile: B
Country of Publ.: United States
Doc Type: BOOK; CONFERENCE PUBLICATION Bibliographic Level: ANALYTIC
Languages: English

(cont. next page)

DIALOG File 89: GEOREF - 29-84/Nov (Copr. American Geological Institute)

Descriptors: *Costa Rica ; economic geology; hydrogeology ; geothermal energy; thermal waters; Central America; heat flow; exploration; geophysical surveys; geothermal gradient ; Cordillera de Guanacaste; Las Hornillas; Miravalles; volcanoes; Guanacaste; temperature; fumaroles; hot springs
Section Headings: 29 .(ECONOMIC GEOLOGY, ENERGY SOURCES)

939176 79-22217
Seismological investigations in geothermal regions
Majer, E.
Univ. of California, Berkeley, Calif., USA
232p., 1978
Subfile: B
Degree Level: Doctoral
Country of Publ.: United States
Doc Type: THESIS Bibliographic Level: MONOGRAPHIC
Languages: English
Availability: Univ. Microfilms
Latitude: N350000; N420000 Longitude: W1140500; W1200000
Descriptors: *California; *Nevada; *Basin and Range Province ; *seismology; *geophysical methods ; economic geology; geophysical surveys; microearthquakes; seismic methods ; geothermal energy; seismic surveys; seismic sources; applications; Sonoma County; United States; The Geysers; Grass Valley; elastic waves; P-waves; S-waves; exploration ; heat flow; anomalies; reflection methods; refraction methods; attenuation; thermal waters; reservoir rocks; velocity
Section Headings: 20 .(GEOPHYSICS, APPLIED)

938246 79-20693
Geothermal exploration in West Java
Wiradiradja, S.; Suari, S.; Razali, Y.; Pekar, L.
Fifth annual convention of the Indonesian Petroleum Association, Jakarta, India, June 7-8, 1976
Proc. Annu. Conv. - Indones. Pet. Assoc. 5, Vol. 2, 275-291p., 1977
CODEN: 33ZWAH
Subfile: B
Country of Publ.: Indonesia
Doc Type: SERIAL; CONFERENCE PUBLICATION Bibliographic Level: ANALYTIC
Languages: English
illus., sketch maps
Latitude: S084500; S055500 Longitude: E1144500; E1051500
Descriptors: *Indonesia ; geophysical surveys; economic geology ; heat flow; geothermal energy; Asia; Java; exploration
Section Headings: 29 .(ECONOMIC GEOLOGY, ENERGY SOURCES)

936074 79-19151
Role of borehole geophysics in defining the physical characteristics of the Raft River geothermal reservoir, Idaho
Keys, W. S.; Sullivan, J. K.
U. S. Geol. Surv., Denver, Colo., USA
Geophysics 44: 6, 1116-1141p., 1979
CODEN: GPYSA7 ISSN: 0016-8033 11 REFS.
Subfile: B
Country of Publ.: United States
Doc Type: SERIAL Bibliographic Level: ANALYTIC
Languages: English
illus., tables, sketch map
Latitude: N420500; N422500 Longitude: W1131500; W1133500
Descriptors: *Idaho; *well-logging; *automatic data processing ; economic geology; interpretation; geophysical surveys ; geothermal geology; reservoir properties; Cassia County; United States; Raft River basin; geothermal energy; exploration; reservoir rocks; boreholes; fractures; faults; radioactivity; porosity; electrical logging; resistivity; acoustical logging
Section Headings: 20 .(GEOPHYSICS, APPLIED)

936073 79-19158
Microseisms in geothermal exploration; studies in Grass Valley, Nevada
Liaw, A. L.; McEvilly, T. V.
Arco Oil and Gas Co., Dallas, Tex., USA; Univ. Calif., USA
Geophysics 44: 6, 1097-1115p., 1979
CODEN: GPYSA7 ISSN: 0016-8033 38 REFS.
Subfile: B
Country of Publ.: United States
Doc Type: SERIAL Bibliographic Level: ANALYTIC
Languages: English
illus., sketch maps
Latitude: N403000; N404000 Longitude: W1173500; W1174500
Descriptors: *Nevada; *automatic data processing; *seismology; *Great Basin; *geophysical methods ; economic geology; geophysical surveys; microseisms; seismic methods ; geothermal energy; data acquisition; seismic surveys; interpretation; Pershing County; United States; Grass Valley; Leach Hot Springs; springs; hot springs; thermal waters; exploration; reservoir rocks; noise; faults; arrays; techniques; passive methods; heat flow; anomalies; data processing
Section Headings: 20 .(GEOPHYSICS, APPLIED)

935993 79-22180
Subsurface structure of the southern portion of the Salton Sea geothermal field
Chan, M. A.; Tewhey, J. D.
Univ. Calif., Lawrence Livermore Lab., Livermore, Calif.,
(cont. next page)

USA
Lawrence Livermore Lab., [Rep.], UCRL 52354, 13p., 1977
3 REFS.
Subfile: B
Country of Publ.: United States
Doc Type: SERIAL; REPORT Bibliographic Level: MONOGRAPHIC
Languages: English
Availability: U. S. Dep. Commer., Natl. Tech. Inf. Serv., Springfield, Va., United States
illus., sketch map
Latitude: N330000; N331500 Longitude: W1153000; W1155000
Descriptors: *California ; economic geology; geophysical surveys ; geothermal energy; electrical surveys; Salton Sea ; United States; exploration; stratigraphy; correlation; structure; spontaneous potential
Section Headings: 20 .(GEOPHYSICS, APPLIED)

935929 79-20575
Fracture and borehole mapping technique development
Aamodt, R. L.; Aki, K.; Albright, J. N.; Fehler, M. C.; Keys, W. S.; Kintzinger, P. R.; Landt, J.; Murphy, H. D.; Potter, R. M.; Spence, R. W.; West, F. G.
Univ. Calif., Los Alamos Sci. Lab., Los Alamos, N.M., USA
Hot Dry Rock Geothermal Energy Development Project; annual report; fiscal year 1977
Anonymous
Los Alamos Sci. Lab., [Rep.] 7109, 82-141p., 1978
CODEN: LASLCA
Subfile: B
Country of Publ.: United States
Doc Type: SERIAL Bibliographic Level: ANALYTIC
Languages: English
illus., tables
Descriptors: *New Mexico ; economic geology; geophysical surveys ; geothermal energy; surveys; exploration; techniques; experimental studies; boreholes; fractures; United States
Section Headings: 29 .(ECONOMIC GEOLOGY, ENERGY SOURCES)

930613 79-12594
A low frequency electromagnetic prospecting system
Jain, B. K.
Univ. California, Berkeley, Calif., USA
133p., 1978
Subfile: B
Degree Level: Doctoral
Country of Publ.: United States
Doc Type: THESIS Bibliographic Level: MONOGRAPHIC
Languages: English
Availability: Univ. Microfilms
Latitude: N350000; N420000 Longitude: W1140500; W1200000
Descriptors: *Nevada; *geophysical methods; *geothermal energy; *automatic data processing ; geophysical surveys; electromagnetic methods; exploration ; electromagnetic surveys; techniques; digital techniques; United States; Grass Valley; frequency; low frequency; sounding; instruments
Section Headings: 20 .(GEOPHYSICS, APPLIED)

928610 79-12651
Telluric mapping in the vicinity of the Salton geothermal area
Humphreys, G.
Univ. Calif., Dep. Earth Sci., Riverside, Calif., USA
American Geophysical Union; 1978 fall annual meeting, San Francisco, Calif., United States, Dec. 4-8, 1978
Eos (Am. Geophys. Union, Trans.) 59: 12, 1201p., 1978
CODEN: EOSTAJ
Subfile: B
Country of Publ.: United States
Doc Type: SERIAL; CONFERENCE PUBLICATION Bibliographic Level: ANALYTIC
Languages: English
Latitude: N330000; N334000 Longitude: W1153000; W1160500
Descriptors: *California; *Pacific Coast ; economic geology ; geophysical surveys ; geothermal energy; Earth-current surveys; Imperial County; Riverside County; United States; Salton Sea; maps; automatic data processing; exploration; resistivity
Section Headings: 20 .(GEOPHYSICS, APPLIED)

928603 79-14085
Utility of seismological methods in the exploration, delineation, and monitoring of geothermal reservoirs
Majer, E. L.; McEvilly, T. V.; Schechter, B.
Lawrence Berkeley Lab., Berkeley, Calif., USA
American Geophysical Union; 1978 fall annual meeting, San Francisco, Calif., United States, Dec. 4-8, 1978
Eos (Am. Geophys. Union, Trans.) 59: 12, 1200p., 1978
CODEN: EOSTAJ
Subfile: B
Country of Publ.: United States
Doc Type: SERIAL; CONFERENCE PUBLICATION Bibliographic Level: ANALYTIC
Languages: English
Latitude: N250000; N420000 Longitude: W1100000; W1240000
Descriptors: *North America; *California; *Nevada; *Mexico; *geophysical methods; *seismology ; geophysical surveys; economic geology; seismic methods; microearthquakes ; seismic surveys; geothermal energy; applications; United States; geothermal systems; reservoir rocks; elastic waves; observations; P-waves; S-waves; propagation; velocity; attenuation
Section Headings: 29 .(ECONOMIC GEOLOGY, ENERGY SOURCES)

DIALOG File 89: GEOREF - 29-84/Nov (Copr. American Geological Institute)

928176 79-14110
Energy and remote sensing applications
Summers, R. A.; Smith, W. L.; Short, N. M.
U. S. Dep. Energy, Washington, D.C., USA; Spectral Data Corp., USA
International symposium on remote sensing of environment, Manilla, Philippines, Apr. 20-26, 1978
Int. Symp. Remote Sensing Environ., Proc. 12, Vol. 1, 395-413p., 1978
CODEN: PISEDM 27 REFS.
Subfile: B
Country of Publ.: International
Doc Type: SERIAL; CONFERENCE PUBLICATION Bibliographic Level: ANALYTIC
Languages: English
illus., plates, table
Descriptors: *United States ; geophysical surveys; environmental geology; economic geology ; remote sensing; conservation; energy sources; applications; planning; exploration; petroleum; natural gas; geothermal energy; uranium; coal; organic residues; oil shale; satellite methods; geophysical methods; Skylab; multispectral analysis; imagery; infrared methods; color imagery; Landsat
Section Headings: 29 .(ECONOMIC GEOLOGY, ENERGY SOURCES)

922513 79-05550
Seismic refraction study of the Raft River geothermal area, Idaho
Ackermann, H. D.
U. S. Geol. Surv., Denver, Colo., USA
Geophysics 44: 2, 216-225p., 1979
CODEN: GPYSA7 13 REFS.
Subfile: B
Country of Publ.: United States
Doc Type: SERIAL Bibliographic Level: ANALYTIC
Languages: English
illus., sketch maps
Latitude: N420300; N421100 Longitude: W1131800; W1133000
Descriptors: *Idaho; *Western Interior; *geophysical methods ; geophysical surveys; economic geology; seismic methods ; seismic surveys; geothermal energy; interpretation; Cassia County; United States; Raft River basin; North America; refraction methods; geothermal fields; thermal waters; wells; exploration
Section Headings: 20 .(GEOPHYSICS, APPLIED)

922385 79-05738
A summary of the geology, geochemistry, and geophysics of the Roosevelt hot springs thermal area, Utah
Ward, S. H.; Parry, W. T.; Nash, W. P.; Sill, W. R.; Cook, K. L.; Smith, R. B.; Chapman, D. S.; Brown, F. H.; Whelan, J. A.; Bowman, J. R.
Univ. Utah, Dep. Geol. and Geophys., Salt Lake City, Utah, USA
Geophysics 43: 7, 1515-1542p., 1978
CODEN: GPYSA7 44 REFS.
Subfile: B
Country of Publ.: United States
Doc Type: SERIAL Bibliographic Level: ANALYTIC
Languages: English
illus., tables, sketch maps
Latitude: N382500; N383000 Longitude: W1124500; W1130000
Descriptors: *Utah; *Western Interior ; geophysical surveys ; economic geology ; surveys; geothermal energy; Beaver County; electrical surveys; gravity surveys; magnetotelluric surveys; applications; exploration; Milford ; Roosevelt hot springs KGRA; United States; North America; microearthquakes; earthquakes; rhyolite; andesite-rhyolite family; composition; springs; hot springs; geochemistry; heat flow; reservoir rocks
Section Headings: 20 .(GEOPHYSICS, APPLIED)

922384 79-05621
Some results from audiomagnetotelluric investigations in geothermal areas
Hoover, D. B.; Long, C. L.; Senterfit, R. M.
U. S. Geol. Surv., Denver, Colo., USA
Geophysics 43: 7, 1501-1514p., 1978
CODEN: GPYSA7 20 REFS.
Subfile: B
Country of Publ.: United States
Doc Type: SERIAL Bibliographic Level: ANALYTIC
Languages: English
illus., table, sketch maps
Descriptors: *geophysical methods; *Basin and Range Province ; *Columbia Plateau; *Western U.S. ; magnetotelluric methods; economic geology; geophysical surveys ; audiomagnetotelluric methods; geothermal energy; magnetotelluric surveys; applications; exploration; audio-frequency methods; United States; spectral analysis; techniques; resistivity
Section Headings: 20 .(GEOPHYSICS, APPLIED)

922383 79-05615
A quadripole resistivity survey of the Imperial Valley, California
Harthill, N.
Group Seven, Inc., Lakewood, Colo., USA
Geophysics 43: 7, 1485-1500p., 1978
CODEN: GPYSA7 28 REFS.
Subfile: B
Country of Publ.: United States
Doc Type: SERIAL Bibliographic Level: ANALYTIC
Languages: English
illus., sketch maps
Latitude: N310000; N340000 Longitude: W1140000; W1170000

(cont. next page)

Descriptors: *California; *geophysical methods; *Pacific Coast ; geophysical surveys; electrical methods; economic geology ; electrical surveys; resistivity; geothermal energy; Imperial County; applications; exploration; United States; Imperial Valley; Salton Trough; quadripole arrays; Gulf of California; Pacific Ocean
Section Headings: 20 .(GEOPHYSICS, APPLIED)

922382 79-05662
Reconnaissance geophysical studies of the geothermal system in southern Raft River valley, Idaho
Mabey, D. R.; Hoover, D. B.; O'Donnell, J. E.; Wilson, C. W.
U. S. Geol. Surv., Denver, Colo., USA
Geophysics 43: 7, 1470-1484p., 1978
CODEN: GPYSA7 22 REFS.
Subfile: B
Country of Publ.: United States
Doc Type: SERIAL Bibliographic Level: ANALYTIC
Languages: English
illus., sketch maps
Latitude: N420000; N421500 Longitude: W1131500; W1133000
Descriptors: *Idaho; *Western Interior ; geophysical surveys; economic geology ; surveys; geothermal energy; Cassia County; gravity surveys; magnetotelluric surveys; applications; exploration; United States; Raft River basin; magnetic surveys; airborne methods; geophysical methods; reservoir rocks; Earth-current surveys; self-potential methods; Cenozoic; Phanerozoic; volcanic rocks; sedimentary rocks; lithology; structure; structural controls; faults; North America
Section Headings: 20 .(GEOPHYSICS, APPLIED)

913458 78-45593
Oahu geothermal exploration
Souto, J. M.
Colo. Sch. Mines, Golden, Colo., USA
Geothermal energy; a novelty becomes resource; Transactions; Volume 2, Section 2
Combs, J.(chairperson)
Geothermal energy; a novelty becomes resource, Hilo, Hawaii, United States, July 25-27, 1978
Publ: Geothermal Resour. Counc.
605-607p., 1978
8 REFS.
Subfile: B
Country of Publ.: United States
Doc Type: BOOK; CONFERENCE PUBLICATION Bibliographic Level: ANALYTIC
Languages: English
sketch maps
Latitude: N212000; N214000 Longitude: W1574000; W1582000
Descriptors: *Hawaii ; economic geology; geophysical surveys ; geothermal energy; electrical surveys; Honolulu County; Pacific Ocean; United States; Oahu; exploration; resistivity; Koolan Range
Section Headings: 29 .(ECONOMIC GEOLOGY, ENERGY SOURCES)

913449 78-43348
Honey Lake KGRA geophysical survey and drilling tests
Pritchard, J. I.; Zebal, G. P.
Electrodyne Surv., Sparks, Nev., USA; George P. Zebal and Assoc., USA
Geothermal energy; a novelty becomes resource; Transactions; Volume 2, Section 2
Combs, J.(chairperson)
Geothermal energy; a novelty becomes resource, Hilo, Hawaii, United States, July 25-27, 1978
Publ: Geothermal Resour. Counc.
545-546p., 1978
2 REFS.
Subfile: B
Country of Publ.: United States
Doc Type: BOOK; CONFERENCE PUBLICATION Bibliographic Level: ANALYTIC
Languages: English
Descriptors: *California ; economic geology; geophysical surveys ; geothermal energy; surveys; United States; Honey Lake KGRA; Skedaddle Mountains; Amedee Mountains; Schaffer Mountain; gravity surveys; magnetic surveys; magnetotelluric surveys; faults; exploration; Litchfield Fault; Amedee Fault
Section Headings: 20 .(GEOPHYSICS, APPLIED)

913442 78-45554
Meager Creek geothermal system, British Columbia; Part I; Exploration and research program
Nevin, A. E.; Crandall, J. T.; Souther, J. G.; Stauder, J.
Nevin Sadlier-Brown Goodbrand, CAN; Geol. Surv. Can., CAN
Geothermal energy; a novelty becomes resource; Transactions; Volume 2, Section 2
Combs, J.(chairperson)
Geothermal energy; a novelty becomes resource, Hilo, Hawaii, United States, July 25-27, 1978
Publ: Geothermal Resour. Counc.
491-493p., 1978
12 REFS.
Subfile: B
Country of Publ.: United States
Doc Type: BOOK; CONFERENCE PUBLICATION Bibliographic Level: ANALYTIC
Languages: English
sketch map
Latitude: N510000; N520000 Longitude: W1220000; W1240000
Descriptors: *British Columbia ; economic geology ; geothermal energy; Canada; Meager Creek; exploration; research; programs; subsurface reservoirs; fractures; electrical surveys; geophysical surveys; resistivity; igneous activity; Cenozoic; Phanerozoic

(cont. next page)

DIALOG File 89: GEOREF - 29-84/Nov (Copr. American Geological Institute)

Section Headings: 29 .(ECONOMIC GEOLOGY, ENERGY SOURCES)

913425 78-45510
Results of electric survey in the area of Hawaii geothermal test well HGP-A
Kauahikaua, J.; Klein, D.
U. S. Geol. Surv., Denver, Colo., USA; Hawaii Inst. Geophys., USA
Geothermal energy; a novelty becomes resource; transactions; Volume 2, Section 1
Combs, J.(chairperson)
Geothermal energy; a novelty becomes resource, Hilo, Hawaii, United States, July 25-27, 1978
Publ: Geothermal Resour. Counc.
363-366p., 1978
10 REFS.
Subfile: B
Country of Publ.: United States
Doc Type: BOOK; CONFERENCE PUBLICATION Bibliographic Level: ANALYTIC
Languages: English
illus., sketch map
Latitude: N191500; N192500 Longitude: W1550500; W1552000
Descriptors: *Hawaii ; economic geology; geophysical surveys ; geothermal energy; electrical surveys; Hawaii County; Pacific Ocean; United States; Kilauea; resistivity ; exploration
Section Headings: 29 .(ECONOMIC GEOLOGY, ENERGY SOURCES)

913392 78-45465
Seismic noise measurements at some geothermal areas in Japan
Ehara, S.; Yuhara, K.
Geothermal energy; a novelty becomes resource; transactions; Volume 2, Section 1
Combs, J.(chairperson)
Geothermal energy; a novelty becomes resource, Hilo, Hawaii, United States, July 25-27, 1978
Publ: Geothermal Resour. Counc.
171-172p., 1978
Subfile: B
Country of Publ.: United States
Doc Type: BOOK; CONFERENCE PUBLICATION Bibliographic Level: ANALYTIC
Languages: English
sketch map
Latitude: N300000; N450000 Longitude: E1470000; E1290000
Descriptors: *Japan ; geophysical surveys; economic geology ; seismic surveys; geothermal energy; Asia; noise; exploration; Toyoha; Kurobe; Noya; Takenoyu; Iwoyama
Section Headings: 29 .(ECONOMIC GEOLOGY, ENERGY SOURCES)

913389 78-45458
Geologic characteristics of the Valles Caldera geothermal system, New Mexico
Dondanville, R. F.
Union Oil Co. Calif., Santa Rosa, Calif., USA
Geothermal energy; a novelty becomes resource; transactions; Volume 2, Section 1
Combs, J.(chairperson)
Geothermal energy; a novelty becomes resource, Hilo, Hawaii, United States, July 25-27, 1978
Publ: Geothermal Resour. Counc.
157-160p., 1978
5 REFS.
Subfile: B
Country of Publ.: United States
Doc Type: BOOK; CONFERENCE PUBLICATION Bibliographic Level: ANALYTIC
Languages: English
illus., geol. sketch map
Latitude: N353000; N354500 Longitude: W1063000; W1070000
Descriptors: *New Mexico; *volcanology ; economic geology; volcanism ; geothermal energy; calderas; Sandoval County; United States; Jemez Mountains; Valles Caldera; eruptions; magma chambers; heat sources; resources; exploration; temperature; geophysical surveys; surveys; heat flow
Section Headings: 29 .(ECONOMIC GEOLOGY, ENERGY SOURCES)

Geothermal reconnaissance of southwestern Montana
Chadwick, R. A.(investigator)
U. S. Geol. Surv., Prof. Pap. 1100, 209p., 1978
CODEN: XGPPA9
Subfile: B
Country of Publ.: United States
Doc Type: SERIAL Bibliographic Level: ANALYTIC
Languages: English
Descriptors: *Montana ; economic geology ; geothermal energy; possibilities; exploration; springs; hot springs; thermal waters; United States; geophysical surveys
Section Headings: 29 .(ECONOMIC GEOLOGY, ENERGY SOURCES)

Potential geothermal reservoirs in southern Colorado
Romero, J. C.(investigator)
U. S. Geol. Surv., Prof. Pap. 1100, 208p., 1978
CODEN: XGPPA9
Subfile: B
Country of Publ.: United States
Doc Type: SERIAL Bibliographic Level: ANALYTIC
Languages: English
Descriptors: *Colorado ; economic geology ; geothermal energy; United States; possibilities; exploration; reservoir rocks; thermal waters; springs; hot springs;

(cont. next page)

geophysical surveys; geothermal systems
Section Headings: 29 .(ECONOMIC GEOLOGY, ENERGY SOURCES)

Aeromagnetic mapping in the Vale-Owyhee area of Oregon
Couch, R. W.(investigator)
U. S. Geol. Surv., Prof. Pap. 1100, 206p., 1978
CODEN: XGPPA9
Subfile: B
Country of Publ.: United States
Doc Type: SERIAL Bibliographic Level: ANALYTIC
Languages: English
Latitude: N431500; N441500 Longitude: W1170000; W1170000
Descriptors: *Oregon ; geophysical surveys ; remote sensing; United States; Vale; Owyhee; magnetic surveys; airborne methods; geophysical methods; maps; geothermal energy; exploration; faults; structural controls
Section Headings: 20 .(GEOPHYSICS, APPLIED)

Geophysical mapping of the central Cascades
Couch, R. W.(investigator)
U. S. Geol. Surv., Prof. Pap. 1100, 206p., 1978
CODEN: XGPPA9
Subfile: B
Country of Publ.: United States
Doc Type: SERIAL Bibliographic Level: ANALYTIC
Languages: English
Latitude: N430000; N440000 Longitude: W1210000; W1220000
Descriptors: *Oregon ; geophysical surveys ; remote sensing; United States; Cascade Range; magnetic surveys; airborne methods; geophysical methods; geothermal energy; exploration; thermal waters; springs; hot springs; maps
Section Headings: 20 .(GEOPHYSICS, APPLIED)

Delineation of buried thermal bodies by precision releveling and gravity reobservations
Smith, R. B.(investigator)
U. S. Geol. Surv., Prof. Pap. 1100, 205p., 1978
CODEN: XGPPA9
Subfile: B
Country of Publ.: United States
Doc Type: SERIAL Bibliographic Level: ANALYTIC
Languages: English
Descriptors: *Wyoming ; geophysical surveys ; gravity surveys; geothermal energy; exploration; United States; Yellowstone National Park; magma chambers
Section Headings: 20 .(GEOPHYSICS, APPLIED)

Characteristics of a Hawaiian geothermal system
Anonymous
U. S. Geol. Surv., Prof. Pap. 1100, 204p., 1978
CODEN: XGPPA9
Subfile: B
Country of Publ.: United States
Doc Type: SERIAL Bibliographic Level: ANALYTIC
Languages: English
Descriptors: *Hawaii ; economic geology ; geothermal energy; Pacific Ocean; United States; geothermal systems; geothermal fields; exploration; geophysical surveys
Section Headings: 29 .(ECONOMIC GEOLOGY, ENERGY SOURCES)

912266 78-45486
Gravity and magnetic surveys as an aid to geothermal exploration in the Monroe-Marysvale area and vicinity, Utah
Halliday, M. E.; Cook, K. L.; Sontag, R. J.
Univ. Utah, Dep. Geol. and Geophys., Salt Lake City, Utah, USA
The Geological Society of America, Rocky Mountain Section, 31st annual meeting, Provo, Utah, United States, April 28-29, 1978
Geol. Soc. Am., Abstr. Programs 10: 5, 217p., 1978
CODEN: GAAPBC
Subfile: B
Country of Publ.: United States
Doc Type: SERIAL; CONFERENCE PUBLICATION Bibliographic Level: ANALYTIC
Languages: English
Latitude: N380000; N393000 Longitude: W1120000; W1130000
Descriptors: *Utah ; economic geology; geophysical surveys ; geothermal energy; surveys; Sevier County; Piute County ; Garfield County; Millard County; United States; Sevier Valley; Sevier Plateau; Sevier Fault; faults; grabens; Sevier orogenic belt; Marysvale; Monroe; Pavant Mountains; exploration; hot springs; thermal waters; springs; gravity anomalies; leveling; magnetic surveys
Section Headings: 29 .(ECONOMIC GEOLOGY, ENERGY SOURCES)

910848 78-45380
South. Methodist Univ., Dep. Geol. Sci., USA
Heat flow studies in the Steamboat Mountain-Lemei Rock area, Skamania County, Washington
Schuster, J. E.; Blackwell, D. D.; Hammond, P. E.; Huntting, M. T.
Wash., Div. Geol. and Earth Resour., Olympia, Wash., USA
Wash., Div. Geol. Earth Resour., Inf. Circ. 62, 56p., 1978
CODEN: ICDRD3 62 REFS.
Subfile: B
Country of Publ.: United States
Doc Type: SERIAL Bibliographic Level: MONOGRAPHIC
Languages: English
illus., tables, sects., strat. col., geol. sketch maps
Latitude: N455400; N460700 Longitude: W1214000; W1215300
Descriptors: *Washington ; geophysical surveys; economic geology ; heat flow; geothermal energy; Skamania County; Big Lava Bed; United States; Steamboat Mountain; Lemei Rock ; exploration; Quaternary; Cenozoic; Cascade Range
(cont. next page)

Section Headings: 29 .(ECONOMIC GEOLOGY, ENERGY SOURCES)

907807 78-40207
Exploration and development of geothermal fields in Indonesia
Akil, I.; Tasan, R.
Pertamina, Geotherm. Div., Jakarta, IDN
Second Circum-Pacific energy and mineral resources conference, Honolulu, Hawaii, United States, July 30-Aug. 4, 1978
Am. Assoc. Pet. Geol., Bull. 62: 7, 1207p., 1978
CODEN: AAPGBS
Subfile: B
Country of Publ.: United States
Doc Type: SERIAL; CONFERENCE PUBLICATION Bibliographic Level: ANALYTIC
Languages: English
Latitude: S093000; S060000 Longitude: E1150000; E1050000
Descriptors: *Indonesia ; economic geology ; geothermal energy; Asia; Java; exploration; geophysical surveys; resources; production; wells; magnetotelluric surveys
Section Headings: 29 .(ECONOMIC GEOLOGY, ENERGY SOURCES)

905740 78-36952
Geothermal investigations in Brazil
Vitorello, I.; Pollack, H. N.; Hamza, V. M.; Araujo, R.
Univ. Mich., Dep. Geol. and Mineral., Ann Arbor, Mich., USA
American Geophysical Union; 1977 spring annual meeting, Washington, D.C., United States, May 30-June 3, 1977
Eos (Am. Geophys. Union, Trans.) 58: 6, 542p., 1977
CODEN: EOSTAJ
Subfile: B
Country of Publ.: United States
Doc Type: SERIAL; CONFERENCE PUBLICATION Bibliographic Level: ANALYTIC
Languages: English
Latitude: S340000; N051500 Longitude: W0340000; W0740000
Descriptors: *Brazil ; economic geology; geophysical surveys ; geothermal energy; heat flow; South America; exploration; boreholes; geothermal gradient; measurement; thermal conductivity
Section Headings: 29 .(ECONOMIC GEOLOGY, ENERGY SOURCES)

905739 78-36956
Gravity investigation of the geothermal potential of the Conway Granite, New Hampshire
Wetterauer, R. H.; Bothner, W. A.
Univ. Maine, Dep. Geol. Sci., Orono, Maine, USA; Univ. N.H., USA
American Geophysical Union; 1977 spring annual meeting, Washington, D.C., United States, May 30-June 3, 1977
Eos (Am. Geophys. Union, Trans.) 58: 6, 542p., 1977
CODEN: EOSTAJ
Subfile: B
Country of Publ.: United States
Doc Type: SERIAL; CONFERENCE PUBLICATION Bibliographic Level: ANALYTIC
Languages: English
Latitude: N435000; N441000 Longitude: W0710000; W0712000
Descriptors: *New Hampshire; *New England; *intrusions ; economic geology; geophysical surveys; batholiths ; geothermal energy; gravity surveys; Carroll County; Conway Granite; United States; White Mountains; Conway; granite; granite-granodiorite family; possibilities; exploration; ground methods; geophysical methods; temperature; depth
Section Headings: 29 .(ECONOMIC GEOLOGY, ENERGY SOURCES)

903738 78-35226
East Mesa geothermal anomaly, Imperial County, California; observations based on temperatures in a deep drill hole near thermal equilibrium
Urban, T. C.; Diment, W. H.; Nathenson, M.
U. S. Geol. Surv., Menlo Park, Calif., USA
American Geophysical Union; 1977 fall annual meeting, San Francisco, Calif., United States, Dec. 5-9, 1977
Eos (Am. Geophys. Union, Trans.) 58: 12, 1241p., 1977
CODEN: EOSTAJ
Subfile: B
Country of Publ.: United States
Doc Type: SERIAL; CONFERENCE PUBLICATION Bibliographic Level: ANALYTIC
Languages: English
Latitude: N324830; N324840 Longitude: W1151530; W1151545
Descriptors: *California; *well-logging ; geophysical surveys; economic geology; interpretation ; heat flow; geothermal energy; temperature; Imperial County; United States; East Mesa; known geothermal resource areas; boreholes; observations; exploration
Section Headings: 20 .(GEOPHYSICS, APPLIED)

903737 78-35146
East Mesa geothermal anomaly; Imperial County, California; effects of canal leakage on shallow thermal regime
Diment, W. H.; Urban, T. C.; Nathenson, M.; Mathias, K. E.
U. S. Geol. Surv., Menlo Park, Calif., USA; U. S. Bur. Reclam., USA
American Geophysical Union; 1977 fall annual meeting, San Francisco, Calif., United States, Dec. 5-9, 1977
Eos (Am. Geophys. Union, Trans.) 58: 12, 1241p., 1977
CODEN: EOSTAJ
Subfile: B
Country of Publ.: United States
Doc Type: SERIAL; CONFERENCE PUBLICATION Bibliographic Level: ANALYTIC
Languages: English
Latitude: N324500; N330000 Longitude: W1151000; W1152000
Descriptors: *California; *ground water ; geophysical

(cont. next page)

surveys; economic geology; surveys ; heat flow; geothermal energy; Imperial County; East Mesa; known geothermal resource areas; United States; geothermal gradient; temperature; leakage; canals; aquifers; levels; recharge; effects; thermal regimes; depth; shallow depth; waterways ; exploration
Section Headings: 20 .(GEOPHYSICS, APPLIED)

902349 78-35190
Evaluation of geothermal basins with analytical solutions for magnetotelluric wave impedance
Liemohn, H. B.
Battelle Pac. Northwest Lab., Richland, Wash., USA
American Geophysical Union; 1977 fall annual meeting, San Francisco, Calif., United States, Dec. 5-9, 1977
Eos (Am. Geophys. Union, Trans.) 58: 12, 1128p., 1977
CODEN: EOSTAJ
Subfile: B
Country of Publ.: United States
Doc Type: SERIAL; CONFERENCE PUBLICATION Bibliographic Level: ANALYTIC
Languages: English
Latitude: N420000; N450000 Longitude: W1100000; W1140000
Descriptors: *Idaho; *Wyoming; *Western U.S.; *geophysical methods ; geophysical surveys; economic geology; magnetotelluric methods ; magnetotelluric surveys; geothermal energy; applications; Cassia County; Teton County; Park County; exploration; electrical conductivity; temperature; profiles; Yellowstone National Park; Raft River; United States
Section Headings: 20 .(GEOPHYSICS, APPLIED)

898142 78-30981
Oreg. Dep. Geol. and Miner. Ind., USA
Geothermal exploration studies in Oregon
Bowen, R. G.; Blackwell, D. D.; Hull, D. A.
Southern Methodist Univ., Dallas, Tex., USA
Oreg., Dep. Geol. Miner. Ind., Misc. Paper 19, 50p., 1977
CODEN: OGIPAB 26 REFS.
Subfile: B
Country of Publ.: United States
Doc Type: SERIAL; MAP Bibliographic Level: MONOGRAPHIC
Languages: English
illus., tables, sketch maps; 1:1,000,000; index map
Latitude: N420000; N462000 Longitude: W1163500; W1243500
Descriptors: *Oregon ; geophysical surveys; economic geology ; heat flow; geothermal energy; United States; geothermal gradient; maps; methods; Snake River basin
Section Headings: 20 .(GEOPHYSICS, APPLIED)

898048 78-30812
Microearthquake surveys of Snake River plain and Northwest Basin and Range geothermal areas
Kumamoto, L. H.
Colorado School of Mines, Golden, Colo., USA
181p., 1976
Subfile: B
Degree Level: Doctoral
Country of Publ.: United States
Doc Type: THESIS Bibliographic Level: MONOGRAPHIC
Languages: English
Availability: Univ. Microfilms
Latitude: N403000; N423000 Longitude: W1130000; W1193000
Descriptors: *Western U.S.; *Idaho; *Nevada; *seismology; *geophysical methods ; geophysical surveys; economic geology ; microearthquakes; seismic methods ; seismic surveys; geothermal energy; applications; Humboldt County; Pershing County; Cassia County; United States; Raft River; Snake River plain; Black Rock Desert; Basin and Range Province; seismicity; exploration; earthquakes; passive systems; fracture zones; reservoir rocks
Section Headings: 19 .(GEOPHYSICS, SEISMOLOGY)

895109 78-28917
Exploration for nonelectric geothermal resources in Colorado
Dick, J. D.; Pearl, R. H.
Colo. Geol. Surv., Denver, Colo., USA
AAPG Rocky Mountain Section meeting, Salt Lake City, Utah, United States, March 19-22, 1978
Am. Assoc. Pet. Geol., Bull. 62: 5, 882-883p., 1978
CODEN: AAPGBS
Subfile: B
Country of Publ.: United States
Doc Type: SERIAL; CONFERENCE PUBLICATION Bibliographic Level: ANALYTIC
Languages: English
Latitude: N371000; N394500 Longitude: W1065000; W1073000
Descriptors: *Colorado ; economic geology; hydrogeology ; geothermal energy; thermal waters; springs; Garfield County ; Archuleta County; United States; Pagosa Springs; Glenwood Springs; hot springs; exploration; temperature; low temperature; nonelectric use; geophysical surveys; heat flow; geothermal gradient; electrical surveys; resistivity; electromagnetic surveys; seismic surveys; surveys; geologic thermometry
Section Headings: 29 .(ECONOMIC GEOLOGY, ENERGY SOURCES)

893931 78-25043
Reservoir engineering
Duffield, R. B.; Tester, J. W.
Hot Dry Rock Geothermal Energy Development Project; annual report, fiscal year 1977
Los Alamos Scientific Laboratory, Hot Dry Rock Project Staff, Los Alamos, N.M., USA
79-240p., 1978
51 REFS.
Subfile: B
Doc Type: REPORT Bibliographic Level: ANALYTIC
Languages: English
Report No.: LA-7109-PR
Availability: NTIS, Springfield, Va., United States
illus., plates, tables
Latitude: N354500; N360000 Longitude: W1063500; W1064500
Descriptors: *New Mexico; *engineering geology ; economic geology; site exploration ; geothermal energy; hot dry rocks; United States; Fenton Hill; boreholes; drilling; reservoir rocks; models; economics; geophysical surveys
Section Headings: 29 .(ECONOMIC GEOLOGY, ENERGY SOURCES)

893928 78-25034
Hot dry rock resource assessment and site selection
Crowe, B. M.; Eddy, A. C.; Eichelberger, J. C.; Gambill, D. T.; Heiken, G.; Kintzinger, P. R.; Laughlin, A. W.; Linn, G. W.; Smith, M. C.; Tester, J. W.; West, F. G.
Hot Dry Rock Geothermal Energy Development Project; annual report, fiscal year 1977
Los Alamos Scientific Laboratory, Hot Dry Rock Project Staff, Los Alamos, N.M., USA
13-41p., 1978
27 REFS.
Subfile: B
Doc Type: REPORT Bibliographic Level: ANALYTIC
Languages: English
Report No.: LA-7109-PR
Availability: NTIS, Springfield, Va., United States
illus., tables, sketch maps
Latitude: N354500; N360000 Longitude: W1063500; W1064500
Descriptors: *New Mexico ; economic geology ; geothermal energy; Conway Granite; Bandelier Tuff; United States; heat flow; heat sources; hot dry rocks; Fenton Hill; possibilities; boreholes; geophysical surveys; site exploration; Valles Caldera; magma chambers; Jemez Mountains; California; Mono County; Long Valley; Coso; Montana; Marysville; New Hampshire
Section Headings: 29 .(ECONOMIC GEOLOGY, ENERGY SOURCES)

891977 78-24985
Use of temperature surveys at a depth of 1 meter in geothermal exploration in Nevada
Olmsted, F. H.
U. S. Geol. Surv., USA
U. S. Geol. Surv., Prof. Pap. 1044-B, 25p., 1977
CODEN: XGPPA9 25 REFS.
Subfile: B
Country of Publ.: United States
Doc Type: SERIAL Bibliographic Level: MONOGRAPHIC
Languages: English
Note: Geohydrology of geothermal systems, illus., sketch maps
Latitude: N393000; N395000 Longitude: W1183000; W1185500
Descriptors: *Nevada ; geophysical surveys; economic geology ; heat flow; geothermal energy; Churchill County; United States; Soda Lakes; Upsal Hogback; exploration; temperature; surveys; depth; shallow depth; fumaroles; steam; anomalies; data; thermal waters
Section Headings: 29 .(ECONOMIC GEOLOGY, ENERGY SOURCES)

891179 78-23601
Gravimetric survey at the southern part of Izu; preliminary survey for geothermal exploration
Ogawa, K.
Jap., Geol. Surv., Bull. 28: 3, 35-44p., 1977
CODEN: JGSBAW
Subfile: B
Country of Publ.: Japan
Doc Type: SERIAL Bibliographic Level: ANALYTIC
Languages: Japanese Summary Languages: English
illus., tables, sketch maps
Latitude: N343000; N351000 Longitude: E1390700; E1384000
Descriptors: *Japan ; geophysical surveys ; gravity surveys; Asia; Izu Peninsula; geothermal energy; exploration; Bouguer anomalies; anomalies; Yugashima Formation; hot springs; Kawazu Spring; Rendaiji; basement; depth; springs; surveys; Shimogamo Spring
Section Headings: 20 .(GEOPHYSICS, APPLIED)

891170 78-23653
Heat discharge measurement and geophysical prospecting at Nigorikawa Basin, northern part of Komagatake
Urakami, K.; Nishida, Y.
Jap., Geol. Surv., Bull. 28: 1, 1-20p., 1977
CODEN: JGSBAW 11 REFS.
Subfile: B
Country of Publ.: Japan
Doc Type: SERIAL Bibliographic Level: ANALYTIC
Languages: Japanese Summary Languages: English
illus., sects., tables, geol. sketch maps
(cont. next page)

Latitude: N413000; N423000 Longitude: E1410000; E1400000
Descriptors: *Japan ; geophysical surveys ; surveys; Asia ; Nigorikawa Basin; Komagatake; Hokkaido; Pleistocene; Quaternary; Cenozoic; calderas; hot springs; fumaroles; temperature; seismic surveys; reflection methods; seismic methods; magnetic surveys; geothermal energy; exploration; brines; heat flow; measurement; anomalies; thermal waters
Section Headings: 20 .(GEOPHYSICS, APPLIED)

890103 78-17389
Resistivity studies in the upper Arkansas Valley and northern San Luis Valley, Colorado
Arestad, J. F.
Colorado School of Mines, Golden, Colo., USA
1977
Subfile: B
Degree Level: Master's
Country of Publ.: United States
Doc Type: THESIS Bibliographic Level: MONOGRAPHIC
Languages: English
Latitude: N370000; N374000 Longitude: W1051000; W1054500
Descriptors: *Colorado; *thermal waters ; geophysical surveys; temperature ; Costilla County; electrical surveys; springs; United States; San Luis Valley; Arkansas Valley; Rio Grande Depression; Miocene; Neogene; Tertiary; Holocene; Quaternary; resistivity; hot springs; heat flow; exploration; quadripole-quadripole arrays; dipole-dipole arrays; Mineral Hot Springs; anomalies; Mount Princeton Hot Springs; Salida Basin; geothermal energy; applications
Section Headings: 20 .(GEOPHYSICS, APPLIED)

886710 78-20187
Insulating properties of Coastal Plain sediments (South Carolina and North Carolina)
Costain, J. K.
Va. Polytech. Inst., Blacksburg, Va., USA
Evaluation and targeting of geothermal energy resources in the southeastern United States
Costain, J. K.; Glover, L., III; Sinha, A. K.
95-113p., 1976
7 REFS.
Subfile: B
Doc Type: REPORT Bibliographic Level: ANALYTIC
Languages: English
Report No.: VPI-SU-5103-2
Availability: NTIS, Springfield, Va., United States
illus., table, sketch maps
Latitude: N320400; N351200 Longitude: W0783200; W0831500
Descriptors: *South Carolina; *North Carolina; *sediments; *Atlantic Coastal Plain; *well-logging ; geophysical surveys; properties; economic geology; interpretation ; heat flow; thermal conductivity; geothermal energy; United States; North America; temperature; data; geothermal gradient; exploration; possibilities; applications
Section Headings: 20 .(GEOPHYSICS, APPLIED)

886709 78-20186
Geophysics (South Carolina)
Costain, J. K.
Va. Polytech. Inst., Blacksburg, Va., USA
Evaluation and targeting of geothermal energy resources in the southeastern United States
Costain, J. K.; Glover, L., III; Sinha, A. K.
82-94p., 1976
Subfile: B
Doc Type: REPORT Bibliographic Level: ANALYTIC
Languages: English
Report No.: VPI-SU-5103-2
Availability: NTIS, Springfield, Va., United States
tables, sketch map
Latitude: N341500; N344500 Longitude: W0804000; W0811500
Descriptors: *South Carolina; *intrusions; *Atlantic Coastal Plain ; geophysical surveys; plutons; economic geology ; heat flow; geothermal energy; Kershaw County; Lancaster County; Richland County; North America; United States; Liberty Hill Pluton; Winnsboro Complex; exploration; possibilities; geothermal gradient; temperature; data; heat sources; genesis; gravity anomalies; magnetic anomalies
Section Headings: 20 .(GEOPHYSICS, APPLIED)

886705 78-21613
Evaluation and targeting of geothermal energy resources in the southeastern United States; progress report, May 1, 1976-October 31, 1976
Costain, J. K.; Glover, L., III; Sinha, A. K.
Va. Polytech. Inst., Blacksburg, Va., USA
170p., 1976
Subfile: B
Doc Type: REPORT Bibliographic Level: MONOGRAPHIC
Languages: English
Report No.: VPI-SU-5103-2
Availability: NTIS, Springfield, Va., United States
Note: Individual reports are cited under the separate authors, illus., tables, geol. sketch maps
Latitude: N320400; N392800 Longitude: W0753000; W0841500
Descriptors: *Atlantic Coastal Plain ; economic geology; hydrogeology; geophysical surveys ; geothermal energy; thermal waters; heat flow; Eastern U.S.; United States; North Carolina; South Carolina; Virginia; North America; temperature; low temperature; resources; exploration; targets; springs; hot springs; reservoir rocks; heat sources; structural controls; data; geothermal ggradient; progress report; 1976
Section Headings: 29 .(ECONOMIC GEOLOGY, ENERGY SOURCES)

881589 78-13814
Remote sensing applications in hydro-geothermal exploration of the northern Basin and Range Province
Hodler, T. W.
Oregon State Univ., Corvallis, Oreg., USA
235p., 1977
Subfile: B
Degree Level: Doctoral
Country of Publ.: United States
Doc Type: THESIS Bibliographic Level: MONOGRAPHIC
Languages: English
Diss. Abstr. Int., Vol. 38, No. 7, p. 3104B, 1978,
Latitude: N380000; N450000 Longitude: W1170000; W1230000
Descriptors: *Basin and Range Province ; geophysical surveys; economic geology ; remote sensing; geothermal energy; United States; California; Oregon; programs; airborne methods; geophysical methods; radar methods; side-scanning methods; infrared methods; applications; exploration; imagery; temperature; thermal waters
Section Headings: 20 .(GEOPHYSICS, APPLIED)

879461 78-10240
Thermal gradients and heat flow at Roosevelt hot springs KGRA
Sill, W. R.; Chapman, D. S.; Wilson, W.; Bodell, J.
Society of Exploration Geophysicists, 47th annual international meeting, Calgary, Canada, Sept. 18-22, 1977
Geophysics 42: 7, 1539p., 1977
CODEN: GPYSA7
Subfile: B
Country of Publ.: United States
Doc Type: SERIAL; CONFERENCE PUBLICATION Bibliographic Level: ANALYTIC
Languages: English
Latitude: N401500; N403000 Longitude: W1100000; W1103000
Descriptors: *Utah ; geophysical surveys; economic geology ; Duchesne County; heat flow; geothermal energy; United States; Roosevelt KGRA; geothermal gradient; measurement; exploration; thermal waters; springs; hot springs
Section Headings: 20 .(GEOPHYSICS, APPLIED)

879460 78-10239
Resistivity structure in southwestern Utah based on magnetotelluric and deep resistivity measurements
Sill, W. R.; Bostick, F. X.; Hohmann, G. W.; Petrick, W.; Phillips, R. J.; Stodt, J.; Swift, C. M., Jr.; Tripp, A.; Ward, S. H.
Society of Exploration Geophysicists, 47th annual international meeting, Calgary, Canada, Sept. 18-22, 1977
Geophysics 42: 7, 1539p., 1977
CODEN: GPYSA7
Subfile: B
Country of Publ.: United States
Doc Type: SERIAL; CONFERENCE PUBLICATION Bibliographic Level: ANALYTIC
Languages: English
Latitude: N370000; N390000 Longitude: W1110000; W1140000
Descriptors: *Utah ; tectonophysics; geophysical surveys ; Beaver County; Duchesne County; crust; surveys; United States; Pioche; Beaver; Tushar; Roosevelt hot springs; geothermal energy; thermal waters; magnetotelluric surveys; electrical surveys; resistivity; deep sounding; electrical conductivity; anomalies
Section Headings: 20 .(GEOPHYSICS, APPLIED)

879382 78-10130
Low-frequency EM sounding in Grass Valley, Nevada
Jain, B.; Dey, A.; Morrison, H. F.
Society of Exploration Geophysicists, 47th annual international meeting, Calgary, Canada, Sept. 18-22, 1977
Geophysics 42: 7, 1510p., 1977
CODEN: GPYSA7
Subfile: B
Country of Publ.: United States
Doc Type: SERIAL; CONFERENCE PUBLICATION Bibliographic Level: ANALYTIC
Languages: English
Latitude: N350000; N420000 Longitude: W1140000; W1200000
Descriptors: *Nevada; *geophysical methods ; geophysical surveys; electromagnetic methods; economic geology ; electromagnetic surveys; applications; geothermal energy; United States; Grass Valley; exploration; low-frequency methods; sounding; ground methods; digital techniques; automatic data processing
Section Headings: 20 .(GEOPHYSICS, APPLIED)

879368 78-10106
Combined use of reflected P- and SH-waves in geothermal reservoir exploration
Goupillaud, P. L.; Cherry, J. T.
Society of Exploration Geophysicists, 47th annual international meeting, Calgary, Canada, Sept. 18-22, 1977
Geophysics 42: 7, 1506p., 1977
CODEN: GPYSA7
Subfile: B
Country of Publ.: United States
Doc Type: SERIAL; CONFERENCE PUBLICATION Bibliographic Level: ANALYTIC
Languages: English
Latitude: N323000; N333000 Longitude: W1143000; W1160000
Descriptors: *California; *geophysical methods ; economic geology; geophysical surveys; seismic methods ; Imperial County; geothermal energy; seismic surveys; techniques; United States; Imperial Valley; East Mesa; reservoir rocks; exploration; P-waves; SH-waves; elastic waves; reflection methods; applications; Vibroseis

(cont. next page)

Section Headings: 20 .(GEOPHYSICS, APPLIED)

879350 78-10078
A 250 km 2 self-potential anomaly caused by conductive mineralization
Corwin, R. F.
Society of Exploration Geophysicists, 47th annual international meeting, Calgary, Canada, Sept. 18-22, 1977
Geophysics 42: 7, 1500p., 1977
CODEN: GPYSA7
Subfile: B
Country of Publ.: United States
Doc Type: SERIAL; CONFERENCE PUBLICATION Bibliographic Level: ANALYTIC
Languages: English
Latitude: N400000; N410000 Longitude: W1180000; W1190000
Descriptors: *Nevada ; geophysical surveys; economic geology ; Pershing County; electrical surveys; maps; geothermal energy; United States; Unionville; East Range; Kyle hot springs; mapping; anomalies; self-potential methods; resistivity methods; electrical conductivity; mineralization; dipole-dipole arrays; exploration; geophysical survey maps; Pershing
Section Headings: 20 .(GEOPHYSICS, APPLIED)

879343 78-10067
Regional aeromagnetic and gravity surveys of the Roosevelt hot springs and Cove Fort-Sulphurdale KGRA's, Utah
Carter, J. A.; Cook, K. L.; Brumbaugh, W. D.; Ward, S. H.; Crebs, T. J.; Thangsuphanich, I.
Society of Exploration Geophysicists, 47th annual international meeting, Calgary, Canada, Sept. 18-22, 1977
Geophysics 42: 7, 1498p., 1977
CODEN: GPYSA7
Subfile: B
Country of Publ.: United States
Doc Type: SERIAL; CONFERENCE PUBLICATION Bibliographic Level: ANALYTIC
Languages: English
Latitude: N370000; N420000 Longitude: W1090000; W1140000
Descriptors: *Utah ; geophysical surveys; economic geology ; Beaver County; Duchesne County; surveys; geothermal energy; maps; United States; Mineral Mountains; Roosevelt hot springs; Cove Fort; Sulphurdale; airborne methods; geophysical methods; magnetic surveys; gravity surveys; resources; known geothermal resource area; magnetic survey maps; lineaments; structure
Section Headings: 20 .(GEOPHYSICS, APPLIED)

878912 78-10032
Heat flow in a geothermal active area; The Geysers, California
Jamieson, I. M.
Univ. of California, Riverside, Calif., USA
176p., 1976
Subfile: B
Degree Level: Doctoral
Country of Publ.: United States
Doc Type: THESIS Bibliographic Level: MONOGRAPHIC
Languages: English
Diss. Abstr. Int., Vol. 38, No. 6, p. 2593B, 1977,
Latitude: N383000; N384500 Longitude: W1224500; W1230000
Descriptors: *California ; geophysical surveys; economic geology ; Sonoma County; heat flow; geothermal energy; United States; north; The Geysers; geothermal gradient; temperature; measurement; boreholes; exploration; thermal waters
Section Headings: 20 .(GEOPHYSICS, APPLIED)

875497 78-06146
Resistivity and soil temperature studies at selected Montana hot springs
Chadwick, R. A.; Galloway, M. J.; Weinheimer, G. J.
Mont. State Univ., Dep. Earth Sci., Bozeman, Mont., USA
Northwest Geol. 6: 2, 60-66p., 1977
CODEN: NWGYAR 8 REFS.
Subfile: B
Country of Publ.: United States
Doc Type: SERIAL Bibliographic Level: ANALYTIC
Languages: English
Latitude: N443000; N470000 Longitude: W1103000; W1123000
Descriptors: *Montana ; hydrogeology; geophysical surveys; economic geology ; Madison County; Lewis and Clark County; Meagher County; springs; electrical surveys; geothermal energy; resistivity; soils; temperature; United States; hot springs; exploration; Broadwater hot springs; Wolf Creek hot springs; White Sulphur Springs; southwest; thermal waters; Rocky Mountains; North America
Section Headings: 20 .(GEOPHYSICS, APPLIED)

875040 78-06102
Geothermal exploration by telluric currents in the Klamath Falls area, Oregon
Tang, R. W. Y.
Oregon State Univ., Corvallis, Oreg., USA
86p., 1974
Subfile: B
Degree Level: Master's
Country of Publ.: United States
Doc Type: THESIS Bibliographic Level: MONOGRAPHIC
Languages: English
illus., tables
Latitude: N421400; N421400 Longitude: W1214700; W1214700
Descriptors: *Oregon; *geothermal energy ; geophysical surveys; exploration ; Klamath County; Earth-current surveys; Klamath Falls; United States; applications
Section Headings: 20 .(GEOPHYSICS, APPLIED)

DIALOG File 89: GEOREF - 29-84/Nov (Copr. American Geological Institute)

866797 77-46641
Deep electrical resistivity soundings in the Rio Grande Rift
Jiracek, G. R.; Smith, C.; Gerety, M. T.
Univ. N.M., Albuquerque, N.M., USA
The Geological Society of America, 89th annual meeting, Denver, Colo., United States, Nov. 8-11, 1976
Geol. Soc. Am., Abstr. Programs 8: 6, 940-941p., 1976
CODEN: GAAPBC
Subfile: B
Country of Publ.: United States
Doc Type: SERIAL; CONFERENCE PUBLICATION Bibliographic Level: ANALYTIC
Languages: English
Descriptors: *New Mexico; *geophysical surveys ; electrical surveys ; Rio Grande Rift; Albuquerque-Belen Basin; Mesilla Basin; United States; resistivity; sounding; basement; faults; applications; thermal waters; geothermal energy; exploration
Section Headings: 20 .(GEOPHYSICS, APPLIED)

863542 77-43828
Telluric mapping over the Mesa geothermal anomaly, Imperial Valley, California
Maas, J, P.
Univ. Calif., Riverside, Calif., USA
Paleogene symposium and selected technical papers; conference on future energy horizons of the Pacific Coast
Weaver, D. W.(EDITOR); Hornaday, G. R.(EDITOR); Tipton, A.(EDITOR)
50th annual meeting of the Pacific sections, AAPG, SEPM, SEG Future energy horizons of the Pacific Coast; Paleogene symposium, Long Beach, Calif., United States, April 23-26, 1975
Publ: Pac. Sect., Am. Assoc. Pet. Geol.
325-342p., 1975
12 REFS.
Subfile: B
Country of Publ.: United States
Doc Type: BOOK; CONFERENCE PUBLICATION Bibliographic Level: ANALYTIC
Languages: English
illus., tables, sketch maps
Latitude: N320000; N330000 Longitude: W1150000; W1153000
Descriptors: *geophysical surveys; *California; *maps; *geothermal energy ; Earth-current surveys; United States; economic geology ; Imperial County; Mesa geothermal anomaly; ground methods; anomalies; exploration; resources; possibilities; contour maps; Imperial Valley
Section Headings: 29 .(ECONOMIC GEOLOGY, ENERGY SOURCES)

862704 77-42583
Seismic mapping of hydraulic fractures made in basement rocks
Albright, J. N.; Hanold, R. J.
Los Alamos Sci. Lab., Los Alamos, N.M., USA
Proceedings of the Second ERDA symposium on enhanced oil and gas recovery; Tulsa, Oklahoma, September 9-10, 1976; Volume 2, Gas
Linville, B.(EDITOR)
Second ERDA symposium on enhanced oil and gas recovery, Tulsa, Okla., United States, Sept. 9-10, 1976
Publ: Pet. Publ. Co.
C8.1-C8.13p., 1976
5 REFS.
Subfile: B
Country of Publ.: United States
Doc Type: BOOK; CONFERENCE PUBLICATION Bibliographic Level: ANALYTIC
Languages: English
illus.
Latitude: N353000; N360000 Longitude: W1061500; W1064500
Descriptors: *New Mexico; *geophysical methods; *geothermal energy; *engineering geology; *Precambrian ; geophysical surveys; seismic methods; reservoirs; United States ; Los Alamos County; Sandoval County; Fenton Hill; applications; fractures; mapping; hydraulic fracturing; production; basement; dry rocks; hot rocks; polarization; subsurface reservoirs; exploration; development; experimental studies
Section Headings: 20 .(GEOPHYSICS, APPLIED)

856767 77-38274
Summary of space imagery studies in Utah and Nevada
Jensen, M. L.; Laylander, P.
Univ. Utah, Salt Lake City, Utah, USA
NASA Earth resources survey symposium, Houston, Tex., United States, June 9-12, 1975
U. S. Natl. Aeronaut. Space Adm., Tech. Memo. X-58168: Vol. I-B, Geology-information systems and services, 673-712p., 1975
Subfile: B
Country of Publ.: United States
Doc Type: SERIAL; CONFERENCE PUBLICATION Bibliographic Level: ANALYTIC
Languages: English
illus., geol. sketch maps
Latitude: N350000; N420000 Longitude: W1090000; W1200000
Descriptors: *Nevada; *geophysical surveys; *Utah; *maps ; remote sensing; cartography ; United States; applications; geomorphology; exploration; geothermal energy; mineral resources; anomalies; satellite; Landsat; Skylab; geologic; explanatory text
Section Headings: 20 .(GEOPHYSICS, APPLIED)

855180 77-34758
Borehole temperature profile of Camas hotsprings, Montana
Qamar, A. A.
Northwest Geol. 5, 54-58p., 1976
CODEN: NWGYAR
Subfile: B
Country of Publ.: United States
Doc Type: SERIAL Bibliographic Level: ANALYTIC
Languages: English
illus.
Latitude: N471500; N474500 Longitude: W1141500; W1144500
Descriptors: *Montana; *heat flow; *geothermal energy ; geophysical surveys; United States ; Sanders County; west; Camas; exploration; boreholes; thermal waters; springs; hot springs; temperature; geothermal gradient
Section Headings: 20 .(GEOPHYSICS, APPLIED)

854568 77-36087
Ethiopia; investigation of geothermal resources for power development; geology, geochemistry and hydrology of hot springs of the East African rift system within Ethiopia
United Nations Development Programme
variously paginatedp., 1973
Subfile: B
Doc Type: REPORT Bibliographic Level: MONOGRAPHIC
Languages: English
Report No.: DP/SF/UN/116
Availability: U.N., New York, N.Y., United States
illus., ; geol. maps
Latitude: N060000; N140000 Longitude: E0421500; E0374500
Descriptors: *Ethiopia; *geothermal energy; *thermal waters; *maps; *springs ; economic geology; Africa ; East African Rift; exploration; geophysical surveys; geochemistry; rift valleys; heat flow; areal geology; hot springs; resources; data; geologic
Section Headings: 29 .(ECONOMIC GEOLOGY, ENERGY SOURCES)

853743 77-34623
Cercetari geoelectrice pentru descoperirea de noi surse de ape termale la Baile Felix, judetul Bihor
Geoelectrical prospecting for thermal ground water in the Baile Felix region, Bihor
Andriescu, G.; Mihail, C.
Rom., Inst. Geol. Geofiz., Stud. Teh. Econ., Ser. D 11, 214-225p., 1976
CODEN: SDPGDB 8 REFS.
Subfile: B
Country of Publ.: Romania
Doc Type: SERIAL Bibliographic Level: ANALYTIC
Languages: Romanian Summary Languages: English
illus., strat. col., geol. sketch map
Latitude: N460000; N480000 Longitude: E0250000; E0220000
Descriptors: *Romania; *geophysical surveys; *ground water; *thermal waters ; electrical surveys; Europe; movement ; Apuseni Mountains; Bihor Mountains; Baile Felix region; resistivity; sounding; anomalies; applications; permeability; limestone; exploration; geothermal energy
Section Headings: 20 .(GEOPHYSICS, APPLIED)

851971 77-34642
Geothermal prospecting with the magneto-telluric method (M.T.-5-E.X.) in the Travale area (Tuscany, Italy)
Celati, R.; Muse, L.; Rossi, A.; Squarci, P.; Taffi, L.; Toro, B.
Geothermics 2: 3-4, 186-190p., 1973
CODEN: GTMCAT 5 REFS.
Subfile: B
Country of Publ.: International
Doc Type: SERIAL Bibliographic Level: ANALYTIC
Languages: English
illus., geol. sketch maps
Descriptors: *Italy; *geophysical methods; *geothermal energy ; geophysical surveys; magnetotelluric methods; Europe ; Tuscany; Travale; applications; exploration; instruments; M.T.-5-E.X.
Section Headings: 20 .(GEOPHYSICS, APPLIED)

851966 77-35968
Exploration in a ''blind'' geothermal area near Marysville, Montana, USA
Blackwell, D. D.
South. Methodist Univ., Dep. Geol. Sci., Dallas, Tex., USA
Geothermics 2: 3-4, 123p., 1973
CODEN: GTMCAT 2 REFS.
Subfile: B
Country of Publ.: International
Doc Type: SERIAL Bibliographic Level: ANALYTIC
Languages: English
Descriptors: *Montana; *geothermal energy; *geophysical surveys; *heat flow ; economic geology; United States; surveys ; Marysville region; resources; exploration; anomalies; heat sources
Section Headings: 29 .(ECONOMIC GEOLOGY, ENERGY SOURCES)

851526 77-32039
Recent discovery of a new geothermal field in Italy; Alfina
Cataldi, R.; Rendina, M.
Geothermics 2: 3-4, 106-116p., 1973
CODEN: GTMCAT 16 REFS.
Subfile: B
Country of Publ.: International
Doc Type: SERIAL Bibliographic Level: ANALYTIC
Languages: English
illus., table, strat. col., geol. sketch maps
Descriptors: *Italy; *geothermal energy; *heat flow ;
(cont. next page)

economic geology; Europe ; Latium; Alfina; resources; exploration; geophysical surveys; measurement
Section Headings: 29 .(ECONOMIC GEOLOGY, ENERGY SOURCES)

851516 77-30704
A five-component magneto-telluric method in geothermal exploration; the M.T.-5-E.X.
Muse, L.
Geothermics 2: 2, 41-50p., 1973
CODEN: GTMCAT 7 REFS.
Subfile: B
Country of Publ.: International
Doc Type: SERIAL Bibliographic Level: ANALYTIC
Languages: English
illus., tables
Descriptors: *geophysical methods; *geothermal energy; *Italy ; magnetotelluric methods; Europe; geophysical surveys ; applications; exploration; new methods; M.T.-5-E.X.; instruments; Tuscany; Travale; resources
Section Headings: 20 .(GEOPHYSICS, APPLIED)

851467 77-30711
Principal facts for a gravity survey of Pinto Hot Springs known geothermal resource area, Nevada
Peterson, D. L.; Hassemer, J. H.
U. S. Geol. Surv., Open-File Rep. 77-67-B, 3p., 1977
CODEN: XGROAG 1 REFS.
Subfile: B
Country of Publ.: United States
Doc Type: SERIAL Bibliographic Level: MONOGRAPHIC
Languages: English
Latitude: N411800; N412500 Longitude: W1184300; W1185500
Descriptors: *Nevada; *geophysical surveys ; gravity surveys ; Humboldt County; north; Pinto Hot Springs KGRA; United States; Pinto Hot Springs; ground; free-air; data; Bouguer anomalies; exploration; geothermal energy
Section Headings: 20 .(GEOPHYSICS, APPLIED)

851466 77-30661
Principal facts for a gravity survey of Breitenbush known geothermal resource area, Oregon
Hassemer, J. H.; Peterson, D. L.
U. S. Geol. Surv., Open-File Rep. 77-67-A, 2p., 1977
CODEN: XGROAG 1 REFS.
Subfile: B
Country of Publ.: United States
Doc Type: SERIAL Bibliographic Level: MONOGRAPHIC
Languages: English
Latitude: N444500; N444900 Longitude: W1214900; W1210800
Descriptors: *Oregon; *geophysical surveys ; gravity surveys ; Jefferson County; northwest; Breitenbush KGRA; United States; Breitenbush; ground; free-air; data; Bouguer anomalies; exploration; geothermal energy
Section Headings: 20 .(GEOPHYSICS, APPLIED)

840415 77-22884
Gravity mapping as an aid to reconnaissance exploration for mineral and geothermal energy resources in the Mogollon-Santa Rita-Tyrone region, southwestern New Mexico
Eaton, G. P.; Peterson, D. L.; Webring, M.; Ratte, J. C.
U. S. Geol. Surv., Denver Fed. Cent., Denver, Colo., USA
Geol. Soc. Am., Abstr. Programs 8: 5: Rocky Mountain Section 29th annual meeting, 584-585p., 1976
CODEN: GAAPBC 0 REFS.
Subfile: B
Country of Publ.: United States
Doc Type: SERIAL Bibliographic Level: ANALYTIC
Languages: English
Descriptors: *New Mexico; *geophysical methods; *mineral resources; *thermal waters ; geophysical surveys; gravity methods; United States ; southwest; Mogollon Rim; Santa Rita; Tyrone; Hanover; Pinos Altos; Silver City; Gila; applications; exploration; geothermal energy; maps; Bouguer anomalies; structure; ore deposits
Section Headings: 20 .(GEOPHYSICS, APPLIED)

839554 77-18620
Evaluation of the petrophysical characteristics of the East Mesa geothermal anomaly, Imperial Valley, California
Sanyal, S. K.; Meidav, H. T.
Geonomics, Inc., Berkeley, Calif., USA
Soc. Explor. Geophys., Annu. Int. Meet., Abstr. 46, 106-107p., 1976
CODEN: SGAMB7 0 REFS.
Subfile: B
Country of Publ.: United States
Doc Type: SERIAL Bibliographic Level: ANALYTIC
Languages: English
Descriptors: *California; *well-logging; *geothermal energy ; geophysical surveys; United States; applications ; Imperial County; south; Imperial Valley; East Mesa; anomalies; exploration
Section Headings: 20 .(GEOPHYSICS, APPLIED)

839552 77-18509
Assessing the geothermal resource base of the southwestern United States; status report of a regional geoelectromagnetic traverse
Hermance, J. F.; Pedersen, J.
Brown Univ., Dep. Geol. Geophys., Providence, R.I., USA
Soc. Explor. Geophys., Annu. Int. Meet., Abstr. 46, 106p., 1976
CODEN: SGAMB7 0 REFS.
Subfile: B
Country of Publ.: United States
Doc Type: SERIAL Bibliographic Level: ANALYTIC
(cont. next page)

DIALOG File 89: GEOREF - 29-84/Nov (Copr. American Geological Institute)

Languages: English
Descriptors: *United States; *geophysical surveys; *geothermal energy ; electromagnetic surveys ; southwest; California; Imperial Valley; Arizona; Tucson Basin; Texas; Rio Grande Rift; El Paso region; High Plains; ground; profiles; evaluation; resources; exploration
Section Headings: 20 .(GEOPHYSICS, APPLIED)

839528 77-18460
Gravity and magnetic surveys of the Mineral Mountains area, Utah, including the Roosevelt Hot Springs KGRA
Crebs, T. J.; Cook, K. L.; Thangsuphanich, I.; Brumbaugh, W. D.; Ward, S. H.
Univ. Utah, Dep. Geol. Geophys., Salt Lake City, Utah, USA
Soc. Explor. Geophys., Annu. Int. Meet., Abstr. 46, 96p., 1976
CODEN: SGAMB7 0 REFS.
Subfile: B
Country of Publ.: United States
Doc Type: SERIAL Bibliographic Level: ANALYTIC
Languages: English
Descriptors: *Utah; *geophysical surveys; *geothermal energy ; surveys; United States ; Beaver County; Miller County; Mineral Mountains; Roosevelt KGRA; exploration; geophysical methods; gravity surveys; magnetic surveys; ground; Bouguer anomalies
Section Headings: 20 .(GEOPHYSICS, APPLIED)

839526 77-18648
Deep electrical investigations of geothermal prospects in the Basin and Range Province of southern New Mexico
Smith, C.; Jiracek, G. R.; Ander, M. E.
Univ. N.M., Albuquerque, N.M., USA
Soc. Explor. Geophys., Annu. Int. Meet., Abstr. 46, 95p., 1976
CODEN: SGAMB7 0 REFS.
Subfile: B
Country of Publ.: United States
Doc Type: SERIAL Bibliographic Level: ANALYTIC
Languages: English
Descriptors: *geothermal energy; *New Mexico; *geophysical methods ; United States; electrical methods; geophysical surveys ; Basin and Range Province; exploration; resistivity; south; applications; techniques; deep
Section Headings: 20 .(GEOPHYSICS, APPLIED)

839524 77-18422
Borehole geophysics evaluation of the Raft River geothermal reservoir, Idaho
Applegate, J. K.; Donaldson, P. R.; Hinkley, D. L.; Wallace, T. L.
Boise State Univ., Dep. Geol. Geophys., Boise, Idaho, USA
Soc. Explor. Geophys., Annu. Int. Meet., Abstr. 46, 94-95 p., 1976
CODEN: SGAMB7 0 REFS.
Subfile: B
Country of Publ.: United States
Doc Type: SERIAL Bibliographic Level: ANALYTIC
Languages: English
illus.
Descriptors: *Idaho; *well-logging; *geothermal energy ; geophysical surveys; applications; United States ; Cassia County; south; Raft River valley; exploration; evaluation; reservoirs; subsurface; systems
Section Headings: 20 .(GEOPHYSICS, APPLIED)

835641 77-18528
Deep resistivity investigations at two known geothermal resource areas (KGRAS) in New Mexico; Radium Springs and Lightning Dock
Jiracek, G. R.; Smith, C.
Univ. N.M., Dep. Geol., Albuquerque, N.M., USA
N. M. Geol. Soc., Spec. Publ. 6: Tectonics and mineral resources of southwestern North America, 71-76p., 1976
CODEN: NMGPAW 14 REFS.
Subfile: B
Country of Publ.: United States
Doc Type: SERIAL Bibliographic Level: ANALYTIC
Languages: English
illus., sketch maps
Descriptors: *New Mexico; *geophysical surveys; *thermal waters ; electrical surveys; United States ; Dona Ana County; Hidalgo County; south; Radium Springs; Lightning Dock; resistivity; deep sounding; ground; exploration; geothermal energy; programs; KGRA; Known Geothermal Resource Areas; electrical methods
Section Headings: 20 .(GEOPHYSICS, APPLIED)

832772 77-16121
Mapping seismic attenuation anomalies in the Coso geothermal area
Ward, R. W.; Young, C.-Y.
Univ. Tex. Dallas, Richardson, Tex., USA
Eos (Am. Geophys. Union, Trans.) 56: 12: Fall annual meeting, 1020p., 1975
CODEN: EOSTAJ 0 REFS.
Subfile: B
Country of Publ.: United States
Doc Type: SERIAL Bibliographic Level: ANALYTIC
Languages: English
Descriptors: *seismology; *geothermal energy; *California ; seismicity; United States; geophysical surveys ; elastic waves; P-waves; attenuation; anomalies; residuals; applications; exploration; Coso geothermal area; seismic surveys; resources; methods; interpretation
Section Headings: 29 .(ECONOMIC GEOLOGY, ENERGY SOURCES)

832406 77-14686
Geophysical studies of the Tatun geothermal field, Taiwan
Cheng, W.-T.
Volcanoes and tectonosphere
Aoki, H.(EDITOR); Iizuka, S.(EDITOR)
Publ: Tokai Univ. Press
309-320p., 1976
9 REFS.
Subfile: B
Country of Publ.: Japan
Doc Type: BOOK Bibliographic Level: ANALYTIC
Languages: English
illus., table, sketch maps
Descriptors: *geothermal energy; *Taiwan; *geophysical surveys ; Asia; surveys ; Tatun; exploration; electrical surveys; resistivity; magnetic surveys; seismic surveys; reflection; gravity surveys
Section Headings: 20 .(GEOPHYSICS, APPLIED)

830991 77-10551
The result of thermal infrared imaging tests in the Kusatsu-Manza geothermal area
Hase, H.; Nishimura, K.
Jap. Soc. Photogramm., J. 12: 3, 1-12p., 1973
CODEN: SASOBR 8 REFS.
Subfile: B
Country of Publ.: Japan
Doc Type: SERIAL Bibliographic Level: ANALYTIC
Languages: Japanese Summary Languages: English
illus., tables, sketch maps
Descriptors: *Japan; *geophysical surveys; *geothermal energy; *volcanology ; infrared surveys; Asia; volcanoes ; Honshu; Fossa Magna; Kusatsu; Manza; Mount Shirane; airborne; ground; exploration; explosions
Section Headings: 20 .(GEOPHYSICS, APPLIED)

830205 77-12124
Geologic setting of the Raft River geothermal area, Idaho
Williams, P. L.; Pierce, K. L.; McIntyre, D. H.; Covington, H. R.; Schmidt, P. W.
U. S. Geol. Surv., Denver, Colo., USA
Geol. Soc. Am., Abstr. Programs 7: 5: Rocky Mountain Section, 28th annual meeting, 652p., 1975
CODEN: GAAPBC 0 REFS.
Subfile: B
Country of Publ.: United States
Doc Type: SERIAL Bibliographic Level: ANALYTIC
Languages: English
Descriptors: *Idaho; *geothermal energy; *thermal waters; *Cenozoic ; economic geology; United States ; Raft River valley; exploration; resources; geophysical surveys; structure; genesis; lithology; reservoir rocks
Section Headings: 29 .(ECONOMIC GEOLOGY, ENERGY SOURCES)

830150 77-10582
Geophysical studies of a geothermal area in the southern Raft River valley, Idaho
Mabey, D. R.; Ackermann, H.; Zohdy, A. A. R.; Hoover, D. B.; Jackson, D. B.; O'Donnell, J. E.
U. S. Geol. Surv., Denver Fed. Cent., Denver, Colo., USA
Geol. Soc. Am., Abstr. Programs 7: 5: Rocky Mountain Section, 28th annual meeting, 624p., 1975
CODEN: GAAPBC 0 REFS.
Subfile: B
Country of Publ.: United States
Doc Type: SERIAL Bibliographic Level: ANALYTIC
Languages: English
Descriptors: *Idaho; *geophysical surveys; *Cenozoic ; surveys; United States ; Raft River valley; gravity surveys ; magnetic surveys; seismic surveys; refraction; magnetotelluric surveys; Earth-current surveys; electrical surveys; resistivity; self-potential; exploration; geothermal energy; depth; structure; igneous rocks; sedimentary rocks
Section Headings: 20 .(GEOPHYSICS, APPLIED)

830148 77-10577
Geophysical studies in the Island Park Caldera, Idaho
Long, C. L.; O'Donnell, J. E.; Smith, B. D.
U. S. Geol. Surv., Theor. & Appl. Geophys. Branch, Denver, Colo., USA
Geol. Soc. Am., Abstr. Programs 7: 5: Rocky Mountain Section, 28th annual meeting, 623p., 1975
CODEN: GAAPBC 0 REFS.
Subfile: B
Country of Publ.: United States
Doc Type: SERIAL Bibliographic Level: ANALYTIC
Languages: English
Descriptors: *Idaho; *geophysical surveys ; magnetotelluric surveys ; Island Park Caldera; United States; sounding; resistivity; exploration; geothermal energy; calderas
Section Headings: 20 .(GEOPHYSICS, APPLIED)

830090 77-11951
The White Earth area, Montana; a geothermal prospect?
Chadwick, R. A.; Blackwell, D. D.; Hansen, J. L.; Rahn, J. E.
Mont. State Univ., Dep. Earth Sci., Bozeman, Mont., USA
Geol. Soc. Am., Abstr. Programs 7: 5: Rocky Mountain Section, 28th annual meeting, 593-594p., 1975
CODEN: GAAPBC 0 REFS.
Subfile: B
Country of Publ.: United States
Doc Type: SERIAL Bibliographic Level: ANALYTIC
Languages: English

(cont. next page)

Descriptors: *Montana; *geothermal energy; *heat flow ; economic geology; United States ; White Earth; Canyon Ferry Reservoir; possibilities; exploration; geophysical surveys
Section Headings: 29 .(ECONOMIC GEOLOGY, ENERGY SOURCES)

830084 77-11944
Heat flow studies of the Snake River Plain
Brott, C. A.; Blackwell, D. D.; Mitchell, J. C.
South. Meth. Univ., Dep. Geol. Sci., Dallas, Tex., USA; Idaho Dep. Water Resour., United States
Geol. Soc. Am., Abstr. Programs 7: 5: Rocky Mountain Section, 28th annual meeting, 590-591p., 1975
CODEN: GAAPBC O REFS.
Subfile: B
Country of Publ.: United States
Doc Type: SERIAL Bibliographic Level: ANALYTIC
Languages: English
Descriptors: *Idaho; *geothermal energy; *heat flow ; economic geology; United States ; Snake River Plain; exploration; possibilities; geophysical surveys; measurement
Section Headings: 29 .(ECONOMIC GEOLOGY, ENERGY SOURCES)

830075 77-11922
Boise geothermal project; a progress report
Applegate, J. K.; Donaldson, P. R.; Hollenbaugh, K. M.; Mink, L. L.; Nichols, C. R.
Boise State Univ., Dep. Geol., Boise, Idaho, USA; Idaho Bur. Mines, United States
Geol. Soc. Am., Abstr. Programs 7: 5: Rocky Mountain Section, 28th annual meeting, 586p., 1975
CODEN: GAAPBC O REFS.
Subfile: B
Country of Publ.: United States
Doc Type: SERIAL Bibliographic Level: ANALYTIC
Languages: English
Descriptors: *geothermal energy; *Idaho; *thermal waters; *geophysical surveys ; United States; economic geology; surveys ; Boise Front; exploration; possibilities; resources; Boise; magnetic surveys; gravity surveys; resistivity
Section Headings: 29 .(ECONOMIC GEOLOGY, ENERGY SOURCES)

828826 77-10581
Telluric mapping over the Mesa geothermal anomaly, Imperial Valley, California
Maas, J. P.
California: Riverside
152p., 1976
O REFS.
Subfile: B
Degree Level: Doctoral
Doc Type: THESIS Bibliographic Level: MONOGRAPHIC
Languages: English
Diss. Abstr. Int., Vol. 37, No. 3, p. 1156B, 1976.
Descriptors: *California; *geophysical methods ; geophysical surveys; Earth-current methods ; Imperial County ; south; Imperial Valley; Mesa geothermal anomaly; applications; geothermal energy; exploration; mapping; sedimentary basins; anomalies; United States
Section Headings: 20 .(GEOPHYSICS, APPLIED)

827045 77-06739
Telluric-magnetotelluric investigations of regional geothermal processes in Iceland
Thayer, R. E.
Brown
291p., 1975
Subfile: B
Degree Level: Doctoral
Doc Type: THESIS Bibliographic Level: MONOGRAPHIC
Languages: English
Diss. Abstr. Int., Vol. 37, No. 1, p. 134B-135B, 1976.
Descriptors: *Iceland; *geothermal energy; *geophysical methods ; geophysical surveys; Europe; methods ; electrical methods; Earth-current methods; magnetotelluric methods; exploration; applications; interpretation; field studies
Section Headings: 20 .(GEOPHYSICS, APPLIED)

825259 77-06702
Heat-flow studies in Steamboat Mountain-Lemei Rock area, Skamania County, Washington
Schuster, J. E.; Blackwell, D. D.; Hammond, P. E.; Huntting, M. T.
Dep. Natur. Resour., Olympia, Wash., USA; South. Methodist Univ., United States
Am. Assoc. Pet. Geol., Bull. 60: 8: New concepts of exploration in Rockies; AAPG-SEPM meeting, 1410p., 1976
CODEN: AAPGBS
Subfile: B
Country of Publ.: United States
Doc Type: SERIAL Bibliographic Level: ANALYTIC
Languages: English
Descriptors: *Washington; *heat flow; *geothermal energy ; geophysical surveys; United States ; Skamania County; Steamboat Mountain; Lemei Rock; measurement; data; geothermal gradient; thermal conductivity; exploration
Section Headings: 20 .(GEOPHYSICS, APPLIED)

825217 77-06520
Geoelectrical investigations of Boise, Idaho, geothermal system
Donaldson, P. R.; Applegate, J. K.
Boise State Univ., Boise, Idaho, USA
Am. Assoc. Pet. Geol., Bull. 60: 8: New concepts of
(cont. next page)

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exploration in Rockies; AAPG-SEPM meeting, 1397p., 1976
CODEN: AAPGBS
Subfile: B
Doc Type: SERIAL Bibliographic Level: ANALYTIC
Languages: English
Descriptors: *Idaho; *geophysical methods; *geothermal energy ; geophysical surveys; electrical methods; United States ; Ada County; Boise; interpretation; electrical conductivity; rocks; techniques; mapping; exploration; structural controls; systems; controls; faults; fractures
Section Headings: 20 .(GEOPHYSICS, APPLIED)

825209 77-07809
Alvord Valley, Oregon geothermal investigation
Cleary, J. G.
Univ. Mont., Missoula, Mont., USA
Am. Assoc. Pet. Geol., Bull. 60: 8: New concepts of exploration in Rockies; AAPG-SEPM meeting, 1394p., 1976
CODEN: AAPGBS
Subfile: B
Doc Type: SERIAL Bibliographic Level: ANALYTIC
Languages: English
Descriptors: *Oregon; *geothermal energy; *thermal waters; *springs; *geophysical surveys ; economic geology; United States; gravity surveys ; southeast; Alvord Valley; exploration; hot springs; profiles; structure; ground
Section Headings: 29 .(ECONOMIC GEOLOGY, ENERGY SOURCES)

825202 77-06479
Heat-flow study of Snake River Plain, Idaho
Brott, C. A.; Mitchell, J. C.
South. Methodist Univ., Dallas, Tex., USA; Idaho Dep. Water Resour., United States
Am. Assoc. Pet. Geol., Bull. 60: 8: New concepts of exploration in Rockies; AAPG-SEPM meeting, 1392p., 1976
CODEN: AAPGBS
Subfile: B
Doc Type: SERIAL Bibliographic Level: ANALYTIC
Languages: English
Descriptors: *Idaho; *heat flow; *geothermal energy ; geophysical surveys; United States ; Snake River Plain; measurement; geothermal gradient; crust; mantle; exploration
Section Headings: 20 .(GEOPHYSICS, APPLIED)

823960 77-06613
Heat flow in the Gulf of California
Lawver, L. A.
California: San Diego
96p., 1976
Subfile: B
Degree Level: Doctoral
Doc Type: THESIS Bibliographic Level: MONOGRAPHIC
Languages: English
Diss. Abstr. Int., Vol. 36, No. 12, Part 1, p. 6031B-6032B, 1976,
Descriptors: *Gulf of California; *heat flow ; geophysical surveys; North America ; measurement; basins; applications ; geothermal energy; exploration
Section Headings: 20 .(GEOPHYSICS, APPLIED)

823699 77-06646
Quadripole mapping near the Fly Ranch geothermal prospect, Northwest Nevada
Morris, D.
Colorado Mines
unpaginatedp., 1975
Subfile: B
Degree Level: Master's
Doc Type: THESIS Bibliographic Level: MONOGRAPHIC
Languages: English
Descriptors: *geophysical methods; *maps; *geothermal energy ; *Nevada ; electrical methods; cartography; United States; geophysical surveys ; interpretation; applications; ground ; resistivity; parameters; models; methods; possibilities ; Fly Ranch; exploration; Hualapai
Section Headings: 20 .(GEOPHYSICS, APPLIED)

823698 77-06737
Exploration for a geothermal system in the Lualualei Valley, Oahu, Hawaii
Tascin, M. T.
Colorado Mines
unpaginatedp., 1975
Subfile: B
Degree Level: Master's
Doc Type: THESIS Bibliographic Level: MONOGRAPHIC
Languages: English
Descriptors: *geophysical surveys; *Hawaii; *geothermal energy ; electrical surveys; United States ; Oahu; Lualualei; ground; resistivity; anomalies; temperature; maps; interpretation; possibilities; exploration
Section Headings: 20 .(GEOPHYSICS, APPLIED)

823696 77-06653
Use of radial and vertical magnetic field components in time-domain electromagnetic sounding
Ofrey, O.
Colorado Mines
unpaginatedp., 1975
Subfile: B
Degree Level: Master's
Doc Type: THESIS Bibliographic Level: MONOGRAPHIC
Languages: English
Descriptors: *geophysical methods; *Nevada ; electromagnetic methods; geophysical surveys ; Pershing

(cont. next page)

County; Humboldt County; applications; interpretation; ground; electromagnetic field; resistivity; radial component; crust; basement; mantle; depth; exploration; geothermal energy; United States; Black Rock Desert
Section Headings: 20 .(GEOPHYSICS, APPLIED)

823663 77-08086
Results of preliminary geothermal exploration in the Dieng-Batur volcanic complex, central Java
Zen, M. T.
Jap. Geotherm. Energy Assoc., J. 8: 2, 34-43p., 1971
Subfile: B
Doc Type: SERIAL Bibliographic Level: ANALYTIC
Languages: English Summary Languages: Japanese
Serial No. 28, illus., geol. sketch map
Descriptors: *Indonesia; *geothermal energy; *geochemistry; *igneous rocks; *springs; *geophysical surveys ; economic geology; Asia; surveys; volcanic; electrical surveys ; Java; Dieng Mountains; Batur; resources; thermal waters; steam; occurrence; structural controls; fracture zones; intersection; exploration; geophysical methods; geochemical methods; chloride; ground water; complexes; distribution; Quaternary; hot springs; resistivity; ground
Section Headings: 29 .(ECONOMIC GEOLOGY, ENERGY SOURCES)

817732 76-43978
On the temperature survey in the Takinoue geothermal area, Iwate Prefecture
Fujikura, K.; Yanagihara, C.; Nakagawa, T.; Noguchi, K.; Okubo, T.
Jap., Geol. Surv., Bull. 21: 2, 53-74p., 1970
CODEN: JGSBAW
Subfile: B
Doc Type: SERIAL Bibliographic Level: ANALYTIC
Languages: Japanese Summary Languages: English
illus., sketch maps
Descriptors: *Japan; *heat flow ; geophysical surveys; Asia ; Iwate; Takinoue; surveys; temperature; measurement ; exploration; geothermal energy
Section Headings: 20 .(GEOPHYSICS, APPLIED)

815721 76-41967
Search for geothermal seismic noise in the East Mesa area, Imperial Valley, California
Katz, L. J.; Wagner, W. D.; Iyer, H. M.
Seismic Explor. Inc., Salt Lake City, Utah, USA; U. S. Geol. Surv., United States
Geophysics 41: 3, 542-543p., 1976
CODEN: GPYSA7
Subfile: B
Doc Type: SERIAL Bibliographic Level: ANALYTIC
Languages: English
Note: Discussion and reply; for reference to paper by Iyer, H. M., see Geophysics, p. 1066, December 1975.
Descriptors: *geophysical methods; *California ; acoustical methods; geophysical surveys ; Imperial County; interpretation; noise; cultural; microseisms; detection; geothermal energy; exploration; United States; Imperial Valley; south; Long Valley
Section Headings: 20 .(GEOPHYSICS, APPLIED)

815489 76-41735
A brief description of the Marysville geothermal area
Blackwell, D. D.; Brott, C. A.; Goforth, T.; Holdaway, M. J.; Morgan, P.; Petefish, D.; Rape, T.; Steele, J. L.; Spafford, R. E.; Waibel, A. F.
South. Methodist Univ., Dallas, Tex., USA
Energy resources of Montana
Doroshenko, J.(EDITOR); Miller, W. R.(EDITOR); Thompson, E. E., Jr.(EDITOR); Rawlins, J. H.(EDITOR)
Publ: Mont. Geol. Soc.
217-222p., 1975
Subfile: B
Country of Publ.: United States
Doc Type: BOOK Bibliographic Level: ANALYTIC
Languages: English
table, geol. sketch maps
Descriptors: *geothermal energy; *Montana ; United States; economic geology ; Marysville; exploration; geophysical surveys; anomalies; possibilities; Empire Creek
Section Headings: 29 .(ECONOMIC GEOLOGY, ENERGY SOURCES)

813644 76-39890
Geothermal survey using thermal infrared remote sensing in Japan
Hase, H.; Matsuno, K.; Nishimura, K.
Int. Symp. Remote Sensing Environ., Proc. 10, Vol. 2, 995-1001p., 1975
Subfile: B
Doc Type: SERIAL Bibliographic Level: ANALYTIC
Languages: English
illus., sketch maps
Descriptors: *Japan; *geothermal energy; *geophysical surveys ; economic geology; remote sensing; Asia ; infrared surveys; thermal; airborne; exploration; methods; indicators; fumaroles; hot springs
Section Headings: 29 .(ECONOMIC GEOLOGY, ENERGY SOURCES)

808695 76-34941
Application of the self-potential method to geothermal exploration in Long Valley, California
Anderson, L. A.; Johnson, G. R.
U. S. Geol. Surv., Denver, Colo., USA
J. Geophys. Res. 81: 8, 1527-1532p., 1976
CODEN: JGREA2
Subfile: B

(cont. next page)

Doc Type: SERIAL Bibliographic Level: ANALYTIC
Languages: English
illus., geol. sketch map
Descriptors: *California; *geophysical surveys ; electrical surveys ; Mono County; Long Valley; Long Valley Caldera; United States; self-potential; anomalies; dipolar; sources ; ground water; thermal waters; applications; exploration; geothermal energy
Section Headings: 20 .(GEOPHYSICS, APPLIED)

807715 76-33961
Reconnaissance geothermal exploration at Raft River, Idaho, from thermal infrared scanning
Watson, K.
Soc. Explor. Geophys., Annu. Int. Meet., Abstr. 45, 66-67 p., 1975
CODEN: SGAMB7
Subfile: B
Doc Type: SERIAL Bibliographic Level: ANALYTIC
Languages: English
Descriptors: *Idaho; *geothermal energy; *geophysical methods ; geophysical surveys; United States; infrared methods ; Cassia County; infrared surveys; Raft River Valley; exploration; temperature; surface; variations; anomalies; remote sensing; imagery; theoretical studies; models; applications; field studies
Section Headings: 20 .(GEOPHYSICS, APPLIED)

807643 76-33889
Reconnaissance geophysics of a known geothermal resource area, Weiser, Idaho, and Vale, Oregon
Long, C. L.; Kaufmann, H. E.
Soc. Explor. Geophys., Annu. Int. Meet., Abstr. 45, 31-32 p., 1975
CODEN: SGAMB7
Subfile: B
Doc Type: SERIAL Bibliographic Level: ANALYTIC
Languages: English
Descriptors: *United States; *geophysical methods; *geothermal energy ; geophysical surveys; methods ; Washington County; Malheur County; surveys; Idaho; Weiser; Oregon; Vale; magnetotelluric methods; audio-magnetotelluric methods; Earth-current methods; interpretation; techniques; maps; applications; exploration; field studies ; 1974
Section Headings: 20 .(GEOPHYSICS, APPLIED)

807642 76-33888
A systematic program for geothermal exploration on the island of Hawaii
Furumoto, A. S.
Soc. Explor. Geophys., Annu. Int. Meet., Abstr. 45, 31p., 1975
CODEN: SGAMB7
Subfile: B
Doc Type: SERIAL Bibliographic Level: ANALYTIC
Languages: English
Descriptors: *Hawaii; *geophysical surveys; *geothermal energy ; surveys; United States ; Kilauea; exploration; programs; infrared surveys; airborne; electrical surveys; resistivity; ground; gravity surveys; magnetic surveys; seismic surveys; microearthquakes; structure; dikes; complexes
Section Headings: 20 .(GEOPHYSICS, APPLIED)

807640 76-33886
Application of MT-AMT in the Marysville, Montana, area
Stodt, J.; Peeples, W. J.; Rankin, D.; Reddy, I. K.
Soc. Explor. Geophys., Annu. Int. Meet., Abstr. 45, 30p., 1975
CODEN: SGAMB7
Subfile: B
Doc Type: SERIAL Bibliographic Level: ANALYTIC
Languages: English
Descriptors: *Montana; *geophysical surveys; *geothermal energy ; magnetotelluric surveys; United States ; Lewis and Clark County; Marysville; audio-magnetotelluric surveys; ground; exploration; heat flow; anomalies; interpretation; 1974
Section Headings: 20 .(GEOPHYSICS, APPLIED)

807637 76-33883
Passive and active seismic studies and the geologic structure of the Boise Front, Idaho
Applegate, J. K.; Donaldson, P. R.
Soc. Explor. Geophys., Annu. Int. Meet., Abstr. 45, 29p., 1975
CODEN: SGAMB7
Subfile: B
Doc Type: SERIAL Bibliographic Level: ANALYTIC
Languages: English
Descriptors: *Idaho; *geophysical surveys; *geothermal energy; *tectonics ; seismic surveys; United States; structure ; Ada County; Snake River Plain; Boise; Boise Front; possibilities; exploration; refraction; earthquakes ; microearthquakes; faults; gravity anomalies; magnetic anomalies; aerial photography; active; passive
Section Headings: 20 .(GEOPHYSICS, APPLIED)

807636 76-33882
Integrated geophysics, Roosevelt hot springs
Olsen, T. L.; Sill, W. R.; Smith, R. B.
Soc. Explor. Geophys., Annu. Int. Meet., Abstr. 45, 28p., 1975
CODEN: SGAMB7
Subfile: B

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Doc Type: SERIAL Bibliographic Level: ANALYTIC
Languages: English
Descriptors: *Utah; *geophysical surveys; *geothermal energy ; *thermal waters; *springs ; surveys; United States ; Roosevelt Hot Springs; electrical surveys; resistivity; induced polarization; electromagnetic surveys; gravity surveys; magnetic surveys; interpretation; techniques; exploration; geophysical methods; earthquakes; microearthquakes; integrated; hot springs
Section Headings: 20 .(GEOPHYSICS, APPLIED)

807635 76-33881
Seismic refraction study in the Raft River geothermal area, Idaho
Ackermann, H. D.
Soc. Explor. Geophys., Annu. Int. Meet., Abstr. 45, 28p., 1975
CODEN: SGAMB7
Subfile: B
Doc Type: SERIAL Bibliographic Level: ANALYTIC
Languages: English
Descriptors: *Idaho; *geophysical surveys; *geothermal energy ; seismic surveys; United States ; Cassia County; south; Raft River Valley; refraction; exploration; structure; basement; depth; interpretation; geophysical methods; seismic methods
Section Headings: 20 .(GEOPHYSICS, APPLIED)

807634 76-33880
Exploring the Raft River geothermal area, Idaho, with the D.C. resistivity method
Zohdy, A. A. R.; Jackson, D. B.; Bisdorf, R. J.
Soc. Explor. Geophys., Annu. Int. Meet., Abstr. 45, 27-28 p., 1975
CODEN: SGAMB7
Subfile: B
Doc Type: SERIAL Bibliographic Level: ANALYTIC
Languages: English
Descriptors: *geothermal energy; *Idaho; *geophysical surveys ; United States; electrical surveys ; Cassia County ; Raft River Valley; exploration; geophysical methods; electrical methods; resistivity; interpretation; maps; drilling; temperature; recording; south; ground
Section Headings: 20 .(GEOPHYSICS, APPLIED)

806972 76-33218
Geothermal investigations in the San Luis Valley, south-central Colorado
Jordan, J. M.
Colorado Mines
unpaginatedp., 1974
Subfile: B
Degree Level: Master's
Doc Type: THESIS Bibliographic Level: MONOGRAPHIC
Languages: English
Descriptors: *Colorado; *geothermal energy; *geophysical surveys : economic geology; United States; surveys ; Saguache County; south-central; San Luis Valley; resources; exploration; evaluation; thermal waters; electrical surveys; electromagnetic surveys; ground; infrared surveys; airborne
Section Headings: 29 .(ECONOMIC GEOLOGY, ENERGY SOURCES)

805478 76-31724
Low-velocity zone under Long Valley as determined from teleseismic events
Steeples, D. W.; Iyer, H. M.
U. S. Geol. Surv., Menlo Park, Calif., USA
J. Geophys. Res. 81: 5, 849-860p., 1976
CODEN: JGREA2
Subfile: B
Doc Type: SERIAL Bibliographic Level: ANALYTIC
Languages: English
Note: Part of the U. S. Geological Survey's geothermal research program in Long Valley, California, 1972-1973, illus., tables
Descriptors: *California; *geophysical surveys; *geothermal energy ; seismic surveys; United States ; Mono County; Long Valley; teleseismic; P-waves; delays; residual; traveltime; velocity; anomalies; techniques; models; interpretation; temperature; applications; exploration; low-velocity zone; methods; seismic methods
Section Headings: 20 .(GEOPHYSICS, APPLIED)

805476 76-31722
Seismic noise survey in Long Valley, California
Iyer, H. M.; Hitchcock, T.
U. S. Geol. Surv., Menlo Park, Calif., USA
J. Geophys. Res. 81: 5, 821-840p., 1976
CODEN: JGREA2
Subfile: B
Doc Type: SERIAL Bibliographic Level: ANALYTIC
Languages: English
Note: Part of the U. S. Geological Survey's geothermal research program in Long Valley, California, 1972-1973, illus., tables, sketch maps
Descriptors: *California; *geophysical surveys; *geothermal energy ; seismic surveys; United States ; Mono County; Long Valley; Long Valley Caldera; Owens River Basin; surface waves; arrays; noise; anomalies; sources; velocity; techniques; data; applications; exploration
Section Headings: 20 .(GEOPHYSICS, APPLIED)

805475 76-31721
Deep electrical investigations in the Long Valley geothermal area, California
Stanley, W. D.; Jackson, D. B.; Zohdy, A. A. R.
U. S. Geol. Surv., Denver, Colo., USA
J. Geophys. Res. 81: 5, 810-820p., 1976
CODEN: JGREA2
Subfile: B
Country of Publ.: United States
Doc Type: SERIAL Bibliographic Level: ANALYTIC
Languages: English
Note: Part of the U. S. Geological Survey's geothermal research program in Long Valley, California, 1972-1973, illus., sketch maps
Descriptors: *California; *geophysical surveys; *geothermal energy ; electrical surveys; United States ; Mono County; Long Valley; Long Valley Caldera; Casa Diablo; Whitmore; direct-current; electromagnetic surveys; resistivity; electrical conductivity; fractures; thermal waters; reservoirs; exploration
Section Headings: 20 .(GEOPHYSICS, APPLIED)

805474 76-31720
Audiomagnetotelluric sounding as a reconnaissance exploration technique in Long Valley, California
Hoover, D. B.; Frischknecht, F. C.; Tippens, C. L.
U. S. Geol. Surv., Denver, Colo., USA
J. Geophys. Res. 81: 5, 801-809p., 1976
CODEN: JGREA2
Subfile: B
Doc Type: SERIAL Bibliographic Level: ANALYTIC
Languages: English
Note: Part of the U. S. Geological Survey's geothermal reserach program in Long Valley, California, 1972-1973, illus., sketch maps
Descriptors: *California; *geophysical surveys; *geothermal energy ; magnetotelluric surveys; United States ; Mono County; Long Valley; sounding; electrical conductivity; resistivity; methods; techniques; applications; exploration
Section Headings: 20 .(GEOPHYSICS, APPLIED)

805472 76-31718
Convective heat flow from hot springs in the Long Valley Caldera, Mono County, California
Sorey, M. L.; Lewis, R. E.
U. S. Geol. Surv., Menlo Park, Calif., USA
J. Geophys. Res. 81: 5, 785-791p., 1976
CODEN: JGREA2
Subfile: B
Doc Type: SERIAL Bibliographic Level: ANALYTIC
Languages: English
Note: Part of the U. S. Geological Survey's geothermal research program in Long Valley, California, 1972-1973, illus., tables, sketch map
Descriptors: *California; *heat flow; *thermal waters; *geothermal energy ; geophysical surveys; United States ; Mono County; Long Valley; Long Valley Caldera; hot springs; distribution; temperature; chemical composition; movement; convection; conduction; models; measurement; exploration
Section Headings: 20 .(GEOPHYSICS, APPLIED)

805471 76-31717
Geothermal setting and simple heat conduction models for the Long Valley Caldera
Lachenbruch, A. H.; Sass, J. H.; Munroe, R. J.; Moses, T. H., Jr.
U. S. Geol. Surv., Menlo Park, Calif., USA
J. Geophys. Res. 81: 5, 769-784p., 1976
CODEN: JGREA2
Subfile: B
Doc Type: SERIAL Bibliographic Level: ANALYTIC
Languages: English
Note: Part of the U. S. Geological Survey's geothermal research program in Long Valley, California, 1972-1973, illus., tables, geol. sketch map
Descriptors: *California; *heat flow; *magmas; *geothermal energy ; geophysical surveys; United States; evolution ; Mono County; Long Valley; Long Valley Caldera; measurement; regional patterns; conductivity; sources; magma chambers; temperature; depth; exploration
Section Headings: 20 .(GEOPHYSICS, APPLIED)

805469 76-31715
A gravity and magnetic investigation of the Long Valley Caldera, Mono County, California
Kane, M. F.; Mabey, D. R.; Brace, R.-L.
J. Geophys. Res. 81: 5, 754-762p., 1976
CODEN: JGREA2
Subfile: B
Doc Type: SERIAL Bibliographic Level: ANALYTIC
Languages: English
Note: Part of the U. S. Geological Survey's geothermal research program in Long Valley, California, 1972-1973, illus., geol. sketch maps
Descriptors: *California; *geophysical surveys; *geothermal energy ; surveys; United States ; Mono County; gravity surveys; magnetic surveys; Long Valley; Long Valley Caldera ; airborne; anomalies; interpretation; lithology; sediments; clastics; terrigenous; metamorphic rocks; metasedimentary; igneous rocks; volcanic; intrusions; magma chambers; applications; exploration
Section Headings: 20 .(GEOPHYSICS, APPLIED)

DIALOG File 89: GEOREF - 29-84/Nov (Copr. American Geological Institute)

805159 76-31405
Contributo allo studio geofisico del Bacino Euganeo
Geophysical study of the Euganean Basin
Amadei, G.; Maino, A.; Motta, A.; Tribalto, G.
Italy, Serv. Geol., Boll. 93, (1972), 3-21p., 1973
CODEN: BOSGAF
Subfile: B
Doc Type: SERIAL Bibliographic Level: ANALYTIC
Languages: Italian Summary Languages: English
illus., table; geophys. surv. maps
Descriptors: *maps; *Italy; *geophysical surveys ; Europe; surveys : Euganean Hills; Euganean Basin; structure; lithology; possibilities; geothermal energy; electrical surveys; gravity surveys; exploration
Section Headings: 20 .(GEOPHYSICS, APPLIED)

804471 76-30717
Geothermal project, Indonesia
Mahon, W. A. J.
N. Z. Geochem. Group, Newsl. 32: Special geothermal issue, 86-87p., 1973
CODEN: NZGNBG
Subfile: B
Doc Type: SERIAL Bibliographic Level: ANALYTIC
Languages: English
Descriptors: *Indonesia; *geothermal energy ; economic geology; Asia ; Java; Kawah Kamojang; Darajat; CiSolok-CiSukarame; resources; exploration; surveys; geophysical surveys; geochemical surveys
Section Headings: 29 .(ECONOMIC GEOLOGY, ENERGY SOURCES)

803644 76-29890
Geothermal exploration in Ethiopia
Lloyd, E. F.
N. Z. Geochem. Group, Newsl. 28: Third special volcanological issue, 82-83p., 1972
CODEN: NZGNBG
Subfile: B
Country of Publ.: New Zealand
Doc Type: SERIAL Bibliographic Level: ANALYTIC
Languages: English
Descriptors: *Ethiopia; *geothermal energy ; economic geology; Africa ; Lake District; Afar; Danakil Depression; Erta'ale Volcano; Tendaho Graben; Allellobeda; resources; exploration; hot springs; surveys; geophysical surveys; programs
Section Headings: 29 .(ECONOMIC GEOLOGY, ENERGY SOURCES)

803549 76-29795
Analysis of magnetic anomalies over Yellowstone National Park; mapping of Curie point isothermal surface for geothermal reconnaissance
Bhattacharyya, B. K.; Leu, L.-K.
Univ. Calif., Dep. Mater. Sci. & Eng., Berkeley, Calif., USA
J. Geophys. Res. 80: 32, 4461-4465p., 1975
CODEN: JGREA2
Subfile: B
Doc Type: SERIAL Bibliographic Level: ANALYTIC
Languages: English
illus., sketch maps
Descriptors: *Wyoming; *geophysical surveys : magnetic surveys ; Yellowstone National Park; United States; airborne; anomalies; techniques; mapping; Curie point; isotherms; interpretation; applications; exploration; geothermal energy
Section Headings: 20 .(GEOPHYSICS, APPLIED)

802700 76-28946
Search for geothermal seismic noise in the East Mesa area, Imperial Valley, California
Iyer, H. M.
U. S. Geol. Surv., Menlo Park, Calif., USA
Geophysics 40: 6, 1066-1072p., 1975
CODEN: GPYSA7
Subfile: B
Doc Type: SERIAL Bibliographic Level: ANALYTIC
Languages: English
illus., sketch maps
Descriptors: *California; *geophysical methods; *geothermal energy ; geophysical surveys; seismic methods; United States ; Imperial County; seismic surveys; south; Imperial Valley; interpretation; noise; anomalies; heat flow; geothermal areas; experimental studies; field studies; applications; exploration
Section Headings: 20 .(GEOPHYSICS, APPLIED)

801077 76-27323
Contribution of heat flow measurements to thermal resource investigations in Sarasota County, Florida
Smith, D. L.
Univ. Fla., Dep. Geol., Gainesville, Fla., USA
Fla. Sci. 39, Supplement 1: 40th annu. mtg. Fla. Acad. Sci., program issue, 26p., 1976
CODEN: FLSCAQ
Subfile: B
Doc Type: SERIAL Bibliographic Level: ANALYTIC
Languages: English
Descriptors: *Florida; *heat flow; *geothermal energy ; geophysical surveys; United States ; Sarasota County; south

(cont. next page)

; geothermal gradient; variations; measurement; applications; exploration; methods; geophysical methods
Section Headings: 20 .(GEOPHYSICS, APPLIED)

801073 76-27319
Gravimetric studies, Sarasota/Charlotte/DeSoto counties
Johns, R. K.
Fla. Sci. 39, Supplement 1: 40th annu. mtg. Fla. Acad. Sci., program issue, 25p., 1976
CODEN: FLSCAQ
Subfile: B
Country of Publ.: United States
Doc Type: SERIAL Bibliographic Level: ANALYTIC
Languages: English
Descriptors: *Florida; *geophysical surveys; *geothermal energy ; gravity surveys; United States ; Charlotte County; DeSoto County; Sarasota County; south; Gulf Coastal Plain; Bouguer anomalies; exploration; geophysical methods; gravity methods
Section Headings: 20 .(GEOPHYSICS, APPLIED)

799839 76-26085
Geothermal exploration with the telluric-magnetotelluric method in northern Iceland
Thayer, R.; Hermance, J. F.
Geophysics 40: 1: Soc. Explor. Geophys., 44th annu. int. meet., 177p., 1975
CODEN: GPYSA7
Subfile: B
Country of Publ.: United States
Doc Type: SERIAL Bibliographic Level: ANALYTIC
Languages: English
Descriptors: *Iceland; *geophysical methods; *geothermal energy ; geophysical surveys; methods; Europe ; Earth-current surveys; magnetotelluric surveys; north; earth-current methods; magnetotelluric methods; ground; interpretation; models; mathematical models; exploration
Section Headings: 20 .(GEOPHYSICS, APPLIED)

799832 76-26078
Deep electrical-resistivity investigations coupled with ''dry'' geothermal experiments in New Mexico
Jiracek, G.; Kintzinger, P. R.
Geophysics 40: 1: Soc. Explor. Geophys., 44th annu. int. meet., 175p., 1975
CODEN: GPYSA7
Subfile: B
Country of Publ.: United States
Doc Type: SERIAL Bibliographic Level: ANALYTIC
Languages: English
Descriptors: *New Mexico; *geothermal energy; *geophysical methods ; geophysical surveys; United States; electrical methods ; Sandoval County; electrical surveys; Valle Grande Mountains; Jemez Mountains; exploration; resistivity; deep ; hot rocks; dry rocks; temperature; techniques; bipole-dipole; dipole-dipole; ground
Section Headings: 20 .(GEOPHYSICS, APPLIED)

799831 76-26077
Toward estimating a regional geothermal resource base for Iceland; a status report
Hermance, J. F.; Thayer, R.; Bjornsson, A.
Geophysics 40: 1: Soc. Explor. Geophys., 44th annu. int. meet., 174-175p., 1975
CODEN: GPYSA7
Subfile: B
Doc Type: SERIAL Bibliographic Level: ANALYTIC
Languages: English
Descriptors: *Iceland; *geophysical methods; *geothermal energy ; geophysical surveys; electrical methods; Europe ; electrical surveys; regional; interpretation; techniques; resistivity; programs; exploration; north-central; possibilities
Section Headings: 20 .(GEOPHYSICS, APPLIED)

799827 76-26073
Electrical exploration of geothermal systems in north central Nevada
Beyer, H.; Morrison, H. F.; Dey, A.
Geophysics 40: 1: Soc. Explor. Geophys., 44th annu. int. meet., 174p., 1975
CODEN: GPYSA7
Subfile: B
Doc Type: SERIAL Bibliographic Level: ANALYTIC
Languages: English
Descriptors: *Nevada; *geophysical methods; *geothermal energy ; geophysical surveys; electrical methods; United States ; electrical surveys; north-central; interpretation; resistivity; automatic data processing; models; two-dimensional; exploration; programs
Section Headings: 20 .(GEOPHYSICS, APPLIED)

798228 76-24474
Seismic noise survey at Solfatara Crater, Phlegraean Fields, Italy
Cappello, P.; Lo Bascio, A.; Luongo, G.
Geothermics 3: 2, 76-80p., 1974
CODEN: GTMCAT
Subfile: B
Doc Type: SERIAL Bibliographic Level: ANALYTIC
Languages: English
illus., sketch maps
Descriptors: *Italy; *geophysical surveys; *geothermal energy ; seismic surveys; Europe ; Phlegraean Fields; Solfatara Crater; relation; spectra; amplitude; distribution; frequency; temperature; rock mechanics;
(cont. next page)

applications; exploration; fumaroles
Section Headings: 20 .(GEOPHYSICS, APPLIED)

797334 76-23580
Geophysical evidence for the availability of geothermal energy in New Britain
Wiebenga, W. A.; Furumoto, A. S.
Hawaii, Univ., Inst. Geophys., Contrib. 1974, 661-675p., 1975
CODEN: HUGCAH
Subfile: B
Doc Type: SERIAL Bibliographic Level: ANALYTIC
Languages: English
Note: With discussion, Contrib. No. 636; reprint from ''The utilization of volcano, energy'', by Colp, John L. (ed.) and Furumoto, Augustine S., (ed.), 1974, illus., sketch maps
Descriptors: *Papua New Guinea; *geophysical surveys; *geothermal energy ; surveys; Australasia ; gravity surveys ; seismic surveys; New Britain; Bouguer anomalies; marine; ground; anomalies; exploration; geophysical methods
Section Headings: 29 .(ECONOMIC GEOLOGY, ENERGY SOURCES)

790955 76-17201
Preliminary gravity maps of the Vale area, Malheur County, Oregon
Larson, K.; Couch, R.
Univ. Oreg., Dep. Geol., USA; Oreg. State Univ.
Ore Bin 37: 8, 138-142p., 1975
CODEN: ORBIAW
Subfile: B
Country of Publ.: United States
Doc Type: SERIAL Bibliographic Level: ANALYTIC
Languages: English
sketch maps
Descriptors: *Oregon; *geophysical surveys; *geothermal energy; *maps ; gravity surveys; United States ; Malheur County; Vale; ground; applications; preliminary report; anomalies; free-air; Bouguer; gravity anomalies; free-air anomalies; Bouguer anomalies; resources; exploration
Section Headings: 20 .(GEOPHYSICS, APPLIED)

790953 76-17199
Geophysical measurements in the Vale, Oregon, geothermal resource area
Couch, R.; French, W. S.; Gemperle, M.; Johnson, A.
Oreg. State Univ., Geophys. Group, Corvallis, Oreg., USA
Ore Bin 37: 8, 125-129p., 1975
CODEN: ORBIAW
Subfile: B
Doc Type: SERIAL Bibliographic Level: ANALYTIC
Languages: English
sketch maps
Descriptors: *Oregon; *geophysical surveys; *geothermal energy ; surveys; United States ; Vale; seismic surveys; gravity surveys; magnetic surveys; ground; measurement; applications; exploration; resources
Section Headings: 20 .(GEOPHYSICS, APPLIED)

779076 76-05322
Geophysical exploration on the structure of volcanoes; two case histories
Furumoto, A. S.
Univ. Hawaii, Hawaii, USA
The utilization of volcano energy
Colp, John L.(EDITOR); Furumoto, Augustine S.(EDITOR)
Publ: Sandia Lab.
41-58p., 1974
Subfile: B
Country of Publ.: United States
Doc Type: BOOK Bibliographic Level: ANALYTIC
Languages: English
Note: Includes a panel discussion of the paper, illus., sketch maps
Descriptors: *volcanology; *Hawaii; *Papua New Guinea; *geophysical surveys ; volcanoes; surveys; seismology ; United States; Koolau; Malay Archipelago; Rabaul; structure; plugs; faults; block; geothermal energy; Australasia; gravity surveys; seismic surveys; applications
Section Headings: 19 .(GEOPHYSICS, SEISMOLOGY)

764955 75-31702
Bonneville Salt Flats; a possible geothermal area?
Whelan, J. A.; Petersen, C. A.
Utah Geol. Miner. Surv., Salt Lake City, Utah, USA
Utah Geol. 1: 1, 71-82p., 1974
CODEN: UTGEDQ
Subfile: B
Doc Type: SERIAL Bibliographic Level: ANALYTIC
Languages: English
illus., tables, geol. sketch map
Descriptors: *geothermal energy; *Utah; *heat flow; *geophysical surveys; *hydrology; *springs ; United States; hydrogeology; surveys; ground water ; Bonneville Salt Flats ; Silver Island Range; exploration; possibilities; thermal waters; magnetic surveys; gravity surveys; aquifers; artesian waters; temperature; recharge; discharge; relation; stratigraphy; lithostratigraphy; structural geology; geothermal gradient; data
Section Headings: 21 .(HYDROGEOLOGY AND HYDROLOGY)

764388 75-30320
Exploration geophysical techniques carried out in the Ixtlan and Los Negritos geothermal areas, Mexico
Del Castillo, G. L.
Univ. Nac. Aut. Mexico, Inst. Geof., Mexico City, MEX
Int. Assoc. Eng. Geol., Int. Congr., Proc. 2, Vol. 2, VII

(cont. next page)

5.1-VII 5.9p., 1974
CODEN: 29ZJA9
Subfile: B
Doc Type: SERIAL Bibliographic Level: ANALYTIC
Languages: English Summary Languages: French
illus., sketch maps
Descriptors: *Mexico; *geophysical surveys; *geothermal energy ; surveys ; Michoacan; Ixtlan; Los Negritos; gravity surveys; magnetic surveys; seismic surveys; ground; exploration; methods
Section Headings: 20 .(GEOPHYSICS, APPLIED)

763329 75-29117
Mapping thermal anomalies on an active volcano by the self-potential method, Kilauea, Hawaii
Zablocki, Charles J.
U.S. Geol. Surv., Hawaii, USA
Second United Nations symposium on the development and use of geothermal resources. San Francisco, Calif., United States, May 20-29, 1975
U. N. Symp. Dev. Use Geotherm. Resour., Abstr. 2, unpaginatedp., 1975
Subfile: B
Doc Type: SERIAL; CONFERENCE PUBLICATION Bibliographic Level: ANALYTIC
Languages: English
Descriptors: *Hawaii; *geophysical methods; *geothermal energy ; geophysical surveys; electrical methods; United States ; electrical surveys; Kilauea; self-potential; measurement; anomalies; exploration; magmas; volcanoes; mapping
Section Headings: 20 .(GEOPHYSICS, APPLIED)

763325 75-29113
Geological and geophysical studies of a geothermal area in the southern Raft river valley, Idaho
Williams, Paul L.; Mabey, Don R.; Pierce, Kenneth L.; Zohdy, Adel A. R.; Ackermann, Hans; Hoover, D. B.
U.S. Geol. Surv., Denver Fed. Cent., Denver, USA
Second United Nations symposium on the development and use of geothermal resources, San Francisco, Calif., United States, May 20-29, 1975
U. N. Symp. Dev. Use Geotherm. Resour., Abstr. 2, unpaginatedp., 1975
Subfile: B
Doc Type: SERIAL; CONFERENCE PUBLICATION Bibliographic Level: ANALYTIC
Languages: English
Descriptors: *Idaho; *geophysical surveys; *tectonics; *Cenozoic; *geothermal energy; *sedimentary rocks ; areal geology; structure; surveys; United States; clastics; terrigenous ; Cassia County; structural geology; economic geology; stratigraphy; Raft River Valley; folds; faults; evolution; gravity surveys; magnetic surveys; electrical surveys; seismic surveys; exploration; resources; composition; clasts; pyroclastics; conglomerate; lithostratigraphy
Section Headings: 13 .(AREAL GEOLOGY, GENERAL)

763324 75-29112
Assessment of the audio-magnetotelluric method for geothermal resistivity surveying
Whiteford, Peter C.
Dep. Sci. Ind. Res., Geophys. Div., Wellington, NZL
Second United Nations symposium on the development and use of geothermal resources, San Francisco, Calif., United States, May 20-29, 1975
U. N. Symp. Dev. Use Geotherm. Resour., Abstr. 2, unpaginatedp., 1975
Subfile: B
Doc Type: SERIAL; CONFERENCE PUBLICATION Bibliographic Level: ANALYTIC
Languages: English
Descriptors: *New Zealand; *geophysical methods; *geothermal energy ; geophysical surveys; magnetotelluric methods; Australasia ; magnetotelluric surveys; Broadlands; audiomagnetotelluric methods; measurement; resistivity; instruments; applications; reservoirs; exploration .
Section Headings: 20 .(GEOPHYSICS, APPLIED)

763323 75-29111
Studies of the propagation and source location of geothermal seismic noise
Whiteford, Peter C.
Dep. Sci. Ind. Res., Geophys. Div., Wellington, NZL
Second United Nations symposium on the development and use of geothermal resources, San Francisco, Calif., United States, May 20-29, 1975
U. N. Symp. Dev. Use Geotherm. Resour., Abstr. 2, unpaginatedp., 1975
Subfile: B
Doc Type: SERIAL; CONFERENCE PUBLICATION Bibliographic Level: ANALYTIC
Languages: English
Descriptors: *New Zealand; *geophysical surveys; *geothermal energy ; seismic surveys; Australasia ; Wairakei; Waiotapu ; seismic noise; propagation; sources; exploration; resources
Section Headings: 20 .(GEOPHYSICS, APPLIED)

763322 75-29110
Electromagnetic soundings in the geothermal environment
Ward, S. H.; Rijo, L.; Petrick, W. R.
Univ. Utah, Salt Lake City, USA
Second United Nations symposium on the development and use of geothermal resources, San Francisco, Calif., United States, May 20-29, 1975

(cont. next page)

U. N. Symp. Dev. Use Geotherm. Resour., Abstr. 2, unpaginatedp., 1975
Subfile: B
Doc Type: SERIAL; CONFERENCE PUBLICATION Bibliographic Level: ANALYTIC
Languages: English
Descriptors: *Utah; *geophysical surveys ; electromagnetic surveys ; Roosevelt Hot Spring; United States; interpretation; sounding; data; experimental studies; exploration; geothermal energy
Section Headings: 20 .(GEOPHYSICS, APPLIED)

763318 75-29106
Geophysical studies in Saraykoy-Kizildere geothermal field, Turkey
Tezcan, A. K.
Maden Tektik ve Arama Enst., Ankara, TUR
Second United Nations symposium on the development and use of geothermal resources. San Francisco, Calif., United States, May 20-29, 1975
U. N. Symp. Dev. Use Geotherm. Resour., Abstr. 2, unpaginatedp., 1975
Subfile: B
Doc Type: SERIAL; CONFERENCE PUBLICATION Bibliographic Level: ANALYTIC
Languages: English
Descriptors: *Turkey; *geophysical surveys; *geothermal energy ; surveys; Middle East ; Saraykoy; Kizildere; gravity surveys; electrical surveys; exploration; reservoirs; steam; thermal waters
Section Headings: 20 .(GEOPHYSICS, APPLIED)

763317 75-29105
The Mesa geothermal anomaly, Imperial Valley, California; a comparison and evaluation of results obtained from surface geophysics and deep drilling
Swanberg, Chandler A.
N. M. State Univ., Las Cruces, USA
Second United Nations symposium on the development and use of geothermal resources, San Francisco, Calif., United States, May 20-29, 1975
U. N. Symp. Dev. Use Geotherm. Resour., Abstr. 2, unpaginatedp., 1975
Subfile: B
Doc Type: SERIAL; CONFERENCE PUBLICATION Bibliographic Level: ANALYTIC
Languages: English
Descriptors: *California; *geothermal energy; *heat flow; *thermal waters ; economic geology; United States ; Imperial Valley; Mesa Anomaly; exploration; geophysical surveys; drilling; anomalies; geothermal gradient; correlation; wells; reservoirs; sedimentary rocks; geochemistry; properties
Section Headings: 29 .(ECONOMIC GEOLOGY, ENERGY SOURCES)

763316 75-29104
A comparative study of hot-water chemistry and bedrock resistivity in the southern lowlands of Iceland
Stefansson, Valgardur; Arnorsson, Stefan
Natl. Energy Auth., Reykjavik, ISL
Second United Nations symposium on the development and use of geothermal resources. San Francisco, Calif., United States, May 20-29, 1975
U. N. Symp. Dev. Use Geotherm. Resour., Abstr. 2, unpaginatedp., 1975
Subfile: B
Doc Type: SERIAL; CONFERENCE PUBLICATION Bibliographic Level: ANALYTIC
Languages: English
Descriptors: *Iceland; *geothermal energy; *geophysical surveys; *thermal waters ; economic geology; Europe; electrical surveys ; south; exploration; geochemical surveys; resources; resistivity; igneous rocks; correlation; geochemistry; ratios; Cl/B
Section Headings: 29 .(ECONOMIC GEOLOGY, ENERGY SOURCES)

763311 75-29099
The detection of buried zones of fractured rock in geothermal fields using resistivity anisotropy measurements
Risk, George F.
Dep. Sci. Ind. Res., Geophys. Div., Wellington, NZL
Second United Nations symposium on the development and use of geothermal resources. San Francisco, Calif., United States, May 20-29, 1975
U. N. Symp. Dev. Use Geotherm. Resour., Abstr. 2, unpaginatedp., 1975
Subfile: B
Doc Type: SERIAL; CONFERENCE PUBLICATION Bibliographic Level: ANALYTIC
Languages: English
Descriptors: *New Zealand; *geophysical methods ; geophysical surveys; electrical methods ; electrical surveys ; Broadlands; measurement; resistivity; anisotropy; rocks ; fractures; exploration; geothermal energy; experimental studies; Australasia
Section Headings: 20 .(GEOPHYSICS, APPLIED)

763310 75-29098
Accurate location of the boundary of the Broadlands geothermal field, New Zealand
Risk, George F.
Dep. Sci. Ind. Res., Geophys. Div., Wellington, NZL
Second United Nations symposium on the development and use of geothermal resources, San Francisco, Calif., United States, May 20-29, 1975
U. N. Symp. Dev. Use Geotherm. Resour., Abstr. 2,
(cont. next page)

unpaginatedp., 1975
Subfile: B
Doc Type: SERIAL; CONFERENCE PUBLICATION Bibliographic Level: ANALYTIC
Languages: English
Descriptors: *New Zealand; *well-logging ; geophysical surveys; electrical ; Broadlands; induced polarization; resistivity; exploration; geothermal energy; Australasia
Section Headings: 20 .(GEOPHYSICS, APPLIED)

763305 75-29093
An evaluation of geothermal potential by resistivity sounding curves
Onodera, Seibe
Kyushu Univ., Dep. Min.,, Fukuoka, JPN
Second United Nations symposium on the development and use of geothermal resources, San Francisco, Calif., United States, May 20-29, 1975
U. N. Symp. Dev. Use Geotherm. Resour., Abstr. 2, unpaginatedp., 1975
Subfile: B
Doc Type: SERIAL; CONFERENCE PUBLICATION Bibliographic Level: ANALYTIC
Languages: English
Descriptors: *Japan; *geophysical surveys; *geothermal energy ; electrical surveys; Asia ; Otake; West Kirishima Field; evaluation; resistivity; measurement; regional; exploration; production; possibilities
Section Headings: 20 .(GEOPHYSICS, APPLIED)

763303 75-29090
Canada; early stages of geothermal investigation in British Columbia
Nevin, Andrew E.
Nevin Sadlier-Brown Goodbrand Ltd. Vancouver, B. C., CAN
Second United Nations symposium on the development and use of geothermal resources, San Francisco, Calif., United States, May 20-29, 1975
U. N. Symp. Dev. Use Geotherm. Resour., Abstr. 2, unpaginatedp., 1975
Subfile: B
Doc Type: SERIAL; CONFERENCE PUBLICATION Bibliographic Level: ANALYTIC
Languages: English
Descriptors: *British Columbia; *geothermal energy ; economic geology; Canada ; southwest; exploration; geophysical surveys; programs; geochemistry; igneous rocks; reservoir rocks; properties
Section Headings: 29 .(ECONOMIC GEOLOGY, ENERGY SOURCES)

763299 75-29086
Predictive regionalization of geothermal potential
McEuen, Robert B.; Birkhahn, Phillip C.; Pinckney, Charles J.
Second United Nations symposium on the development and use of geothermal resources, San Francisco, Calif., United States, May 20-29, 1975
U. N. Symp. Dev. Use Geotherm. Resour., Abstr. 2, unpaginatedp., 1975
Subfile: B
Doc Type: SERIAL; CONFERENCE PUBLICATION Bibliographic Level: ANALYTIC
Languages: English
Descriptors: *Washington; *geothermal energy ; economic geology; United States ; Cascade Range; Skamania County; Klickitat County; exploration; geophysical surveys; geochemistry; resources; regional planning; prediction
Section Headings: 29 .(ECONOMIC GEOLOGY, ENERGY SOURCES)

763292 75-29079
Electrical resistivity and microearthquake surveys of the Sempaya, Lake Kitagata geothermal anomalies, western Uganda
Maasha, Ntungwa
Columbia Univ., Lamont-Doherty Geol. Obs., Palisades, N. Y., USA
Second United Nations symposium on the development and use of geothermal resources, San Francisco, Calif., United States, May 20-29, 1975
U. N. Symp. Dev. Use Geotherm. Resour., Abstr. 2, unpaginatedp., 1975
Subfile: B
Doc Type: SERIAL; CONFERENCE PUBLICATION Bibliographic Level: ANALYTIC
Languages: English
Descriptors: *Uganda; *geophysical surveys; *geothermal energy; *springs ; electrical surveys; Africa ; Lake Kitagata; Sempaya; anomalies; resistivity; microearthquakes; noise; exploration; resources; hot springs
Section Headings: 20 .(GEOPHYSICS, APPLIED)

763282 75-29069
Deep geothermal exploration in New Mexico using electrical resistivity
Jiracek, George R.
Univ. N. M., Dep. Geol., Albuquerque, USA
Second United Nations symposium on the development and use of geothermal resources, San Francisco, Calif., United States, May 20-29, 1975
U. N. Symp. Dev. Use Geotherm. Resour., Abstr. 2, unpaginatedp., 1975
Subfile: B

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DIALOG File 89: GEOREF - 29-84/Nov (Copr. American Geological Institute)

Doc Type: SERIAL; CONFERENCE PUBLICATION Bibliographic Level: ANALYTIC
Languages: English
Descriptors: *New Mexico; *geophysical surveys ; electrical surveys ; Jemez Mountains; Valles Caldera; United States; anomalies; resistivity; boreholes; hot dry-rock; dipole-dipole; exploration; resources; geothermal energy
Section Headings: 20 .(GEOPHYSICS, APPLIED)

763281 75-29068
Geothermal exploration of the Parbati Valley geothermal field, Kulu District, Himachal Pradesh, India
Jangi, B. L.; Prakash, Gyan; Pathak, C. S.; Thussu, J. L.
Ind., Geol. Surv., Lucknow, Uttar Pradesh, IND
Second United Nations symposium on the development and use of geothermal resources, San Francisco, Calif., United States, May 20-29, 1975
U. N. Symp. Dev. Use Geotherm. Resour., Abstr. 2, unpaginatedp., 1975
Subfile: B
Doc Type: SERIAL; CONFERENCE PUBLICATION Bibliographic Level: ANALYTIC
Languages: English
Descriptors: *India; *geophysical surveys; *geothermal energy; *springs ; electrical surveys; Asia ; Himachal Pradesh; Kulu; Parbati Valley; Manikaran; Kasol; exploration; boreholes; hot springs; geochemistry; geothermal gradient; resources
Section Headings: 20 .(GEOPHYSICS, APPLIED)

763279 75-29066
Seismic noise as a geothermal exploration tool; techniques and results
Iyer, H. M.; Hitchcock, Tim
U. S. Geol. Surv., Menlo Park, Calif., USA
Second United Nations symposium on the development and use of geothermal resources, San Francisco, Calif., United States, May 20-29, 1975
U. N. Symp. Dev. Use Geotherm. Resour., Abstr. 2, unpaginatedp., 1975
Subfile: B
Doc Type: SERIAL; CONFERENCE PUBLICATION Bibliographic Level: ANALYTIC
Languages: English
Descriptors: *United States; *geophysical surveys ; seismic surveys ; California; The Geysers; Imperial Valley; Long Valley; Wyoming; Yellowstone National Park; anomalies; noise; exploration; geothermal energy; techniques
Section Headings: 20 .(GEOPHYSICS, APPLIED)

763278 75-29065
Gravity and magnetic studies of The Geysers-Clear Lake geothermal region, California
Isherwood, William F.
U. S. Geol. Surv., Denver Fed. Cent., Denver, Colo., USA
Second United Nations symposium on the development and use of geothermal resources, San Francisco, Calif., United States, May 20-29, 1975
U. N. Symp. Dev. Use Geotherm. Resour., Abstr. 2, unpaginatedp., 1975
Subfile: B
Doc Type: SERIAL; CONFERENCE PUBLICATION Bibliographic Level: ANALYTIC
Languages: English
Descriptors: *California; *geophysical surveys; *automatic data processing ; surveys ; Clear Lake; The Geysers; Mount Hannah; Boggs Mountains; United States; gravity surveys; magnetic surveys; airborne; exploration; geothermal energy; applications
Section Headings: 20 .(GEOPHYSICS, APPLIED)

763277 75-29064
Audio-magnetotelluric methods in reconnaissance geothermal exploration
Hoover, D. B.; Long, C. L.
U. S. Geol. Surv., Theoret. Appl. Geophys., Denver, Colo., USA
Second United Nations symposium on the development and use of geothermal resources, San Francisco, Calif., United States, May 20-29, 1975
U. N. Symp. Dev. Use Geotherm. Resour., Abstr. 2, unpaginatedp., 1975
Subfile: B
Doc Type: SERIAL; CONFERENCE PUBLICATION Bibliographic Level: ANALYTIC
Languages: English
Descriptors: *geophysical methods; *United States; *geophysical surveys ; magnetotelluric methods; surveys ; audiomagnetotelluric methods; applications; exploration; geothermal energy; California; Long Valley; Surprise Valley ; Idaho; Bruneau-Grand View; Raft River; Island Park; magnetic surveys; gravity surveys; telluric surveys
Section Headings: 20 .(GEOPHYSICS, APPLIED)

763276 75-29063
Comparison of satellite and airborne infrared line scanning of Ethiopia for geothermal exploration
Hodder, David T.
Second United Nations symposium on the development and use of geothermal resources, San Francisco, Calif., United States, May 20-29, 1975

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U. N. Symp. Dev. Use Geotherm. Resour., Abstr. 2, unpaginatedp., 1975
Subfile: B
Doc Type: SERIAL; CONFERENCE PUBLICATION Bibliographic Level: ANALYTIC
Languages: English
Descriptors: *Ethiopia; *geophysical surveys; *geothermal energy ; infrared surveys; Africa ; Danakil; anomalies; thermal; airborne; satellite; remote sensing; exploration
Section Headings: 20 .(GEOPHYSICS, APPLIED)

763275 75-29062
Geophysical exploration of the Kawah Kamojang geothermal field (West-Java)
Hochstein, Manfred P.
Univ. Auckland, Geol. Dep., Auckland, NZL
Second United Nations symposium on the development and use of geothermal resources, San Francisco, Calif., United States, May 20-29, 1975
U. N. Symp. Dev. Use Geotherm. Resour., Abstr. 2, unpaginatedp., 1975
Subfile: B
Doc Type: SERIAL; CONFERENCE PUBLICATION Bibliographic Level: ANALYTIC
Languages: English
Descriptors: *Indonesia; *geophysical surveys; *geothermal energy; *well-logging ; electrical surveys; Asia; electrical ; Java; Kawah Kamojang; measurement; direct-current; resistivity; boreholes; exploration; resources; thermal waters; steam; reservoirs
Section Headings: 20 .(GEOPHYSICS, APPLIED)

763274 75-29061
Geophysical exploration of the El Tatio geothermal field (northern Chile)
Hochstein, Manfred P.
Univ. Auckland, Geol. Dep., Auckland, NZL
Second United Nations symposium on the development and use of geothermal resources, San Francisco, Calif., United States, May 20-29, 1975
U. N. Symp. Dev. Use Geotherm. Resour., Abstr. 2, unpaginatedp., 1975
Subfile: B
Doc Type: SERIAL; CONFERENCE PUBLICATION Bibliographic Level: ANALYTIC
Languages: English
Descriptors: *Chile; *geophysical surveys; *geothermal energy ; electrical surveys; South America ; north; El Tatio; measurement; resistivity; exploration; springs; reservoirs
Section Headings: 20 .(GEOPHYSICS, APPLIED)

763268 75-29055
D.C. resistivity studies in the Puga geothermal field, Himalayas, India
Gupta, Mohan L.; Singh, S. B.; Rao, G. V.
Natl. Geophys. Res. Inst., Hyderabad, IND
Second United Nations symposium on the development and use of geothermal resources, San Francisco, Calif., United States, May 20-29, 1975
U. N. Symp. Dev. Use Geotherm. Resour., Abstr. 2, unpaginatedp., 1975
Subfile: B
Doc Type: SERIAL; CONFERENCE PUBLICATION Bibliographic Level: ANALYTIC
Languages: English
Descriptors: *India; *well-logging; *geothermal energy ; geophysical surveys; electrical; Asia ; electrical surveys; Himalayas; Fuga Hot Spring Valley; resistivity; direct current; boreholes; exploration; resources; hot springs
Section Headings: 20 .(GEOPHYSICS, APPLIED)

763266 75-29053
Geoelectric study of the geothermal zone of Cerro Prieto, Baja California, Mexico
Garcia Duran, Salvador
Com. Fed. Electr., Mexico City, MEX
Second United Nations symposium on the development and use of geothermal resources, San Francisco, Calif., United States, May 20-29, 1975
U. N. Symp. Dev. Use Geotherm. Resour., Abstr. 2, unpaginatedp., 1975
Subfile: B
Doc Type: SERIAL; CONFERENCE PUBLICATION Bibliographic Level: ANALYTIC
Languages: English
Descriptors: *Mexico; *geophysical surveys; *geothermal energy ; electrical surveys ; Baja California; Cerro Prieto ; Mexicali Valley; measurement; resistivity; dipole-dipole ; exploration; resources
Section Headings: 20 .(GEOPHYSICS, APPLIED)

763265 75-29052
A coordinated exploration program for geothermal sources on the island of Hawaii
Furumoto, Augustine S.
Univ. Hawaii, Honolulu, USA
Second United Nations symposium on the development and use of geothermal resources, San Francisco, Calif., United States, May 20-29, 1975
U. N. Symp. Dev. Use Geotherm. Resour., Abstr. 2, unpaginatedp., 1975
Subfile: B

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Doc Type: SERIAL; CONFERENCE PUBLICATION Bibliographic Level: ANALYTIC
Languages: English
Descriptors: *Hawaii; *geothermal energy; *geophysical surveys ; economic geology; United States; surveys ; Kilauea; exploration; geochemistry; drilling; resources; thermal waters; magnetic surveys; gravity surveys; seismic surveys; electrical surveys; airborne; ground
Section Headings: 29 .(ECONOMIC GEOLOGY, ENERGY SOURCES)

763264 75-29051
Rotating dipole surveys; an improved dipole method for measuring earth resistivity in geothermal exploration
Furgerson, Robert B.
Argonant Enterp., Denver, Colo., USA
Second United Nations symposium on the development and use of geothermal resources, San Francisco, Calif., United States, May 20-29, 1975
U. N. Symp. Dev. Use Geotherm. Resour., Abstr. 2, unpaginatedp., 1975
Subfile: B
Doc Type: SERIAL; CONFERENCE PUBLICATION Bibliographic Level: ANALYTIC
Languages: English
Descriptors: *California; *geophysical methods; *geothermal energy ; geophysical surveys; electrical methods; United States ; electrical surveys; Coso Hot Springs; measurement; resistivity; dipole; rotating; experimental studies; field studies; models; exploration; resources; hot springs
Section Headings: 20 .(GEOPHYSICS, APPLIED)

763255 75-29042
The detection of near-surface thermal anomalies using microwave radiometry
England, A. W.; Johnson, Gordon R.
U. S. Geol. Surv., Denver, Colo., USA
Second United Nations symposium on the development and use of geothermal resources, San Francisco, Calif., United States, May 20-29, 1975
U. N. Symp. Dev. Use Geotherm. Resour., Abstr. 2, unpaginatedp., 1975
Subfile: B
Doc Type: SERIAL; CONFERENCE PUBLICATION Bibliographic Level: ANALYTIC
Languages: English
Descriptors: *geophysical methods; *geothermal energy ; methods; exploration ; microwave radiometry; detection; anomalies; thermal; near-surface; techniques; mathematical models; radiobrightness; soils; resources; geophysical surveys
Section Headings: 20 .(GEOPHYSICS, APPLIED)

763247 75-29034
Self-potential exploration for geothermal reservoirs
Corwin, R. F.
Univ. Calif. Berkeley, Calif., USA
Second United Nations symposium on the development and use of geothermal resources, San Francisco, Calif., United States, May 20-29, 1975
U. N. Symp. Dev. Use Geotherm. Resour., Abstr. 2, unpaginatedp., 1975
Subfile: B
Doc Type: SERIAL; CONFERENCE PUBLICATION Bibliographic Level: ANALYTIC
Languages: English
Descriptors: *geophysical methods; *Nevada ; electrical methods; geophysical surveys ; experimental studies; exploration; self-potential; thermo-electric; geothermal energy; ground water; United States; electrical surveys; north-central
Section Headings: 20 .(GEOPHYSICS, APPLIED)

763246 75-29033
Geological and geophysical exploration of the Marysville geothermal area
Blackwell, D. D.; Morgan, Paul
South. Meth. Univ., Dep. Geol. Sci., Dallas, Texas, USA
Second United Nations symposium on the development and use of geothermal resources, San Francisco, Calif., United States, May 20-29, 1975
U. N. Symp. Dev. Use Geotherm. Resour., Abstr. 2, unpaginatedp., 1975
Subfile: B
Doc Type: SERIAL; CONFERENCE PUBLICATION Bibliographic Level: ANALYTIC
Languages: English
Descriptors: *Montana; *geophysical surveys; *geothermal energy ; surveys; United States ; Lewis and Clark County; Marysville; electrical surveys; seismic surveys; heat flow; ground; anomalies; reservoir rocks; exploration; drilling ; igneous rocks; structure; water; flow
Section Headings: 20 .(GEOPHYSICS, APPLIED)

763243 75-29030
Geophysical prospecting applied to the discovery of the Cesena geothermal field (northern Latium, Italy)
Cameli, G.; Mouton, J.; Scandellari, F.
ENEL, Centro di Ric. Geoterm., Pisa, ITA; Cia. Mediterr. Prospezioni
Second United Nations symposium on the development and use of geothermal resources, San Francisco, Calif., United States, May 20-29, 1975
U. N. Symp. Dev. Use Geotherm. Resour., Abstr. 2,

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unpaginatedp., 1975
Subfile: B
Doc Type: SERIAL; CONFERENCE PUBLICATION Bibliographic Level: ANALYTIC
Languages: English
Descriptors: *Italy; *geophysical surveys; *geothermal energy ; surveys; Europe ; Latium; Cesena; gravity surveys; magnetic surveys; electrical surveys; conductivity ; clay; igneous rocks; volcanic; exploration; resources
Section Headings: 20 .(GEOPHYSICS, APPLIED)

763241 75-29028
Heat discharge, shallow temperature and gravimetric surveys at northern Kurikoma geothermal area, Northeast Japan
Baba, Kenzo
Jap., Geol. Surv., Kawasaki-shi, JPN
Second United Nations symposium on the development and use of geothermal resources, San Francisco, Calif., United States, May 20-29, 1975
U. N. Symp. Dev. Use Geotherm. Resour., Abstr. 2, unpaginatedp., 1975
Subfile: B
Doc Type: SERIAL; CONFERENCE PUBLICATION Bibliographic Level: ANALYTIC
Languages: English
Descriptors: *Japan; *geophysical surveys; *springs ; gravity surveys; Asia ; northeast; Kurikoma; Oyasu; Ohyu; Kawarake; Arayu; Yunotai; anomalies; structure; discharge; heat; reservoir rocks; shallow; hot springs; exploration; resources; geothermal energy
Section Headings: 20 .(GEOPHYSICS, APPLIED)

763237 75-29024
Field and laboratory determination of thermal diffusivity in some basalts and sediments from Hawaii
Adams, W. M.; Watts, G. P.
Univ. Hawaii Honolulu, Hawaii, USA
Second United Nations symposium on the development and use of geothermal resources, San Francisco, Calif., United States, May 20-29, 1975
U. N. Symp. Dev. Use Geotherm. Resour., Abstr. 2, unpaginatedp., 1975
Subfile: B
Doc Type: SERIAL; CONFERENCE PUBLICATION Bibliographic Level: ANALYTIC
Languages: English
Descriptors: *geophysics; *Hawaii ; experimental studies; geophysical surveys ; thermal conductivity; basalt; sediments; diffusivity; applications; exploration; geothermal energy; heat flow; United States; Mauna Kea
Section Headings: 17 .(GEOPHYSICS, GENERAL)

763222 75-29009
Hydrogeological aspects of Ahuachapan geothermal field, El Salvador
Romagnoli, P.; Cataldi, R.; Cuellar, G.; Ghezzi, G.; Jimenez, M.
ELC-Electroconsult, Milan, ITA
Second United Nations symposium on the development and use of geothermal resources, San Francisco, Calif., United States, May 20-29, 1975
U. N. Symp. Dev. Use Geotherm. Resour., Abstr. 2, unpaginatedp., 1975
Subfile: B
Doc Type: SERIAL; CONFERENCE PUBLICATION Bibliographic Level: ANALYTIC
Languages: English
Descriptors: *El Salvador; *thermal waters; *igneous rocks; *Quaternary ; hydrogeology; Central America; andesite-rhyolite family ; Ahuachapan; exploration; geochemistry; geophysical surveys; reservoir rocks; geothermal energy; andesite; distribution; volcanism; Pleistocene; Ahuachopan Andesite
Section Headings: 21 .(HYDROGEOLOGY AND HYDROLOGY)

763217 75-29004
Geothermal energy explorations in Turkey
Alpan, S.
Miner. Res. Explor. Inst. Turkey, Ankara, TUR
Second United Nations symposium on the development and use of geothermal resources, San Francisco, Calif., United States, May 20-29, 1975
U. N. Symp. Dev. Use Geotherm. Resour., Abstr. 2, unpaginatedp., 1975
Subfile: B
Doc Type: SERIAL; CONFERENCE PUBLICATION Bibliographic Level: ANALYTIC
Languages: English
Descriptors: *Turkey; *geothermal energy; *springs; *thermal waters; *water resources ; economic geology; Middle East ; regional; exploration; surveys; geophysical surveys; geochemistry; drilling; inventory; thermal springs; production; effects; environment; hot springs
Section Headings: 29 .(ECONOMIC GEOLOGY, ENERGY SOURCES)

763199 75-28986
Possible geothermal resources in southern British Columbia
Lewis, Trevor; Judge, A. S.; Jessop, A. M.
Dep. Energy, Mines and Resour., Earth Phys. Br., Ottawa, CAN
Second United Nations symposium on the development and use of geothermal resources, San Francisco, Calif., United States, May 20-29, 1975
U. N. Symp. Dev. Use Geotherm. Resour., Abstr. 2,
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unpaginatedp., 1975
Subfile: B
Doc Type: SERIAL; CONFERENCE PUBLICATION Bibliographic Level: ANALYTIC
Languages: English
Descriptors: *British Columbia; *geothermal energy; *heat flow ; economic geology; Canada ; south; exploration; distribution; occurrence; resources; areal geology; structure; tectonics; geophysical surveys; possibilities
Section Headings: 29 .(ECONOMIC GEOLOGY, ENERGY SOURCES)

763196 75-28983
A review of Indian geothermal provinces and their potential for energy utilisation
Krishnaswamy, V. S.
Geol. Surv. India, Lucknow, Uttar Pradesh, IND
Second United Nations symposium on the development and use of geothermal resources, San Francisco, Calif., United States, May 20-29, 1975
U. N. Symp. Dev. Use Geotherm. Resour., Abstr. 2, unpaginatedp., 1975
Subfile: B
Doc Type: SERIAL; CONFERENCE PUBLICATION Bibliographic Level: ANALYTIC
Languages: English
Descriptors: *India; *geothermal energy; *geophysical surveys ; economic geology; Asia; surveys ; regional; exploration; production; utilization; seismic surveys; gravity surveys; heat flow; applications
Section Headings: 29 .(ECONOMIC GEOLOGY, ENERGY SOURCES)

763194 75-28981
Geothermal exploration in Kenya
Noble, John W.; Ojiambo, Sebastian B.
E.A. Power & Lighting Co. Ltd., Nairobi, KEN
Second United Nations symposium on the development and use of geothermal resources, San Francisco, Calif., United States, May 20-29, 1975
U. N. Symp. Dev. Use Geotherm. Resour., Abstr. 2, unpaginatedp., 1975
Subfile: B
Doc Type: SERIAL; CONFERENCE PUBLICATION Bibliographic Level: ANALYTIC
Languages: English
Descriptors: *Kenya; *geothermal energy; *thermal waters ; economic geology; Africa ; Rift Valley; Olkaria; Lake Naivasha; exploration; areal geology; hydrogeology; geophysical surveys; geochemistry; resources; reservoir rocks; possibilities; utilization
Section Headings: 29 .(ECONOMIC GEOLOGY, ENERGY SOURCES)

763190 75-28977
Overview of geothermal energy studies in Indonesia
Radja, Vincent
Power Res. Inst., Jakarta, IDN
Second United Nations symposium on the development and use of geothermal resources, San Francisco, Calif., United States, May 20-29, 1975
U. N. Symp. Dev. Use Geotherm. Resour., Abstr. 2, unpaginatedp., 1975
Subfile: B
Doc Type: SERIAL; CONFERENCE PUBLICATION Bibliographic Level: ANALYTIC
Languages: English
Descriptors: *Indonesia; *geothermal energy ; economic geology; Asia ; Java; Kawah Kamojang; Dieng Mountains; exploration; drilling; maps; geophysical surveys; geochemistry; review
Section Headings: 29 .(ECONOMIC GEOLOGY, ENERGY SOURCES)

763187 75-28974
The Kawah Kamojang Geothermal Field
Pardyanto, Liek; Alzwar, Muzil
Geol. Surv. Indonesia, Pertamina, IDN
Second United Nations symposium on the development and use of geothermal resources, San Francisco, Calif., United States, May 20-29, 1975
U. N. Symp. Dev. Use Geotherm. Resour., Abstr. 2, unpaginatedp., 1975
Subfile: B
Doc Type: SERIAL; CONFERENCE PUBLICATION Bibliographic Level: ANALYTIC
Languages: English
Descriptors: *Indonesia; *geothermal energy; *geophysical surveys; *thermal waters ; economic geology; Asia; electrical surveys ; Kawah Kamojang; exploration; drilling; geochemistry; possibilities; hot springs; fumaroles; structure; igneous rocks; volcanic
Section Headings: 29 .(ECONOMIC GEOLOGY, ENERGY SOURCES)

763185 75-28972
Geothermal studies in Australia
Thomas, Lindsay
Univ. Melbourne, Parkville, Victoria, AUS
Second United Nations symposium on the development and use of geothermal resources, San Francisco, Calif., United States, May 20-29, 1975
U. N. Symp. Dev. Use Geotherm. Resour., Abstr. 2, unpaginatedp., 1975
Subfile: B
Doc Type: SERIAL; CONFERENCE PUBLICATION Bibliographic Level: ANALYTIC

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Languages: English
Descriptors: *Victoria; *geothermal energy ; economic geology; Australia ; west; exploration; geophysical surveys; heat flow; resistivity; possibilities; programs
Section Headings: 29 .(ECONOMIC GEOLOGY, ENERGY SOURCES)

763176 75-28963
Regional sand distribution of the Frio Formation (Oligocene); a preliminary study in the search for geothermal energy in South Texas
Bebout, D. G.; Agagu, O. K.
Univ. Tex., Austin, Tex., USA
Second United Nations symposium on the development and use of geothermal resources, San Francisco, Calif., United States, May 20-29, 1975
U. N. Symp. Dev. Use Geotherm. Resour.,. Abstr. 2, unpaginatedp., 1975
Subfile: B
Doc Type: SERIAL; CONFERENCE PUBLICATION Bibliographic Level: ANALYTIC
Languages: English
Note: Foraminifera, biostratigraphy, Oligocene,
Descriptors: *Texas; *geothermal energy; *Oligocene; *sedimentation; *foraminifera ; economic geology; United States; processes; biostratigraphy ; Cameron County; Willacy County; Nueces County; Frio Formation; exploration; possibilities; reservoir rocks; analysis; lithofacies; thickness; sandstone; deposition; subsidence; environment; marine; drilling; cores; geophysical surveys; south
Section Headings: 29 .(ECONOMIC GEOLOGY, ENERGY SOURCES)

763175 75-28962
Preliminary report on the Cesano hot brine deposit (northern Latium, Italy)
Calamai, A.; Cataldi, R.; Ferrara, Giancarlo
Enel-Centro Riceca Geoterm., Pisa, ITA
Second United Nations symposium on the development and use of geothermal resources, San Francisco, Calif., United States, May 20-29, 1975
U. N. Symp. Dev. Use Geotherm. Resour., Abstr. 2, unpaginatedp., 1975
Subfile: B
Doc Type: SERIAL; CONFERENCE PUBLICATION Bibliographic Level: ANALYTIC
Languages: English
Descriptors: *Italy; *geothermal energy; *thermal waters; *geophysical surveys ; economic geology; Europe; surveys ; Latium; Cesano; Cesano-1; exploration; drilling; brines; heat flow; chemical analysis; resources; gravity surveys; electrical surveys; wells
Section Headings: 29 .(ECONOMIC GEOLOGY, ENERGY SOURCES)

763172 75-28959
Reykholar, West Iceland; a low temperaure area controlled by vertical dykes
Bjornsson, A.; Gronvold, Karl
Natl. Energy Auth., Reykjavik, ISL
Second United Nations symposium on the development and use of geothermal resources, San Francisco, Calif., United States, May 20-29, 1975
U. N. Symp. Dev. Use Geotherm. Resour., Abstr. 2, unpaginatedp., 1975
Subfile: B
Doc Type: SERIAL; CONFERENCE PUBLICATION Bibliographic Level: ANALYTIC
Languages: English
Descriptors: *Iceland; *geothermal energy; *thermal waters; *ground water; *geophysical surveys; *springs ; economic geology; Europe; aquifers; surveys ; west; Reykholar; exploration; drilling; hot springs; reservoir rocks; wells ; well-logging; movement; controls; structural controls; pumping; resources; electrical surveys; magnetic surveys; applications; maps; geochemistry
Section Headings: 29 .(ECONOMIC GEOLOGY, ENERGY SOURCES)

763168 75-28955
Geothermal research in western Campania (southern Italy); geological and geophysical results
Cameli, G.; Puxeddu, Mariano; Rendina, Michele; Rossi, Aristide; Squarci, Paolo; Taffi, Learco
ENEL, Centro Ricerca Geoterm., Pisa, ITA; CNR, Inst. Int. Ricerche Geoterm.
Second United Nations symposium on the development and use of geothermal resources, San Francisco, Calif., United States, May 20-29, 1975
U. N. Symp. Dev. Use Geotherm. Resour., Abstr. 2, unpaginatedp., 1975
Subfile: B
Doc Type: SERIAL; CONFERENCE PUBLICATION Bibliographic Level: ANALYTIC
Languages: English
Descriptors: *Italy; *geothermal energy; *geophysical surveys ; economic geology; Europe; surveys ; south; Campania; Phlegraean Fields; exploration; resources; drilling; gravity surveys; electrical surveys; magnetotelluric surveys; infrared surveys
Section Headings: 29 .(ECONOMIC GEOLOGY, ENERGY SOURCES)

763167 75-28954
On a possibility of heat utilization of the Avachinsky volcanic chamber
Fedotov, Sergey A.; Balesta, Stanislav T.; Droznin, Valery A.; Masurenkov, Yury P.; Sugrobov, Victor M.
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Inst. Volcanol., Petropavlosk-Kamchatsky, SUN
Second United Nations symposium on the development and use of geothermal resources, San Francisco, Calif., United States, May 20-29, 1975
U. N. Symp. Dev. Use Geotherm. Resour., Abstr. 2, unpaginatedp., 1975
Subfile: B
Doc Type: SERIAL; CONFERENCE PUBLICATION Bibliographic Level: ANALYTIC
Languages: English
Descriptors: *USSR; *geothermal energy; *geophysical surveys ; economic geology; surveys ; Kamchatka; Avachinsky Volcano; exploration; resources; volcanoes; gravity surveys; magnetic surveys; seismic surveys; temperature; heat sources; utilization; magma chambers
Section Headings: 29 .(ECONOMIC GEOLOGY, ENERGY SOURCES)

763150 75-28937
Geothermal energy possibilities, their exploration and evaluation in Turkey
Kurtman, F.; Samilgil, E.
M.T.A. Petrol. Sb., Ankara, TUR
Second United Nations symposium on the development and use of geothermal resources, San Francisco, Calif., United States, May 20-29, 1975
U. N. Symp. Dev. Use Geotherm. Resour., Abstr. 2, unpaginatedp., 1975
Subfile: B
Doc Type: SERIAL; CONFERENCE PUBLICATION Bibliographic Level: ANALYTIC
Languages: English
Descriptors: *Turkey; *geothermal energy; *thermal waters ; economic geology; Middle East ; Anatolia; Afyon; Gecek; Denizli; Kizildere; Izmir; Seferihisar; exploration; evolution; resources; possibilities; geophysical surveys; geochemistry; drilling
Section Headings: 29 .(ECONOMIC GEOLOGY, ENERGY SOURCES)

763144 75-28931
A preliminary report on the structural geology of the Cerro Prieto geothermal field, B. C., Mexico
Paredes A., Eduardo
Secr. Recursos Hidraulicos, Mexicali, MEX
Second United Nations symposium on the development and use of geothermal resources, San Francisco, Calif., United States, May 20-29, 1975
U. N. Symp. Dev. Use Geotherm. Resour., Abstr. 2, unpaginatedp., 1975
Subfile: B
Doc Type: SERIAL; CONFERENCE PUBLICATION Bibliographic Level: ANALYTIC
Languages: English
Descriptors: *Mexico; *faults; *geothermal energy ; structural geology; effects ; Baja California; Cerro Prieto ; heat flow; lithology; exploration; drilling; production ; steam; geophysical surveys; reservoir rocks
Section Headings: 16 .(STRUCTURAL GEOLOGY)

763143 75-28930
Tuzla geothermal field, Canakkale, Turkey
Ongur, Tahir
M.T.A., Ankara, TUR
Second United Nations symposium on the development and use of geothermal resources, San Francisco, Calif., United States, May 20-29, 1975
U. N. Symp. Dev. Use Geotherm. Resour., Abstr. 2, unpaginatedp., 1975
Subfile: B
Doc Type: SERIAL; CONFERENCE PUBLICATION Bibliographic Level: ANALYTIC
Languages: English
Descriptors: *Turkey; *geothermal energy; *thermal waters; *springs; *igneous rocks; *Pliocene ; economic geology; Middle East; volcanic ; Anatolia; Canakkale; Tuzla Geothermal Field; exploration; drilling; areal geology; geochemical surveys; geophysical surveys; hot springs; chemical analysis; resources; andesite-rhyolite family; dacite; quartz latite; reservoir rocks; lithofacies
Section Headings: 29 .(ECONOMIC GEOLOGY, ENERGY SOURCES)

761140 75-26911
Geoelectric-geothermal exploration on Hawaii island; preliminary results
Klein, Douglas P.; Kauahikaua, James P.
Hawaii, Univ., Inst. Geophys., [Rep.] 75-6, 23p., 1975
CODEN: HIGRAC
Subfile: B
Doc Type: SERIAL Bibliographic Level: MONOGRAPHIC
Languages: English
Geothermal resources exploration in Hawaii; No. 2, illus., tables, sketch maps
Descriptors: *Hawaii; *geophysical surveys; *geothermal energy ; electrical surveys; United States ; Hawaii Island; dipole-dipole; resistivity; anomalies; depth; soundings; exploration; resources
Section Headings: 29 .(ECONOMIC GEOLOGY, ENERGY SOURCES)

757207 75-22978
Heat flow and radioactivity studies in Colorado and Utah, 1971-1972
Hallin, James S.
1973
Subfile: B
Degree Level: Master's
Doc Type: THESIS
Languages: English
Descriptors: *Colorado; *Geophysical surveys; *Heat flow;

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DIALOG File 89: GEOREF - 29-84/Nov (Copr. American Geological Institute)

*Utah ; radioactivity surveys; United States : Rocky Mountains; Colorado Plateau; Cisco; boreholes; geothermal energy; exploration; measurement; 1971-1972
Section Headings: 18 .(GEOPHYSICS, SOLID EARTH)

757059 75-22830
Geophysical exploration of the northern Hachimantai Geothermal Field
Yora, Mitsuo; Ito, Junji.
Min. Geol. (Soc. Min. Geol. Jap.) Vol. 24, Part 2, No. 124, p. 149-156 (Jap.; Engl. sum.), sketch maps, 1974
CODEN: KOZCAZ
Subfile: B
Doc Type: SERIAL
Languages: Japanese
Descriptors: *Japan; *Geothermal energy ; Economic geology; Asia ; Akita; Iwate; Hachimantai Geothermal Field; exploration; extent; geophysical surveys; gravity surveys; anomalies; thermal waters; genesis; volcanic; utilization
Section Headings: 29 .(ECONOMIC GEOLOGY, ENERGY SOURCES)

755267 75-21038
A brief description of geological and geophysical exploration of the Marysville geothermal area
Blackwell, D. D.; Brott, C. A.; Goforth, T. T.; Holdaway, M. J.; Morgan, P.; Petefish, D.; Rape, T.; Steele, J. L.; Spafford, R. E.; Waibel, A. F.
in Conference on Research for the Development of Geothermal Energy Resources (see Nakamura, Yukio); Resources exploration and assessment, p. 98-110, illus. (incl. geol. sketch map),
Calif. Inst. Technol., Jet Propul. Lab.--Natl. Sci. Found. Pasadena, California, Washington, D. C., 1974
Subfile: B
Languages: English
Descriptors: *Montana; *Geothermal energy; *Geophysical surveys; *Precambrian; *Phanerozoic ; Economic geology; Surveys; United States ; Lewis and Clark County; Marysville ; infrared surveys; airborne; gravity surveys; magnetic surveys; heat flow; seismic surveys; ground noise; microseisms; electrical surveys; dipole-dipole; resistivity ; magnetotelluric surveys; audio-magnetotelluric surveys; anomalies; sedimentary rocks; igneous rocks; Helena Limestone; Empire Shale; intrusions; granitic; Cretaceous; Cenozoic; exploration; remote sensing; models; Spokane Shale; Marsh Shale; Greenhorn Quartzite; Black Mountain Quartzite
Section Headings: 29 .(ECONOMIC GEOLOGY, ENERGY SOURCES)

755265 75-21036
The Colorado School of Mines Nevada geothermal study
Keller, G. V.; Grose, L. T.; Crewdson, R. A.
in Conference on Research for the Development of Geothermal Energy Resources (see Nakamura, Yukio); Resources exploration and assessment, p. 73-84, illus. (incl. geol. sketch map),
Calif. Inst. Technol., Jet Propul. Lab.--Natl. Sci. Found. Pasadena, California, Washington, D. C., 1974
Subfile: B
Languages: English
Descriptors: *Nevada; *Thermal waters; *geothermal energy; *Geophysical surveys ; Hydrogeology; United States; Surveys ; Fly Ranch; hot springs; indicators; systems; faults; active; infrared surveys; electrical surveys; resistivity; airborne; heat flow; exploration; remote sensing; microseisms; South Willow Formation
Section Headings: 21 .(HYDROGEOLOGY AND HYDROLOGY)

746110 75-11880
Geophysics of Colorado and geothermal energy
Keller, George V.
in Proceedings of a Symposium on Geothermal Energy and Colorado,
Colo. Geol. Surv., Bull. No. 35, p. 31-43, illus. (incl. sketch maps), 1974
CODEN: CGBLB3
Subfile: B
Doc Type: SERIAL
Languages: English
Descriptors: *Colorado; *Geothermal energy ; Economic geology; United States ; exploration; thermal waters; springs; heat flow; geophysical surveys; gravity surveys; electrical surveys; resistivity; seismicity
Section Headings: 29 .(ECONOMIC GEOLOGY, ENERGY SOURCES)

739242 75-04637
Exploration at a ''blind'' geothermal area near Marysville, Montana[abstr.]
Blackwell, D. D.
Am. Assoc. Pet. Geol., Soc. Econ. Paleontol. Mineral., Annu. Mtg. Abstr. Vol. 1, p. 8-9, 1974
CODEN: APGAB2
Subfile: B
Doc Type: SERIAL
Languages: English
Descriptors: *Montana; *Geothermal energy ; Economic geology; United States ; Marysville; exploration; blind; heat flow; geophysical surveys; microearthquakes; boreholes ; Lewis and Clark County
Section Headings: 29 .(ECONOMIC GEOLOGY, ENERGY SOURCES)

737098 75-02492
Geophysical Investigations for Geothermal Energy Sources, Imperial Valley, California; Phase 1, 1968 Field Project
Meidav, Tsvi; Rex, Robert W.
Calif. Univ. (Riverside), Inst. Geophys. Planet. Phys., Tech. Rep. No. 3, 54 p., illus. (incl. sketch maps), 1970
CODEN: CGPPAG

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Subfile: B
Doc Type: SERIAL
Languages: English
Descriptors: *California; *Geothermal energy; *Geophysical surveys; *Heat flow ; Economic geology; United States; Surveys ; Imperial Valley; exploration; resources; geothermal gradient; temperature; depth; profiles; maps; Quaternary; magnetic surveys; Bouguer electrical surveys; resistivity; interpretation; regional patterns
Section Headings: 29 .(ECONOMIC GEOLOGY, ENERGY SOURCES)

733835 74-38982
Thermal and Electrical Resistivity Investigations of the Dunes Geothermal Anomaly, Imperial Valley, California [abstr.]
Black, W. E.; Nelson, J. S.; Combs, Jim.
In Fall Annual Meeting, San Francisco, 1973; Section of Volcanology, Geochemistry, and Petrology; Geothermal Resource Investigations; II, General Session,
Eos (Am. Geophys. Union, Trans.) Vol. 54, No. 11, p. 1214, 1973
CODEN: EOSTAJ
Subfile: B
Doc Type: SERIAL
Languages: English
Descriptors: *California; *Geophysical surveys; *heat flow; *Geothermal energy ; Electrical surveys; United States ; south; Imperial Valley; Dunes Geothermal Anomaly; measurement; geothermal gradient; anomalies; relation; faults; San Andreas Fault; ground; resistivity; exploration; structure; temperature
Section Headings: 18 .(GEOPHYSICS, SOLID EARTH)

733832 74-38979
Heat Flow Studies in the State of Oregon [abstr.]
Bowen, Richard G.; Blackwell, David D.
In Fall Annual Meeting, San Francisco, 1973; Section of Volcanology, Geochemistry, and Petrology; Geothermal Resource Investigations; II, General Session,
Eos (Am. Geophys. Union, Trans.) Vol. 54, No. 11, p. 1213, 1973
CODEN: EOSTAJ
Subfile: B
Doc Type: SERIAL
Languages: English
Descriptors: *Oregon; *Heat flow; *geothermal energy ; Geophysical surveys; United States ; west; measurement; deep; shallow; conductivity; anomalies; exploration; regional patterns; possibilities
Section Headings: 18 .(GEOPHYSICS, SOLID EARTH)

733828 74-38975
The application of the self-potential method in the exploration for geothermal energy in Long Valley, California [abstr.]
Anderson, Lennart A.; Johnson, Gordon R.
In Fall Annual Meeting, San Francisco, 1973; Section of Volcanology, Geochemistry, and Petrology; Geothermal resource investigation; I, Long Valley Symposium,
Eos (Am. Geophys. Union, Trans.) Vol. 54, No. 11, p. 1212, 1973
CODEN: EOSTAJ
Subfile: B
Doc Type: SERIAL
Languages: English
Descriptors: *California; *Geophysical surveys; *Geothermal energy ; Electrical surveys ; United States ; east; Mono County; Long Valley; Casa Diablo; anomalies; relation; thermal waters; movement; ground water; self potential; exploration; geophysical methods; hot springs
Section Headings: 18 .(GEOPHYSICS, SOLID EARTH)

733827 74-38974
Audio-magnetotelluric sounding as a reconnaissance exploration technique in Long Valley, California [abstr.]
Hoover, Donald B.; Frischknecht, Frank C.; Tippens, Charles L.
In Fall Annual Meeting, San Francisco, 1973; Section of Volcanology, Geochemistry, and Petrology; Geothermal resource investigation; I, Long Valley Symposium,
Eos (Am. Geophys. Union, Trans.) Vol. 54, No. 11, p. 1212, 1973
CODEN: EOSTAJ
Subfile: B
Doc Type: SERIAL
Languages: English
Descriptors: *California; *Geophysical surveys; *Geothermal energy ; Magnetotelluric surveys; United States ; east; Mono County; Long Valley; audio-magnetotelluric; experimental studies; resistivity; anomalies; depth; relation; thermal waters; hot springs; exploration; geophysical methods
Section Headings: 18 .(GEOPHYSICS, SOLID EARTH)

733826 74-38973
Direct current and electromagnetic soundings in Long Valley, California [abstr.]
Jackson, Dallas B.; Stanley, William D.; Zohdy, Adel A. R.
In Fall Annual Meeting, San Francisco, 1973; Section of Volcanology, Geochemistry, and Petrology; Geothermal resource investigation; I, Long Valley Symposium,
Eos (Am. Geophys. Union, Trans.) Vol. 54, No. 11, p. 1212,

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1973
CODEN: EOSTAJ
Subfile: B
Doc Type: SERIAL
Languages: English
Descriptors: *California; *Geophysical surveys; *Geothermal energy ; Surveys; United States ; Electrical surveys; electromagnetic surveys; east; Mono County; Long Valley; ground; anomalies; depth; structure; resistivity; exploration
Section Headings: 18 .(GEOPHYSICS, SOLID EARTH)

733825 74-38972
A total-field resistivity map of Long Valley, California [abstr.]
Stanley, William D.; Jackson, Dallas B.; Zohdy, Adel A. R.
in Fall Annual Meeting, San Francisco, 1973; Section of Volcanology, Geochemistry, and Petrology; Geothermal resource investigation; I, Long Valley Symposium,
Eos (Am. Geophys. Union, Trans.) Vol. 54, No. 11, p. 1212, 1973
CODEN: EOSTAJ
Subfile: B
Doc Type: SERIAL
Languages: English
Descriptors: *California; *Geophysical surveys; *Geothermal energy ; Electrical surveys; United States ; east; Mono County; Long Valley; ground; interpretation; structural geology; hydrothermal alteration; resistivity; exploration; structure
Section Headings: 18 .(GEOPHYSICS, SOLID EARTH)

731108 74-36255
Telluric current exploration for geothermal anomalies in Oregon
Bodvarsson, Gunnar; Couch, Richard W.; MacFarlane, William T.; Tank, Rex W.; Whitsett, Robert M.
Ore Bin Vol. 36, No. 6, p. 93-107, illus. (incl. geol. sketch map), 1974
CODEN: ORBIAW
Subfile: B
Doc Type: SERIAL
Languages: English
Descriptors: *Oregon; *Geophysical surveys ; Electrical surveys ; telluric surveys; Klamath Falls; United States; observations; anomalies; heat flow; indicators; possibilities; geothermal energy; ground
Section Headings: 18 .(GEOPHYSICS, SOLID EARTH)

725105 74-30246
Geophysical logs from the Kilauea geothermal research drill hole
Keller, George V.; Murray, John C.; Towle, Guy H.
Soc. Prof. Well Log Anal. Annu. Logging Symp., Trans. No. 15, p. L1-L17, illus. (incl. sketch map), 1974
CODEN: LGSTA6
Subfile: B
Doc Type: SERIAL
Languages: English
Descriptors: *Hawaii; *Well-logging; *Geothermal energy; *Igneous rocks ; Geophysical surveys; Interpretation; United States; Basalt family ; Hawaii County; Kilauea; Temperature; gamma-gamma; neutron; electrical; acoustical; exploration; drilling; Basalt; physical properties; porosity; density
Section Headings: 18 .(GEOPHYSICS, SOLID EARTH)

722937 74-28078
Airborne Thermal Infrared Scanning used for Geothermal Energy Exploration
De Donato, G.
Geothermal Energy Mag. Vol. 2, No. 4, p. 56, 1974
CODEN: GTEMAJ
Subfile: B
Doc Type: SERIAL
Languages: English
Descriptors: *Africa; *Geophysical surveys ; Infrared surveys ; Ethiopia; Kenya; side scanning; thermal; airborne; applications; exploration; geothermal energy; resources
Section Headings: 18 .(GEOPHYSICS, SOLID EARTH)

722767 74-27908
Iceland; preliminary results of geologic, hydrologic, oceanographic, and agricultural studies with ERTS-1 imagery
Williams, Richard S., Jr.; Boovarsson, Agust; Frioriksson, Sturla; Palmason, Guomundur; Rist, Sigurjon; Sigtryggsson, Hlynur; Saemundsson, Kristjan; Thorarinsson, Sigurour; Thorsteinsson, Ingvi.
in Management and Utilization of Remote Sensing Data, p. 17-35, illus. (incl. sketch maps),
Am. Soc. Photogramm. Falls Church, Virginia, 1973
Subfile: B
Languages: English
Descriptors: *Iceland; *volcanology; *marine geology; *geophysical surveys; *Geothermal energy; *Glacial geology ; Areal geology; Europe; Volcanism; Atlantic Ocean; Glacial features; Surveys ; Economic geology; geomorphology; ERTS-1; exploration; remote sensing; Eruptions; satellite
Section Headings: 13 .(AREAL GEOLOGY, GENERAL)

717157 74-22293
Terrestrial heat flow and its implications on the location of geothermal reservoirs in Washington
Blackwell, David D.
in Energy resources of Washington,
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Wash., Div. Mines Geol., Inf. Circ. No. 50, p. 21-33, sketch maps, 1974
CODEN: WCMCAI
Subfile: B
Doc Type: SERIAL
Languages: English
Descriptors: *Washington; *Heat flow; *Geothermal energy ; Geophysical surveys; United States ; anomalies; geothermal gradient; regional patterns; measurement; Cenozoic; resources; exploration; possibilities
Section Headings: 18 .(GEOPHYSICS, SOLID EARTH)

705014 74-10131
Total-field resistivity mapping--Levantamiento del campo resistivo total [abstr.]
Zohdy, Adel A. R.
Soc. Explor. Geophys., Annu. Int. Mtg. No. 43, p. 50-51 (Engl.), p. 52 (Span.), 1973
CODEN: SGAMB7
Subfile: B
Doc Type: SERIAL
Languages: English; Spanish
Asoc. Mex. Geofis. Explor. Mtg., No. 5,
Descriptors: *Geophysical methods; *California ; Electrical methods; Geophysical surveys ; Interpretation; resistivity; total field; evaluation; applications; exploration; geothermal energy; United States; Long Valley; Electrical surveys; Mono County
Section Headings: 18 .(GEOPHYSICS, SOLID EARTH)

704997 74-10114
Microearthquakes and seismic ground noise mapping; conjunctive geothermal exploration tool--Cartografiado de microtemblores de tierra y del ruido de la tierra-una herramienta conjunta de la exploracion geotermica [abstr.]
Bailey, John R.
Soc. Explor. Geophys., Annu. Int. Mtg. No. 43, p. 43 (Engl.), p. 44 (Span.), 1973
CODEN: SGAMB7
Subfile: B
Doc Type: SERIAL
Languages: English; Spanish
Asoc. Mex. Geofis. Explor. Mtg., No. 5,
Descriptors: *United States; *Geophysical methods; *geothermal energy; *Seismology ; Geophysical surveys; Seismic methods; microseisms ; Seismic surveys; Interpretation; microearthquakes; applications; exploration ; structural geology; Regional; correlation; structure
Section Headings: 18 .(GEOPHYSICS, SOLID EARTH)

704996 74-10113
A review of geothermal exploration by infrared line scanning in North America, Europe, and East Africa--Una revision de la exploracion geotermica por barredor de linea infrarojo en Norte America, Europa y Este de Africa [abstr.]
Hodder, David T.
Soc. Explor. Geophys., Annu. Int. Mtg. No. 43, p. 42 (Engl.), p. 43 (Span.), 1973
CODEN: SGAMB7
Subfile: B
Doc Type: SERIAL
Languages: English; Spanish
Asoc. Mex. Geofis. Explor. Mtg., No. 5,
Descriptors: *North America; *Geophysical surveys; *geothermal energy; *Europe; *Africa ; Infrared surveys; exploration ; heat flow; east; airborne; interpretation; Geophysical methods; infrared methods
Section Headings: 18 .(GEOPHYSICS, SOLID EARTH)

704995 74-10112
An aeromagnetic study of the Colorado River Delta area, Baja California, Mexico--Estudio aeromagnetico del area del Delta del Rio Colorado, Baja California, Mexico [abstr.]
De la Fuente Duch, Mauricio; Sumner, John S.
Soc. Explor. Geophys., Annu. Int. Mtg. No. 43, p. 42 (Engl.), p. 43 (Span.), 1973
CODEN: SGAMB7
Subfile: B
Doc Type: SERIAL
Languages: English; Spanish
Asoc. Mex. Geofis. Explor. Mtg., No. 5,
Descriptors: *Mexico; *Geophysical surveys; *tectonophysics; *geothermal energy ; Magnetic surveys; Plate tectonics ; Baja California; Colorado River Delta; airborne; interpretation; structural geology; applications; exploration; structure; possibilities; movement; center; spreading; Panga de Abajo
Section Headings: 18 .(GEOPHYSICS, SOLID EARTH)

704994 74-10111
Geoelectrical investigations near The Geysers geothermal area, California--Investigaciones geoelectricas cerca del area geotermica de Geysers, California [abstr.]
Stanley, William D.; Jackson, Dallas B.
Soc. Explor. Geophys., Annu. Int. Mtg. No. 43, p. 41-42 (Engl.), p. 42-43 (Span.), 1973
CODEN: SGAMB7
Subfile: B
Doc Type: SERIAL
Languages: English; Spanish
Asoc. Mex. Geofis. Explor. Mtg., No. 5,
(cont. next page)

Descriptors: *California; *Geophysical surveys; *geothermal energy; *Quaternary; *Sedimentary rocks ; Electrical surveys; United States; Properties ; north; Lake County; The Geysers; resistivity; correlation; gravity surveys; anomalies; interpretation; heat flow; exploration; electrical properties; igneous rocks; volcanic; Clear Lake Volcanic Series; applications
Section Headings: 18 .(GEOPHYSICS, SOLID EARTH)

704992 74-10109
Regional aspects of the geothermal resource base in northwest Mexico and the southwest United States--Aspectos regionales de la base de la riqueza geotermica en el noroeste de Mexico y suroeste de los Estados Unidos de Norte America [abstr.]
Hermance, John F.
Soc. Explor. Geophys., Annu. Int. Mtg. No. 43, p. 40-41 (Engl.), p. 41-42 (Span.), 1973
CODEN: SGAMB7
Subfile: B
Doc Type: SERIAL
Languages: English; Spanish
Asoc. Mex. Geofis. Explor. Mtg., No. 5,
Descriptors: *Geothermal energy; *North America; *Tectonophysics; *Geophysical methods ; Plate tectonics; Methods; Economic geology ; Mexico; northwest; United States; southwest; structure; exploration; theoretical studies; Relation; sea-floor spreading; subduction; applications; geophysical surveys; Interpretation; seismic methods; gravity methods; magnetic methods; magnetotelluric methods
Section Headings: 26 .(ECONOMIC GEOLOGY, GENERAL & MINING)

704991 74-10108
The application of the self-potential method in the search for geothermal energy--La aplicacion del metodo de potencial espontaneo en la busqueda de energia geotermica [abstr.]
Anderson, Lennart; Johnson, Gordon.
Soc. Explor. Geophys., Annu. Int. Mtg. No. 43, p. 40 (Engl.), p. 41 (Span.), 1973
CODEN: SGAMB7
Subfile: B
Doc Type: SERIAL
Languages: English; Spanish
Asoc. Mex. Geofis. Explor. Mtg., No. 5,
Descriptors: *Nevada; *Geophysical surveys; *California; *geothermal energy ; Electrical surveys; United States ; north-central; Humboldt County; Golconda; Valmy; east; Mono County; Long Valley; Casa Diablo; ground; interpretation; anomalies; applications; exploration; structure; possibilities
Section Headings: 18 .(GEOPHYSICS, SOLID EARTH)

701995 74-07099
Exploracion geoelectrica a lo largo de la Falla de Agua Blanca, B. C.
Geoelectric exploration along the Agua Blanca Fault, Mexico][abstr.
Garcia Duran, Salvador; Gonzalez Salazar, Arturo.
Union Geofis. Mex., Reun. Anu., Programa Resumenes 1973, p. 11-12, 1973
CODEN: UGMRAZ
Subfile: B
Doc Type: SERIAL
Languages: Spanish
Descriptors: *Mexico; *Geophysical surveys; *geothermal energy; *Energy sources ; Surveys ; Electrical surveys; Baja California; Ensenada; Agua Blanca Fault; ground; exploration
Section Headings: 18 .(GEOPHYSICS, SOLID EARTH)

696756 74-01859
Seismic Noise in Geothermal Areas [abstr.]
Iyer, H. M.
Geophysics Vol. 38, No. 1, p. 177-178, 1973
CODEN: GPYSA7
Subfile: B
Doc Type: SERIAL
Languages: English
Descriptors: *California; *Geophysical surveys; *geothermal energy ; Seismic surveys; United States ; The Geysers; Imperial Valley; East Mesa; ground; noise; exploration
Section Headings: 18 .(GEOPHYSICS, SOLID EARTH)

696747 74-01850
Exploration Significance of Recent Geophysical Surveys in the Mexicali-Cerro Prieto Geothermal Area [abstr.]
Evans, Kenneth R.; Sumner, John S.; Del Castillo, Luis.
Geophysics Vol. 38, No. 1, p. 171, 1973
CODEN: GPYSA7
Subfile: B
Doc Type: SERIAL
Languages: English
Descriptors: *Mexico; *Geophysical surveys; *geothermal energy ; Magnetic surveys ; Mexicali; Cerro Prieto; airborne; exploration
Section Headings: 18 .(GEOPHYSICS, SOLID EARTH)

696745 74-01848
Spectral Variability in Seismic Noise Measurements and Implications for Geothermal Exploration [abstr.]
Crosson, Robert S.; Mayers, Ian R.
Geophysics Vol. 38, No. 1, p. 168, 1973
(cont. next page)

CODEN: GPYSA7
Subfile: B
Doc Type: SERIAL
Languages: English
Descriptors: *United States; *Geophysical methods; *geothermal energy ; Geophysical surveys; Seismic methods ; Seismic surveys; Washington; Oregon; Cascades; Klamath; Interpretation; variations; spectra; noise; ground; exploration
Section Headings: 18 .(GEOPHYSICS, SOLID EARTH)

674031 73-13302
Geothermal activity in 1972
Bowen, Richard G.
Ore Bin Vol. 35, No. 1, p. 4-7, sketch maps, 1973
CODEN: ORBIAW
Subfile: B
Doc Type: SERIAL
Languages: English
Geologic reconnaissance, geophysical surveys; temperature-gradients, heat-flow measurements, Baker, Malheur counties, Oregon; development of geothermal energy, California
Descriptors: *Oregon; *Geothermal energy; *California; *Geophysical surveys ; Economic geology; United States; Surveys ; exploration; production; electrical surveys; seismic surveys; acoustical surveys; magnetotelluric surveys ; ground
Section Headings: 26 .(ECONOMIC GEOLOGY, GENERAL & MINING)

669867 73-09131
Geothermal ground-noise surveys
Douze, E. J.; Sorrells, G. G.
Geophysics Vol. 37, No. 5, p. 813-824, illus. (incl. sketch maps), 1972
CODEN: GPYSA7
Subfile: B
Doc Type: SERIAL
Languages: English
High noise levels above reservoir in frequency range of 0.5-5.0 hz, complex pattern, California
Descriptors: *California; *Geophysical surveys; *Geothermal energy; *Geophysical methods ; Acoustical surveys; United States; Acoustical methods ; Imperial Valley; exploration; Interpretation; ground
Section Headings: 18 .(GEOPHYSICS, SOLID EARTH)

666772 73-06037
Exploration Significance of Recent Geophysical Surveys in the Mexicali-Cerro Prieto Geothermal Area [abstr.]
Evans, Kenneth R.; Sumner, John S.; Del Castillo, Luis.
Soc. Explor. Geophys., Annu. Int. Mtg. No. 42, p. 38-39, 1972
CODEN: SGAMB7
Subfile: B
Doc Type: SERIAL
Languages: English
Descriptors: *Mexico; *Geophysical surveys; *geothermal energy ; Magnetic surveys ; Mexicali; Cerro Prieto; airborne; exploration; magnetic methods
Section Headings: 18 .(GEOPHYSICS, SOLID EARTH)

665207 73-04472
Recent geophysical exploration of the Kawerau Geothermal Field, North sland, New Zealand
MacDonald, W. J. P.; Muffler, L. J. P.
N. Z. J. Geol. Geophys. Vol. 15, No. 3, p. 303-317, illus. (incl. sketch maps), 1972
CODEN: NEZOAY
Subfile: B
Doc Type: SERIAL
Languages: English
Resistivity surveys, temperature measurements, major production from fractures in andesite
Descriptors: *New Zealand; *Geophysical surveys; *Geothermal energy; *Igneous rocks; *fractures ; Electrical surveys; Australasia; Andesite-rhyolite family; Genesis ; North Island; Kawerau Geothermal Field; resources; Andesite; Tension; resistivity
Section Headings: 18 .(GEOPHYSICS, SOLID EARTH)

664252 73-03517
Heat Flow Studies in Thermal Areas of The North Island of New Zealand
Dawson, G. B.; Dickinson, D. J.
in United Nations Symposium on the Development and Utilization of Geothermal Resources, Proc., Vol. 2, Part 1,
Geothermics Spec. Issue, No. 2, p. 466-473, illus. (incl. sketch maps), 1971
CODEN: GTMCAT
Subfile: B
Doc Type: SERIAL
Languages: English
Empirical relations between parameters of heat transfer, direct and indirect (infrared) methods, temperature maps
Descriptors: *New Zealand; *Geophysical surveys; *heat flow; *geothermal energy; *Thermal waters; *Maps; *Springs ; Infrared surveys; Australasia ; North Island; airborne; measurement; exploration; temperature; hot springs
Section Headings: 18 .(GEOPHYSICS, SOLID EARTH)

664250 73-03515
Heat Flow Along the Candelaro Fault; Gargano Headland (Italy)
Mongelli, F.; Ricchetti, G.
in United Nations Symposium on the Development and Utilization of Geothermal Resources, Proc., Vol. 2, Part 1,
(cont. next page)

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Geothermics Spec. Issue, No. 2, p. 450-458, illus. (incl. geol. sketch maps), 1971
CODEN: GTMCAT
Subfile: B
Doc Type: SERIAL
Languages: English
Broad horst rising since Cretaceous, geothermal gradients, conductivity, high heat flow, causes
Descriptors: *Italy; *Heat flow; *Geothermal energy; *Faults ; Geophysical surveys; Europe; Systems ; Gargano; Candelaro Fault; geothermal gradient; conductivity; heat sources; exploration; Horsts
Section Headings: 18 .(GEOPHYSICS, SOLID EARTH)

664249 73-03514
Geothermal Gradient and Heat Flow in the Radicofani Region (East of Monte Amiata, Italy)
Burgassi, P. D.; Ceron, P.; Ferrara, G. C.; Sestini, G.; Toro, B.
in United Nations Symposium on the Development and Utilization of Geothermal Resources, Proc., Vol. 2, Part 1,
Geothermics Spec. Issue, No. 2, p. 443-449, illus. (incl. geol. sketch map), 1971
CODEN: GTMCAT
Subfile: B
Doc Type: SERIAL
Languages: English
Geological outline (Pliocene volcanism, Tertiary stratigraphy), test wells, conductivity
Descriptors: *Italy; *Heat flow; *Geothermal energy ; Geophysical surveys; Europe ; Radicofani; geothermal gradient; temperature; conductivity; exploration
Section Headings: 18 .(GEOPHYSICS, SOLID EARTH)

664247 73-03512
Heat-Flow Measurement in Non-Homogeneous Terrains; Its Application to Geothermal Areas
Sestini, G.
in United Nations Symposium on the Development and Utilization of Geothermal Resources, Proc., Vol. 2, Part 1,
Geothermics Spec. Issue, No. 2, p. 424-436, illus. (incl. sketch map), 1971
CODEN: GTMCAT
Subfile: B
Doc Type: SERIAL
Languages: English
Example of flysch terrains, geothermal wells, methods, evaluation, Italy
Descriptors: *Italy; *Heat flow; *Sedimentary rocks; *Geothermal energy ; Geophysical surveys; Europe; Clastics; terrigenous ; Piancastagnaio; geothermal gradient; flysch; exploration
Section Headings: 18 .(GEOPHYSICS, SOLID EARTH)

664246 73-03511
Infra-Red Remote Sensing of Thermal Ground in the Taupo Region, New Zealand
Hochstein, M. P.; Dickinson, D. J.
in United Nations Symposium on the Development and Utilization of Geothermal Resources, Proc., Vol. 2, Part 1,
Geothermics Spec. Issue, No. 2, p. 420-423, illus. (incl. sketch map), 1971
CODEN: GTMCAT
Subfile: B
Doc Type: SERIAL
Languages: English
Boundaries of discharge areas of hydrothermal systems, emissive radiation of 4.5-5.5 mu m band, minimum heat flow detectable range 150-350 mu cal/cm 2 /sec
Descriptors: *New Zealand; *Geophysical surveys; *Geophysical methods; *heat flow; *Geothermal energy ; Infrared surveys; Australasia; Infrared methods ; Taupo; airborne; Instruments; interpretation; regional patterns; exploration
Section Headings: 18 .(GEOPHYSICS, SOLID EARTH)

664245 73-03510
Ground and Airborne Thermal Imagery on Italian Volcanic Areas
Cassinis, R.; Marino, C. M.; Tonelli, A. M.
in United Nations Symposium on the Development and Utilization of Geothermal Resources, Proc., Vol. 2, Part 1,
Geothermics Spec. Issue, No. 2, p. 413-419, illus., 1971
CODEN: GTMCAT
Subfile: B
Doc Type: SERIAL
Languages: English
Infrared, quantitative approach, instruments, methods, results
Descriptors: *Italy; *Geophysical surveys; *Geophysical methods; *geothermal energy ; Infrared surveys; Europe; Infrared methods ; ground; airborne; Interpretation; instruments; exploration
Section Headings: 18 .(GEOPHYSICS, SOLID EARTH)

664244 73-03509
Aerial Infrared Surveys of Reykjanes and Torfajoekull Thermal Areas, Iceland, with a Section on Cost of Exploration Surveys
Palmason, G.; Friedman, J. D.; Williams, R. S., Jr.; Jonsson, J.; Saemundsson, K.
in United Nations Symposium on the Development and Utilization of Geothermal Resources, Proc., Vol. 2, Part 1,
Geothermics Spec. Issue, No. 2, p. 399-412, illus. (incl. geol. sketch map), 1971

(cont. next page)

DIALOG File 89: GEOREF - 29-84/Nov (Copr. American Geological Institute)

CODEN: GTMCAT
Subfile: B
Doc Type: SERIAL
Languages: English
Instruments and data processing, general geology, heat flow, hydrothermal features
Descriptors: *Iceland; *Geophysical surveys; *heat flow; *Geophysical methods; *Automatic data processing; *Geothermal energy ; Infrared surveys; Europe; Infrared methods ; Reykjanes; Torfajoekull; airborne; regional patterns; Instruments; interpretation; exploration
Section Headings: 18 .(GEOPHYSICS, SOLID EARTH)

664243 73-03508
Photogeologic and Thermal Infrared Reconnaissance Surveys of the los Negritos-Ixtlan De Los Hervores Geothermal Area, Michoacan, Mexico
Gomez Valle, R.; Friedman, J. D.; Gawarecki, S. J.; Banwell, C. J.
in United Nations Symposium on the Development and Utilization of Geothermal Resources, Proc., Vol. 2, Part 1,
Geothermics Spec. Issue, No. 2, p. 381-398, illus. (incl. sketch maps), 1971
CODEN: GTMCAT
Subfile: B
Doc Type: SERIAL
Languages: English
Physiography, geology, hydrothermal features, instruments, data evaluation
Descriptors: *Mexico; *Geophysical surveys; *geothermal energy ; Infrared surveys ; photogeology; Los Negritos; Ixtlan de los Hervores; airborne; exploration
Section Headings: 18 .(GEOPHYSICS, SOLID EARTH)

664242 73-03507
Application of Remote Sensing to Geothermal Prospecting
Hodder, D. T.
in United Nations Symposium on the Development and Utilization of Geothermal Resources, Proc., Vol. 2, Part 1,
Geothermics Spec. Issue, No. 2, p. 368-380, illus. (incl. sketch maps), 1971
CODEN: GTMCAT
Subfile: B
Doc Type: SERIAL
Languages: English
Geological criteria, physical criteria, selection of sites, evaluation of techniques, applications in California
Descriptors: *California; *Geophysical surveys; *Geophysical methods; *geothermal energy ; Infrared surveys; United States; Infrared methods ; remote sensing; satellite; Interpretation; exploration
Section Headings: 18 .(GEOPHYSICS, SOLID EARTH)

664241 73-03506
The AAPG Geothermal Survey of North America
Kehle, R. O.; Schoeppel, R. J.; Deford, R. K.
in United Nations Symposium on the Development and Utilization of Geothermal Resources, Proc., Vol. 2, Part 1,
Geothermics Spec. Issue, No. 2, p. 358-367, illus. (incl. sketch maps), 1971
CODEN: GTMCAT
Subfile: B
Doc Type: SERIAL
Languages: English
Objective is a geothermal map, correcting nonequilibrium temperature data, mathematical approach
Descriptors: *North America; *Heat flow; *maps; *Geothermal energy ; Geophysical surveys ; Regional; geothermal gradient; regional patterns; exploration
Section Headings: 18 .(GEOPHYSICS, SOLID EARTH)

664240 73-03505
The Study of Underground Structure and Geophysical State in Geothermal Areas by Seismic Exploration
Hayakawa, M.
in United Nations Symposium on the Development and Utilization of Geothermal Resources, Proc., Vol. 2, Part 1,
Geothermics Spec. Issue, No. 2, p. 347-357, illus. (incl. sketch maps), 1971
CODEN: GTMCAT
Subfile: B
Doc Type: SERIAL
Languages: English
Historical review of seismic exploration, analysis of reflection data, deep-seated structures, Japan
Descriptors: *Japan; *Geophysical surveys; *Geophysical methods; *geothermal energy ; Seismic surveys; Asia; Seismic methods ; reflection; ground; Interpretation; exploration
Section Headings: 18 .(GEOPHYSICS, SOLID EARTH)

664239 73-03504
Seismic, Gravity and Magnetic Studies, Broadlands Geothermal Field, New Zealand
Hochstein, M. P.; Hunt, T. M.
in United Nations Symposium on the Development and Utilization of Geothermal Resources, Proc., Vol. 2, Part 1,
Geothermics Spec. Issue, No. 2, p. 333-346, illus. (incl. sketch maps), 1971
CODEN: GTMCAT
Subfile: B
Doc Type: SERIAL
Languages: English
Methods, interpretation, anomalies, rhyolite domes
(cont. next page)

Descriptors: *New Zealand; *Geophysical surveys; *Geophysical methods; *geothermal energy; *Igneous rocks; *Folds ; Surveys; Australasia; Methods; Andesite-rhyolite family; Style ; Magnetic surveys; seismic surveys; gravity surveys; Broadlands; ground; Interpretation; gravity methods; magnetic methods; seismic methods; exploration; Rhyolite; domes
Section Headings: 18 .(GEOPHYSICS, SOLID EARTH)

664238 73-03503
Induction Methods in Prospecting for Hot Water
Keller, G. V.
in United Nations Symposium on the Development and Utilization of Geothermal Resources, Proc., Vol. 2, Part 1,
Geothermics Spec. Issue, No. 2, p. 318-332, illus. (incl. sketch maps), 1971
CODEN: GTMCAT
Subfile: B
Doc Type: SERIAL
Languages: English
Use of four electromagnetic methods for exploration, audio-frequency magneto-telluric method, two-coil profiling, two-coil frequency domain sounding, coil/wire time-domain sounding, United States, New Zealand
Descriptors: *United States; *Geophysical surveys; *New Zealand; *Geophysical methods; *geothermal energy; *thermal waters ; Surveys; Methods; Australasia ; Electromagnetic surveys; magnetotelluric surveys; west; north; induction; ground; Interpretation; magnetotelluric methods; electromagnetic methods; exploration
Section Headings: 18 .(GEOPHYSICS, SOLID EARTH)

664237 73-03502
Near-Surface Resistivity Surveys of Geothermal Areas Using the Electromagnetic Method
Lumb, J. T.; MacDonald, W. J. P.
in United Nations Symposium on the Development and Utilization of Geothermal Resources, Proc., Vol. 2, Part 1,
Geothermics Spec. Issue, No. 2, p. 311-317, illus. (incl. sketch maps), 1971
CODEN: GTMCAT
Subfile: B
Doc Type: SERIAL
Languages: English
Horizontal coplanar loop technique, depth up to 30 m, resistivity maps, Broadlands, New Zealand, El Tatio, Chile
Descriptors: *New Zealand; *Geophysical surveys; *Chile; *Geophysical methods; *geothermal energy ; Electromagnetic surveys; South America; Electromagnetic methods; Australasia ; Broadlands; El Tatio; resistivity; ground; Interpretation; exploration
Section Headings: 18 .(GEOPHYSICS, SOLID EARTH)

664236 73-03501
Application of Electrical Resistivity and Gravimetry in Deep Geothermal Exploration
Meidav, T.
in United Nations Symposium on the Development and Utilization of Geothermal Resources, Proc., Vol. 2, Part 1,
Geothermics Spec. Issue, No. 2, p. 303-310, illus. (incl. sketch maps), 1971
CODEN: GTMCAT
Subfile: B
Doc Type: SERIAL
Languages: English
Fundamental relationships, Imperial Valley case history, exploration program, results, California
Descriptors: *California; *Geophysical surveys; *Geophysical methods; *geothermal energy ; Surveys; United States; Methods ; Gravity surveys; electrical surveys; Imperial Valley; ground; Interpretation; electrical methods; resistivity; gravity methods; exploration
Section Headings: 18 .(GEOPHYSICS, SOLID EARTH)

664235 73-03500
Delineation of Geothermal Deposits by Means of Long-Spacing Resistivity and Airborne Magnetics
McEuen, R. B.
in United Nations Symposium on the Development and Utilization of Geothermal Resources, Proc., Vol. 2, Part 1,
Geothermics Spec. Issue, No. 2, p. 295-302, illus. (incl. sketch maps), 1971
CODEN: GTMCAT
Subfile: B
Doc Type: SERIAL
Languages: English
Temperature distribution at depth, zones of permeability, field data analysis, instruments, California, Basin and Range
Descriptors: *United States; *Geophysical surveys; *geothermal energy; *Geophysical methods ; Surveys; Methods ; Electrical surveys; magnetic surveys; Basin and Range; California; Imperial Valley; airborne; Interpretation; instruments; electrical methods; resistivity; magnetic methods; exploration
Section Headings: 18 .(GEOPHYSICS, SOLID EARTH)

664234 73-03499
D. C. Resistivity Surveys of the Broadlands Geothermal Region, New Zealand
Risk, G. F.; MacDonald, W. J. P.; Dawson, G. B.
in United Nations Symposium on the Development and Utilization of Geothermal Resources, Proc., Vol. 2, Part 1,
Geothermics Spec. Issue, No. 2, p. 287-294, illus. (incl. sketch maps), 1971

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DIALOG File 89: GEOREF - 29-84/Nov (Copr. American Geological Institute)

CODEN: GTMCAT
Subfile: B
Doc Type: SERIAL
Languages: English
Factors determining rock resistivities, methods, instruments, theoretical studies, data analysis, low resistivity rocks, circular body
Descriptors: *New Zealand; *Geophysical surveys; *geothermal energy; *Geophysical methods ; Electrical surveys; Australasia; Electrical methods ; Broadlands; resistivity; exploration; Interpretation
Section Headings: 18 .(GEOPHYSICS, SOLID EARTH)

664233 73-03498
Contribution de la Geophysique a l'Etude de la Region Geothermique de Denizli-Saraykoey, Turquie
Geophysical contribution to the study of the geothermal region of Denizli-Saraykoy, Turkey
Duprat, A.
In United Nations Symposium on the Development and Utilization of Geothermal Resources, Proc., Vol. 2, Part 1,
Geothermics Spec. Issue, No. 2, p. 275-286, illus. (incl. geol. sketch map), 1971
CODEN: GTMCAT
Subfile: B
Doc Type: SERIAL
Languages: French
General geology (Paleozoic basement, Tertiary-Quaternary stratigraphy), gravity, electrical and heat flow surveys
Descriptors: *Turkey; *Geophysical surveys; *heat flow; *geothermal energy ; Surveys; Middle East ; Gravity surveys ; electrical surveys; Denizli; Saraykoy; exploration; geothermal gradient
Section Headings: 18 .(GEOPHYSICS, SOLID EARTH)

664232 73-03497
Geophysical Exploration in the Tatun Volcanic Region, Taiwan
Cheng, W. T.
In United Nations Symposium on the Development and Utilization of Geothermal Resources, Proc., Vol. 2, Part 1,
Geothermics Spec. Issue, No. 2, p. 262-274, illus. (incl. sketch maps), 1971
CODEN: GTMCAT
Subfile: B
Doc Type: SERIAL
Languages: English
Reconnaisance magnetic survey, electrical resistivity surveys, geothermal energy
Descriptors: *Formosa; *Geophysical surveys; *geothermal energy ; Surveys; Asia ; Magnetic surveys; electrical surveys; Tatun Shan; exploration
Section Headings: 18 .(GEOPHYSICS, SOLID EARTH)

664228 73-03493
Development of Otake Geothermal Field
Hayashida, T.; Ezima, Y.
In United Nations Symposium on the Development and Utilization of Geothermal Resources, Proc., Vol. 2, Part 1,
Geothermics Spec. Issue, No. 2, p. 208-220, illus. (incl. geol. sketch map), 1971
CODEN: GTMCAT
Subfile: B
Doc Type: SERIAL
Languages: English
Exploration, geophysical surveys, production, fractures, plant design, Japan
Descriptors: *Japan; *Geothermal energy; *Geophysical surveys; *Thermal waters; *Fractures ; Economic geology; Asia; Surveys; Style ; Otake; exploration; production; development; magnetic surveys; electrical surveys; seismic surveys; temperature; Joints
Section Headings: 26 .(ECONOMIC GEOLOGY, GENERAL & MINING)

664225 73-03490
The Present State of Geothermal Development in Japan
Sato, K.
In United Nations Symposium on the Development and Utilization of Geothermal Resources, Proc., Vol. 2, Part 1,
Geothermics Spec. Issue, No. 2, p. 155-184, illus. (incl. geol. sketch maps), 1971
CODEN: GTMCAT
Subfile: B
Doc Type: SERIAL
Languages: English
History, fields, distribution, geophysical surveys, heat flow, development
Descriptors: *Japan; *Geothermal energy; *Thermal waters; *Heat flow; *Geophysical surveys ; Economic geology; Asia; Surveys ; distribution; exploration; production; temperature; heat sources; electrical surveys; seismic surveys
Section Headings: 26 .(ECONOMIC GEOLOGY, GENERAL & MINING)

664219 73-03484
Les Possibilites Geothermiques de l'Algerie
Geothermal possibilities of Algeria
Cormy, G.; Demians D'Archimbaud, J.
In United Nations Symposium on the Development and Utilization of Geothermal Resources, Proc., Vol. 2, Part 1,
Geothermics Spec. Issue, No. 2, p. 110-116, illus. (incl. sketch maps), 1971
CODEN: GTMCAT
Subfile: B
Doc Type: SERIAL

(cont. next page)

DIALOG File 89: GEOREF - 29-84/Nov (Copr. American Geological Institute)

Languages: French
Reservoirs, lithology, exploration, geochemical methods, electrical surveys, heat flow
Descriptors: *Algeria; *Geothermal energy; *Thermal waters; *Geophysical surveys; *heat flow; *Springs ; Economic geology ; Africa; Surveys ; exploration; temperature; geochemistry; electrical surveys; geothermal gradient
Section Headings: 26 .(ECONOMIC GEOLOGY, GENERAL & MINING)

662069 73-01333
Geothermal system of the Dieng-Batur Volcanic complex
Zen, M. T.
Bandung, Inst. Teknol., Proc. Vol. 6, No. 1, p. 23-28, illus. (incl. geol. map 1:62,500), 1971
CODEN: PITBBG
Subfile: B
Doc Type: SERIAL
Languages: English
Geophysical and geochemical surveys, intersection of 2 major fracture zones, hot water and steam, depth configuration of system, power reserves
Descriptors: *Indonesia; *Geothermal energy; *Volcanology; *Geophysical surveys; *Thermal waters ; Economic geology; Asia; Volcanism; Electrical surveys ; Java; Dieng-Batur Volcanic Complex; exploration; reserves; Processes; geochemistry
Section Headings: 26 .(ECONOMIC GEOLOGY, GENERAL & MINING)

658037 72-39469
Geothermal ground-noise surveys [abstr.]
Sorrells, G. G.
Assoc. Eng. Geol., Ann. Meet., Program Abstr. No. 15, p. 35 , 1972
CODEN: CAGPAV
Subfile: B
Doc Type: SERIAL
Languages: English
High levels of surface noise detected by short-period seismographs, 0.5-5.0 Hz, California
Descriptors: *California; *Geophysical surveys; *geothermal energy ; Seismic surveys; United States ; Imperial Valley; noise levels; exploration; seismic methods
Section Headings: 18 .(GEOPHYSICS, SOLID EARTH)

656287 72-37609
Geologic Structure Controlling Heat Flow Systems at Shallow Geothermal Underground
Hase, Hirokazu.
in Prof. Jun-ichi Iwai Memorial Volume, p. 489-501 (Jap.; Engl. sum.), illus. (incl. geol. sketch map),
Tohoku Univ., Inst. Geol. Paleontol. Sendai, Japan, 1972
Subfile: B
Languages: Japanese
Problems in surface surveys caused by fault and fracture systems; infrared surveys and calorimetry, interpretation of anomalies; Nasu Volcano, Mount Mihara, Kusatsu-Shirane Volcano, Japan
Descriptors: *Heat flow; *Japan; *Geothermal energy; *Geophysical surveys; *Mineral exploration ; Asia; Economic geology; Infrared surveys; Geophysical methods ; Honshu; conductivity; heat sources; structural controls; anomalies; measurement; O-shima; Mount Mihara; Kusatsu; Mount Shirane; Nasu; fractures; faults; infrared methods
Section Headings: 26 .(ECONOMIC GEOLOGY, GENERAL & MINING)

642006 72-23228
Seismic noise measurements in a geothermal area
Goforth, T. T.; Douze, E. J.; Sorrells, G. G.
Geophys. Prospect. (The Hague) Vol. 20, No. 1, p. 76-82, illus. (incl. sketch maps), 1972
CODEN: GPPRAR
Subfile: B
Doc Type: SERIAL
Languages: English
Presentation of a method of exploring for geothermal energy by correlation with high seismic noise levels, example given of Imperial Valley, California
Descriptors: *California; *Geophysical surveys; *geothermal energy; *Seismology ; Seismic surveys; United States; Methods ; Imperial Valley; applications; exploration; interpretation; seismic noise; Correlation
Section Headings: 18 .(GEOPHYSICS, SOLID EARTH)

627434 72-08495
Surface Heat-Flow Studies for Remote Sensing of Geothermal Resources
Hase, Hirokazu.
Jap. Soc. Photogramm., J. Vol. 10, No. 3, p. 9-17 (incl. Jap. sum.), illus. (incl. sketch map), 1971
CODEN: SASOBR
Subfile: B
Doc Type: SERIAL
Languages: English
Descriptors: *Geophysical surveys; *California; *Wyoming; *geothermal energy ; Infrared surveys; Exploration ; United States; Mono Lake; Yellowstone National Park
Section Headings: 18 .(GEOPHYSICS, SOLID EARTH)

619198 72-00243
Seismic prospecting in geothermal field in Japan
Ramirez, M.; Celis, J. Rubin de; Hayakawa, M.
Int. Inst. Seismol. Earthquake Eng., Bull. Vol. 7, p. 61-78, illus. (incl. sketch maps), 1970
CODEN: IISBB2
Subfile: B
Doc Type: SERIAL

(cont. next page)

Languages: English
Descriptors: *Japan; *Geophysical surveys; *Thermal waters; *Geothermal energy ; Seismic surveys; Asia ; geothermal fields; Matsukawa; exploration
Section Headings: 18 .(GEOPHYSICS, SOLID EARTH)

593794 71-13074
Geothermal exploration in the Salton trough, California abstr.]
Meidav, Tsvi; Rex, R. W.
Geophysics Vol. 35, No. 6, p. 1169, 1970
CODEN: GPYSA7
Subfile: B
Doc Type: SERIAL
Languages: English
Descriptors: *Geothermal energy; *California; *Geophysical surveys ; Exploration; United States ; Salton trough; electrical; heat flow
Section Headings: 18 .(GEOPHYSICS, SOLID EARTH)

593793 71-13073
The application of geophysics to geothermal areas in Mexico [abstr.]
Del Castillo G., L.; Sandoval O., J. H.
Geophysics Vol. 35, No. 6, p. 1168-1169, 1970
CODEN: GPYSA7
Subfile: B
Doc Type: SERIAL
Languages: English
Descriptors: *Geothermal energy; *Mexico; *Electrical surveys ; Exploration; geophysical surveys ; Michoacan; electrical
Section Headings: 18 .(GEOPHYSICS, SOLID EARTH)

580601 70-34888
Geothermal exploration in the Salton trough, California [abstr.]
Meidav, Tsvi; Rex, R. W.
in Searching the Seventies, from Moho to Mars, p. 119-120,
Soc. Explor. Geophys. New Orleans, 1970
Subfile: B
Languages: English
Descriptors: *Geophysical methods; *Geothermal energy; *Geophysical surveys; *California; *Energy sources ; Applications; exploration; Economic geology ; Salton trough ; Mineral resources
Section Headings: 26 .(ECONOMIC GEOLOGY, GENERAL & MINING)

580600 70-34887
The application of geophysics to geothermal areas in Mexico [abstr.]
Del Castillo G., L.; Sandoval O., J. H.
in Searching the Seventies, from Moho to Mars, p. 118-119,
Soc. Explor. Geophys. New Orleans, 1970
Subfile: B
Languages: English
Descriptors: *Geophysical methods; *Geothermal energy; *Geophysical surveys; *Mexico; *Mineral resources; *Energy sources ; Applications; exploration; Economic geology ; Regional
Section Headings: 26 .(ECONOMIC GEOLOGY, GENERAL & MINING)

577810 70-32083
Geothermal infrared anomalies of low intensity, Yellowstone National Park
White, Donald E.; Miller, Lee D.
in Earth resources aircraft program, status review; Vol. I, Geology, geography, and sensor studies, Sect. 16, p. 1-4,
U.S., Nat. Aeronaut. Space Admin., Manned Spacecraft Cent. Houston, Texas, 1968
Subfile: B
Languages: English
Thermal water, natural steam, occurrence of deep-seated reservoirs, infrared remote sensing as exploration tool, temperature gradient and heat flow criteria, Old Faithful and other test sites, Wyoming
Descriptors: *Wyoming; *infrared surveys; *heat flow; *Thermal waters; *Geothermal energy ; Geophysical surveys; Regional patterns ; Yellowstone National Park; exploration
Section Headings: 18 .(GEOPHYSICS, SOLID EARTH)

540490 71-10420-G
UNE ETUDE THERMOGRAPHIQUE SUR LES ANTILLES (A THERMOGRAPHIC SURVEY IN THE WEST INDIES (WITH ENGLISH AND SPANISH VERSIONS))
PEKAR, L.; GUY, M.
PHOTO INTERPRETATION, V. 69-1, NOS. 5-6, P. 30-47 1969
Subfile: G
Descriptors: *EXPLORATION; *GEOPHYSICAL SURVEYS; *GEOTHERMAL ENERGY; *INFRARED; *INFRARED SURVEY; *INFRARED SURVEYS; *NEGATIVE; *WEST INDIES

533426 70-08402-G
ON IR IMAGERY AND ITS APPLICATION TO THE MAPPING OF GEOTHERMAL DISTRIBUTIONS
MATSUNO, K.; HASE, H.; NISHIMURA, K.
PHOTOGRAMMETRIA, V. 25, NOS. 2-3, P. 61-74 1969
Subfile: G
Descriptors: *EXPLORATION; *GEOPHYSICAL SURVEYS; *GEOTHERMAL ENERGY; *INFRARED; *INFRARED SURVEYS; *JAPAN

531490 70-04204-G
RESISTIVITY EXPLORATION FOR ALTERED ZONE AT OTAKE GEOTHERMAL AREA-JAPAN
NOGUCHI, T.; ONODERA, S.
BULL. VOLCANOL., V. 33, NO. 1, P. 205-227 1969
Subfile: G
Descriptors: *ELECTRICAL; *ELECTRICAL SURVEYS; *GEOPHYSICAL SURVEYS; *GEOTHERMAL ENERGY; *JAPAN; *OTAKE GEOTHERMAL AREA

464234 69-07307-N
GEOPHYSICAL INVESTIGATIONS IN THE SELF-SEALING GEOTHERMAL FIELDS
FACCA, G.
BULL. VOLCANOL., V. 33, NO. 1, P. 119-121 1969
Subfile: N
Descriptors: *AHUACHAPAN AREA; *AHUACHAPAN GEOTHERMAL AREA; *EL SALVADOR; *EXPLORATION; *EXTENT; *GEOCHEMICAL SURVEYS; *GEOCHEMISTRY; *GEOPHYSICAL STUDIES; *GEOPHYSICAL SURVEYS; *GEOTHERMAL ENERGY; *SELF-SEALING FIELD; *SELF-SEALING

461403 69-03755-N
AERIAL INFRARED SURVEYS AT THE GEYSERS GEOTHERMAL STEAM FIELD, CALIFORNIA, IN GEOLOGICAL SURVEY RESEARCH 1969, CHAP. C
MOXHAM, R. M.
U.S. GEOL. SURVEY PROF. PAPER 650-C, P. C106-C122 1969
Subfile: N
Descriptors: *AIRBORNE; *CALIFORNIA; *EXPLORATION; *GEOPHYSICAL SURVEYS; *GEOTHERMAL ENERGY; *GEYSERS GEOTHERMAL AREA; *GEYSERS; *INFRARED; *INFRARED SURVEY; *INFRARED SURVEYS

DIALOG File 89: GEOREF - 29-84/Nov (Copr. American Geological Institute)

Section Headings: 18 .(GEOPHYSICS, SOLID EARTH)

1027390 81-16433
Geophysical reconnaissance of Los Humeros Caldera, Mexico
Alvarez, R.; Morrison, H. F.
Univ. Calif., Dep. Eng. Geosci., Berkeley, Calif., USA
Proceedings of the International congress on thermal waters, geothermal energy and vulcanism of the Mediterranean area; geothermal energy; Volume 1
Augustithis, S. S.(president)
International congress on thermal waters, geothermal energy and vulcanism of the Mediterranean area; geothermal energy, Athens, Greece, Oct. 1976
Publ: Natl. Tech. Univ.
29-42p., 1976
5 REFS.
Subfile: B
Country of Publ.: Greece
Doc Type: BOOK; CONFERENCE PUBLICATION Bibliographic Level: ANALYTIC
Languages: English
illus., sketch map
Latitude: N194000; N194000 Longitude: W0972500; W0972500
Descriptors: *Mexico ; geophysical surveys ; electrical logging; North America; well-logging; Los Humeros Caldera; Mexican volcanic belt; geothermal energy; volcanology; volcanism; fumaroles; tectonics; faults; magnetic anomalies; magnetic surveys; remote sensing; satellites; exploration; Monte Nuevo Fault; Zaragoza Fault
Section Headings: 18 .(GEOPHYSICS, SOLID EARTH)

1027389 81-16997
Etude geothermique preliminaire du NE espagnol
A preliminary geothermal study of northeastern Spain
Albert-Beltran, J. F.
Proceedings of the International congress on thermal waters, geothermal energy and vulcanism of the Mediterranean area; geothermal energy; Volume 1
Augustithis, S. S.(president)
International congress on thermal waters, geothermal energy and vulcanism of the Mediterranean area; geothermal energy, Athens, Greece, Oct. 1976
Publ: Natl. Tech. Univ.
17-28p., 1976
9 REFS.
Subfile: B
Country of Publ.: Greece
Doc. Type: BOOK; CONFERENCE PUBLICATION Bibliographic Level: ANALYTIC
Languages: French
tables
Latitude: N403000; N423000 Longitude: E0033000; E0000000
Descriptors: *Spain ; hydrogeology; economic geology ; thermal waters; geothermal energy; Europe; genesis; seismicity; epicenters; Pyrenees; Maladeta Massif; granodiorite; granite-granodiorite family; Andorra Massif; intrusions; Pliocene; Neogene; Tertiary; Cenozoic; volcanism; volcanology; geochemistry; chemical composition; albite-anorthite system; ion exchange; geothermal gradient; heat flow; geophysical surveys; Catalonia; electrical logging; well-logging; Gerona; tectonics; regional patterns; fracture zones; faults; exploration; areal geology
Section Headings: 21 .(HYDROGEOLOGY AND HYDROLOGY)

1024903 81-12376
A study on the detection of reflection events in a complex geothermal areas
Ishii, Y.; Tsumuraya, Y.
J. Min. Metall. Inst. Jap. 96: 1107, 301-306p., 1980
ISSN: 0369-4194 6 REFS.
Subfile: B
Country of Publ.: Japan
Doc Type: SERIAL Bibliographic Level: ANALYTIC
Languages: Japanese Summary Languages: English
illus.
Latitude: N300000; N450000 Longitude: E1470000; E1290000
Descriptors: *Japan; *geophysical methods ; geophysical surveys; economic geology; seismic methods ; seismic surveys; geothermal energy; interpretation; Asia; exploration; reflection; stacking methods
Section Headings: 20 .(GEOPHYSICS, APPLIED)

1022906 81-14201
Contribution to the study of the deep lithospheric profiles; ''deep'' reflecting horizons in Larderello-Travale geothermal field
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Models of an extending lithosphere and heat flow in the Basin and Range province

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ABSTRACT

Reduced heat flow in the Basin and Range province is characteristically greater by 50% to 100% than that in stable regions; in the hotter subprovinces like the Battle Mountain High, it is greater by 300%. Evidence for distributed tectonic extension and magmatism throughout the province suggests that much of the anomalous heat is transferred from the asthenosphere by convection in the lithosphere, in the solid state by stretching, and in the magmatic state by intrusion. Simple steady-state thermomechanical models of these processes yield relations among reduced heat flow, asthenosphere flux, lithosphere thickness, extension rate, and basalt production by the asthenosphere. Thermal effects in an extending lithosphere lead to decreased estimates of temperature and increased estimates of lithosphere thickness in the Basin and Range province. Moderate extension rates can account for high heat flow in the province without calling on anomalous conductive flux from the asthenosphere. The heat and mass budgets of bimodal volcanic centers suggest that they occur at points where the lithosphere is pulling apart rapidly, drawing up basalt to fill the void. Intrusion can probably facilitate lithosphere extension at low stress levels either by brittle "hydrofracturing" by basaltic dikes or by warming and thinning caused by basaltic underplating. Whether lithosphere extension occurs in the distributed mode or in the plate-tectonic mode might depend largely upon whether the lateral divergence of mass can be supplied by asthenosphere basalt, or whether it must be supplied by the ascent of very viscous ultramafic material which requires wide conduits separated by large distances. For a range of plausible models of distributed extension, the anomalous heat flow increases roughly 1 HFU (10^{-6} cal·cm^{-2}·s^{-1}) for every 1% to 2%/m.y. increase in extension rate; the relation suggests extension rates in the Great Basin consistent with estimates from structural evidence. It also suggests much more rapid local extension in the hotter subprovinces, an inference supported by limited evidence from other sources.

INTRODUCTION

Heat flow from the Earth's surface plays a central role in discussions of the tectonics of active regions. Although it is the principal source of information regarding temperature in the lithosphere and thermal manifestations of flow in the asthenosphere, the implications of heat flow are more ambiguous than is sometimes realized. The ambiguities are introduced at two distinct interpretive steps: (1) abstracting a generalized or characteristic heat flow from the observational data for a region and (2) selecting a thermal model for downward continuation of this generalized surface heat flow. In a previous paper (Lachenbruch and Sass, 1977), we discussed the first step for the Basin and Range province in some detail. In this paper (which is a sequel to that one), we present an updated heat-flow map and review the basis for selecting heat flows to characterize different regions in the province and the basis for the simple conduction model used to construct crustal geotherms. We then consider simple thermal models that are thought to be more appropriate to an extending lithosphere.

Relations between reduced heat flow and thickness of the continental lithosphere were discussed in terms of heat-conduction models by Crough and Thompson (1976) and Pollack and Chapman (1977). In their models the anomalous heat flow at the surface (corrected for radioactivity) is the same as anomalous flux conducted into the base of the lithosphere; no provision is made for convective transport in the lithosphere. Although each of these models is reasonable for the purpose for which it was used, the models cannot be applied to a lithosphere undergoing distributed extension; within such a lithosphere, material must be moving vertically, and vertical convection of heat must be taking place. In this paper we examine relations among surface heat flow, extension rate, lithosphere thickness, and asthenosphere flux for the simplest thermomechanical models of extension. Because of the complexity of the problem, we consider only steady-state models. The validity of the steady-state assumption must be judged a posteriori, according to the resulting lithosphere thickness and the supposed duration of the geologic processes responsible for the thermal condition. Although the assumption is a serious limitation, it yields a useful limiting case that provides insight from simple analytical results. The models are discussed in terms of heat-flow regimes believed to be characteristic of the Basin and Range province; they indicate some constraints and options for the interpretation of heat flow in regions of extensional tectonics.

A list of symbols is given in Appendix 1.

REVIEW OF THE STATUS OF HEAT-FLOW STUDIES IN THE BASIN AND RANGE PROVINCE

Regional Heat Flow

The number of heat-flow determinations suitable for a regional analysis in the Western United States has now increased to more than 500 (from 2 in the 1950s), but still only gross regional generalizations are possible because of the irregular coverage and local variability. Figure 9-1 is an updated version of the heat-flow map presented recently by Lachenbruch and Sass (1977), to which paper the reader is referred for a background discussion. With notable exceptions, the generalized heat flow throughout most of the Western United States, and throughout the Basin and Range province in particular, is greater than 1.5 HFU, the approximate average for the continents. A histogram for the Basin and Range province (Fig.

9-2) shows that in addition to having a large mean, the heat-flow values in the province are widely dispersed. We have suggested elsewhere (Lachenbruch and Sass, 1977) that the large dispersion is caused primarily by convective transfer associated with ground-water circulation and that the large mean is probably caused primarily by convective transfer by ascending magma. In the earlier paper (Lachenbruch and Sass, 1977), we considered the effects on regional heat flow of circulatory hydrothermal convection; in this paper we shall consider some effects of magmatic movements and solid-state convection in the lithosphere.

The maps (Fig. 9-1) show subregions of extremely high heat flow (>2.5 HFU). Many, like the Long Valley volcanic center in eastern California (LV, Fig. 9-1a), are only a few tens of kilometres across. However, two large subprovinces, the Battle Mountain High (BMH, Fig. 9-1a) in northern Nevada (Sass and others, 1971) and the Rio Grande Rift (RGR, Fig. 9-1a) in central New Mexico and Colorado (Reiter and others, 1975), are taking shape as regional features, although their boundaries are not yet well defined. We have drawn the map in such a way as to suggest a possible connection between the Battle Mountain High and the Yellowstone volcanic region in Wyoming (Y, Fig. 9-1a); the two are separated by the Snake River Plain (SRP, Fig. 9-1a), a volcanic region in which the measurement of heat flow is complicated by hydrologic circulation (Brott and others, 1976). The Snake River Plain also separates the Battle Mountain High from a region of very high conductive heat flow and hydrothermal activity in the Idaho batholith (IB, Fig. 9-1a).

Heat Production

Several of the heat-flow measurements in the Basin and Range province were made in granitic rock where determinations were also made of the radioactive heat production (A_o) of core and outcrop samples. The heat-flow–heat-production (q–A_o) data for the Basin and Range province are displayed with similar data from the Sierra Nevada province and the Eastern United States (that is, east of the Great Plains; see Fig. 9-1b) in Figure 9-3. The data for the Sierra Nevada province and the Eastern United States follow the well-known linear relation first discovered in radioactive rocks of New England by Birch and others (1968).

$$q = q_r + DA_o. \tag{1}$$

In this relation the intercept q_r is the "reduced heat flow" or heat flow for zero surface radioactivity. The slope D is a "characteristic depth" for the vertical distribution of heat production (10 km for the Sierra Nevada; 7½ km for the Eastern United States). Although this relation has been widely discussed (for example, Birch and others, 1968; Roy and others, 1968, 1972; Lachenbruch, 1968, 1970; Blackwell, 1971; Lachenbruch and Sass, 1977), we consider it briefly here, as it forms the basis for discussion to follow.

The simplest interpretation, consistent with the requirement that equation 1 survive differential erosion, is that heat production $A(z)$ be distributed vertically (in the upper crust at least) approximately as

$$A(z) = A_o e^{-z/D}. \tag{2}$$

Where equation 1 applies throughout large provinces, the reduced heat flow q_r is uniform, and it is reasonable to assume that the more local effects expected from hydrologic and magmatic convection are unimportant and that q_r represents uniform conductive flux from

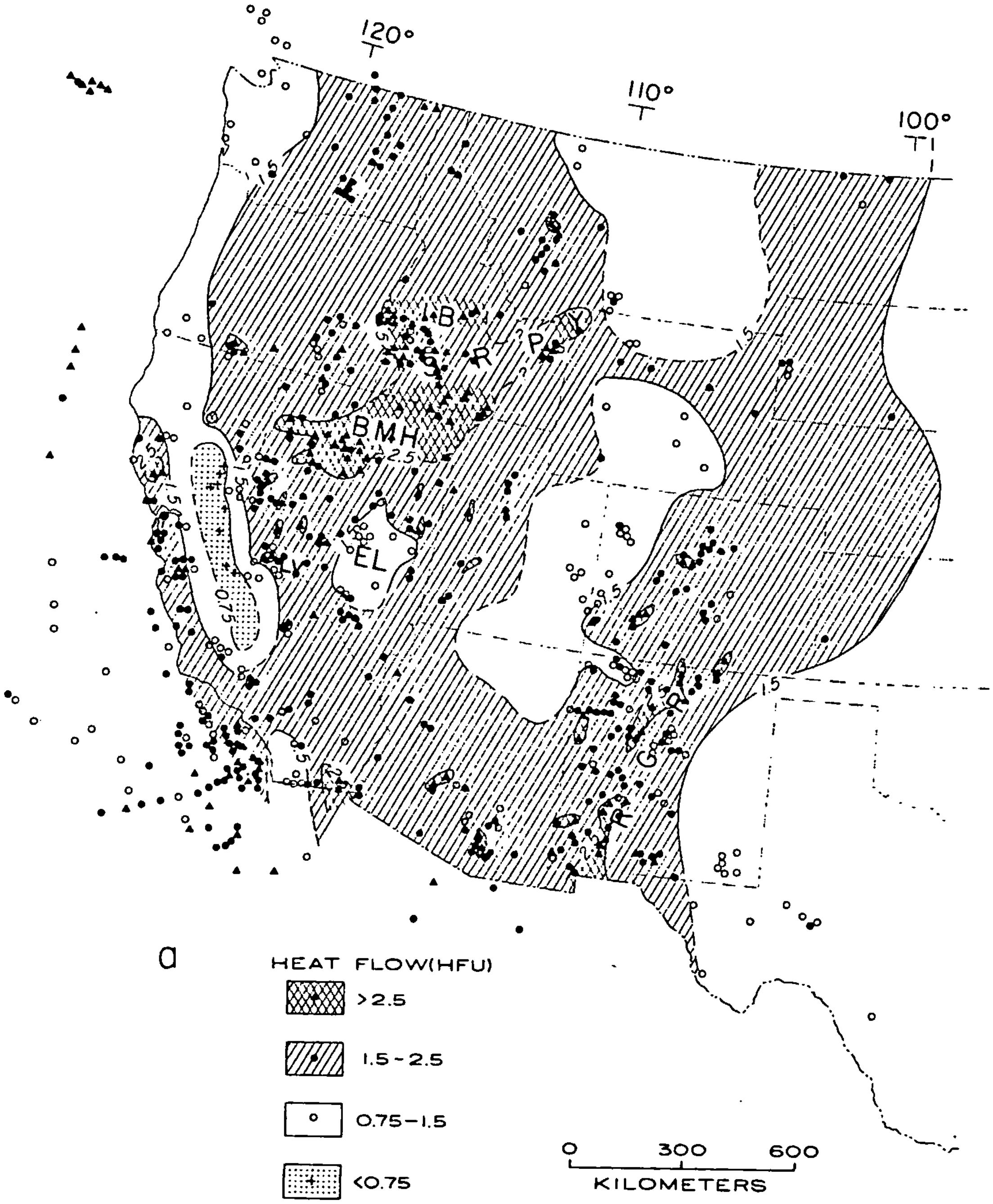
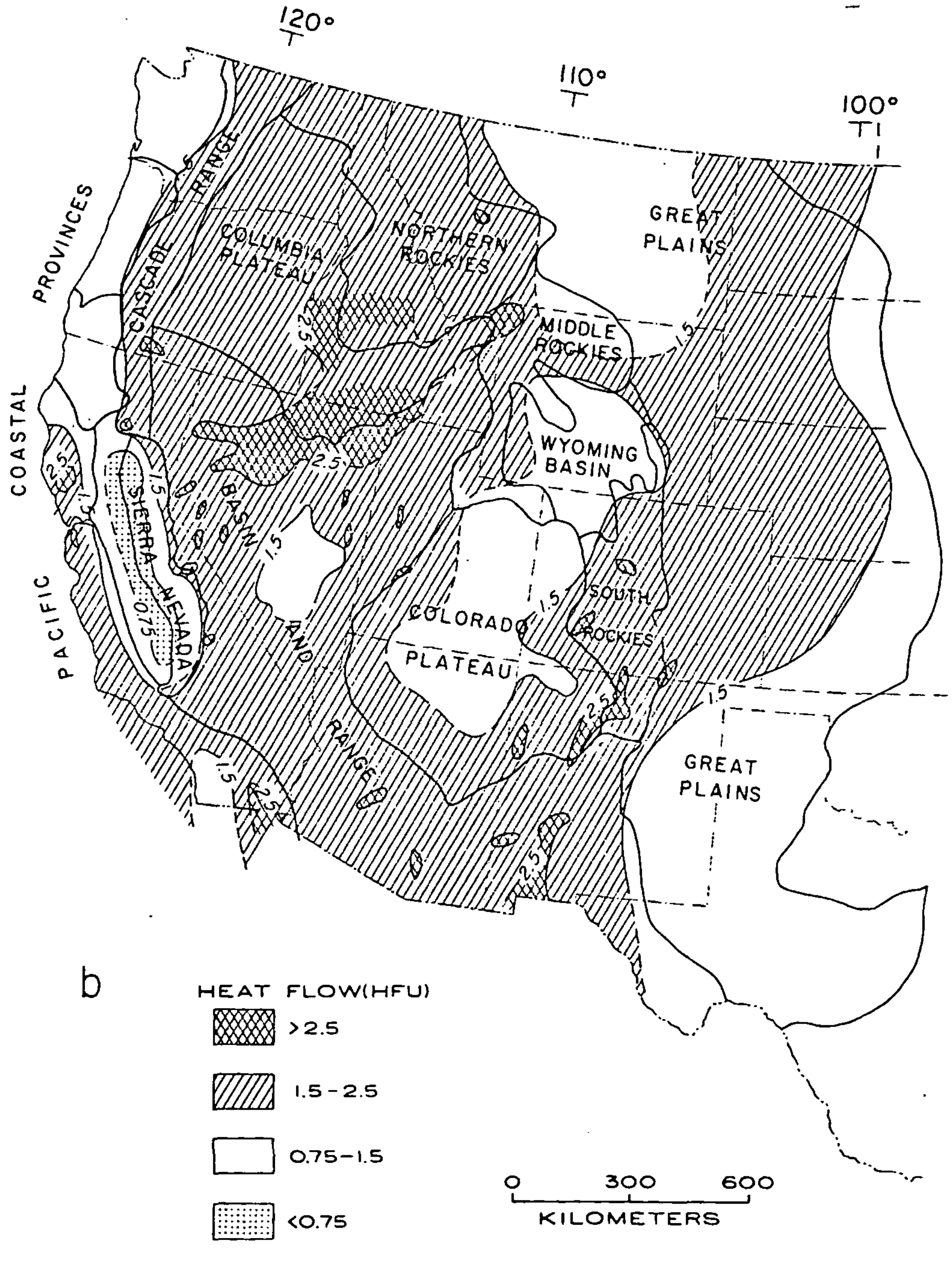


Figure 9-1. (a) A contour map of surface heat flow in the Western United States adapted from Figures 1 and 2 of Lachenbruch and Sass (1977) with additional U.S. Geological Survey unpublished data and new data in Idaho from Brott and others (1976). Abbreviations are BMH for Battle Mountain High, EL



for Eureka Low, LV for Long Valley volcanic center, IB for Idaho Batholith, SRP for eastern and Central Snake River Plain, Y for Yellowstone thermal area, and RGR for Rio Grande Rift. (b) Heat-flow contours superimposed on major physiographic units of the Western United States.

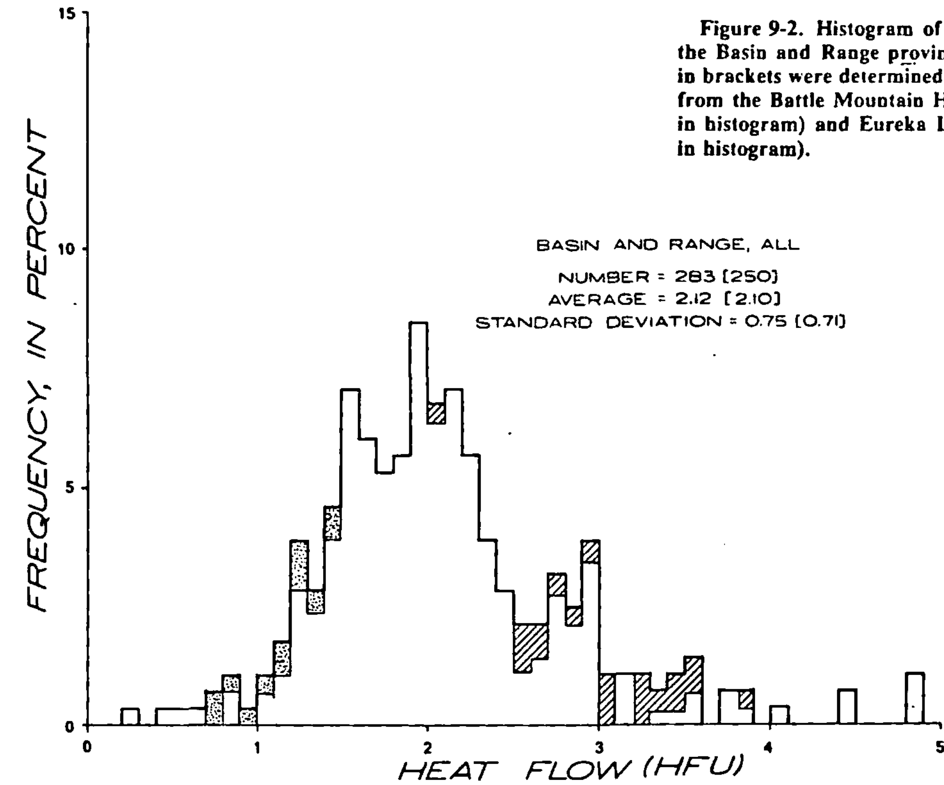


Figure 9-2. Histogram of heat flow in the Basin and Range province. Statistics in brackets were determined without data from the Battle Mountain High (hatched in histogram) and Eureka Low (stippled in histogram).

the deep crust or mantle. If we assume uniform thermal conductivity K, the steady temperature θ under these circumstances is given by

$$\theta(z) = \frac{1}{K}\,[q_r z + D^2 A_o(1 - e^{-z/D})]. \qquad (3)$$

The depth to which equation 3 or similar relations based on equation 1 are valid depends upon (1) the depth to which heat transfer is predominantly by steady conduction and (2) the depth to which equation 2 or similar relations between $A(z)$ and A_o are valid.

When only a few heat-flow–heat-production pairs were available from the Basin and Range province, they were described reasonably well by a regression line (dashed, Fig. 9-3) proposed by Roy and others (1968). However, from the accumulated data shown in Figure 9-3, it now appears that the linear relation does not apply throughout the province as a whole; q_r is not uniform, and D is not defined. However, it is still possible to define the "non-radiogenic" contribution q_r for each site (Roy and others, 1972) in a manner consistent with equation 1:

$$q_r \equiv q - DA_o. \qquad (4)$$

The distribution of reduced heat flow q_r for the Basin and Range province (Fig. 9-4b) has been computed from equation 4 by assuming $D = 10$ km, the value established in related rocks of the adjacent Sierra Nevada province (Fig. 9-3). From the data in Figure 9-4, we

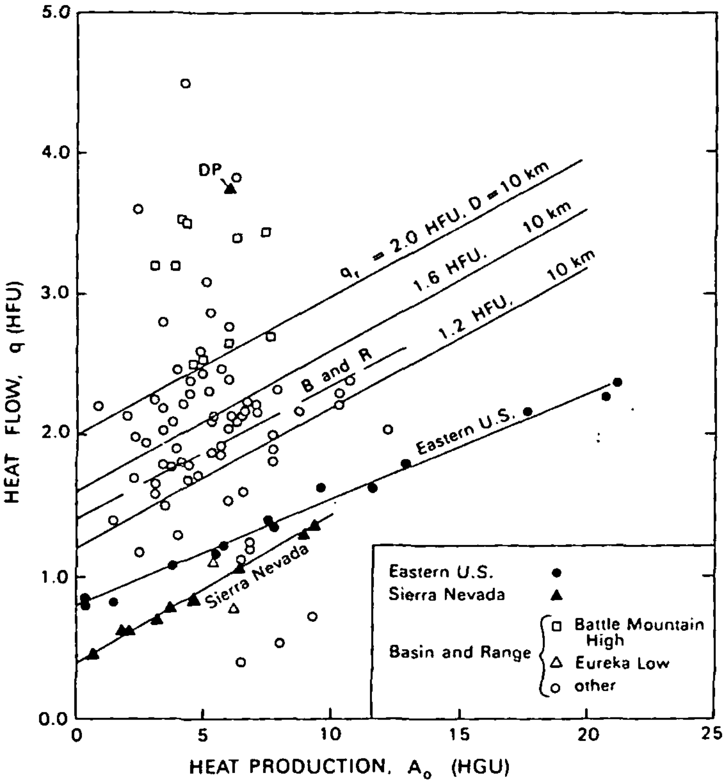


Figure 9-3. Heat flow and radioactive heat production in crystalline rock from three provinces. Original least-squares lines, labeled Sierra Nevada, Eastern U.S., and B and R, are from Roy and others (1968); they predate most of the Basin and Range observations. DP is adjacent to the Long Valley volcanic center.

concluded that variations in surface heat flow caused by convective processes and their related transients are greater by a factor of perhaps 3 or 4 than those caused by lateral variations in crustal radioactivity (Lachenbruch and Sass, 1977).

Crustal Temperatures: A Static Model

Almost half the values of q_r in Figure 9-4b lie in the modal range 1.2 to 1.6 HFU. We take this to be the characteristic range of q_r for the province, based on the belief that most of the departures, both positive and negative, result from circulatory hydrothermal convection. However, in hotter subregions like the Battle Mountain High, q_r is consistently greater than 2.0, and it averages about 2.5 HFU (the actual heat flows, including those for which radioactivity was not available, average about 3 in the Battle Mountain High, Fig. 9-2). The generalized crustal temperature profiles for the province (curves C, D, E, and F, Fig. 9-5) were obtained from equation 3 by introducing the four values of q_r (1.2, 1.6, 2.0, and 2.5 HFU) and the near-average value of 5 HGU for A_0 (Fig. 9-4c). From the intercept value of the line for the Eastern United States (Fig. 9-3), we may infer that 0.8 HFU is a characteristic value for q_r in stable regions (Roy and others, 1968). Curve B, Figure 9-5, shows the temperatures one should expect in the Basin and Range province if it were underlain by such a stable lithosphere. Shown also in Figure 9-5 (curve A) is the generalized curve for the Sierra Nevada province, where q_r is only 0.4 HFU (see Fig. 9-3). As this is probably a transient condition, curve A probably underestimates temperatures at depth (see, for example, Blackwell, 1971).

Figure 9-5 is about as far as we can go at present in constructing geotherms with a steady conduction model and observations of heat flow and radioactivity at the surface. In the more

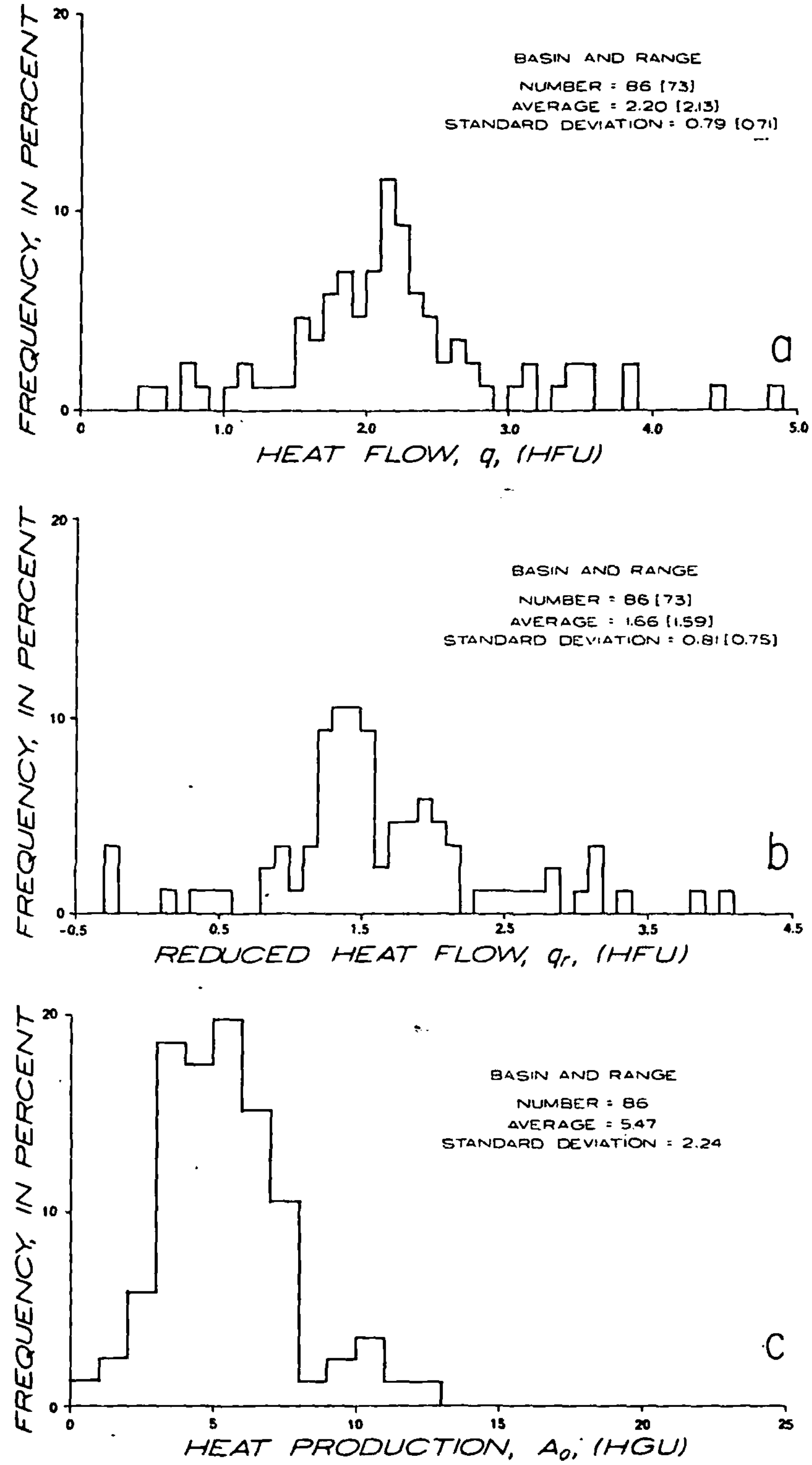


Figure 9-4. Histograms of (a) heat flow, (b) reduced heat flow, and (c) radioactive heat production for sites at which both q and A_o were measured in granitic rocks of the Basin and Range province. Statistics in brackets in (a) and (b) were determined without data from Battle Mountain High and Eureka Low.

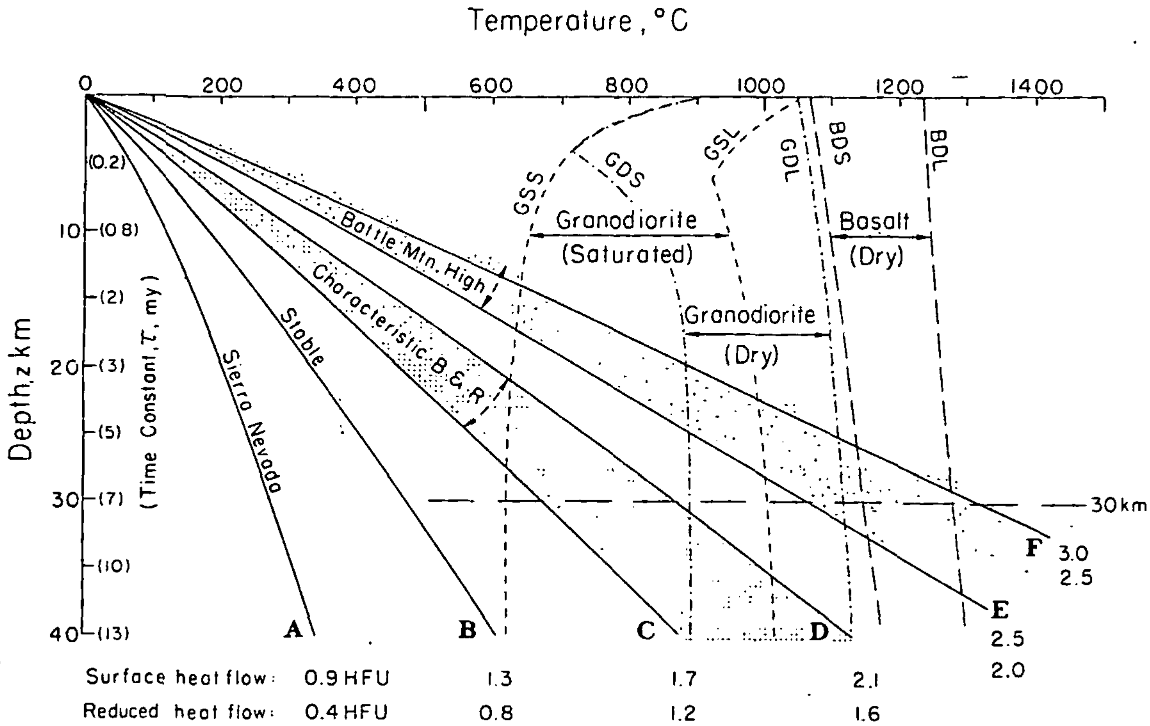


Figure 9-5. Generalized conductive temperature profiles for the Sierra Nevada crust (A), a stable reference crust (B), the characteristic Basin and Range crust (C to D), and lower limiting (E) and average (F) conditions in the crust of the Battle Mountain High. All curves are drawn for a surface heat production (A_o) of 5 HGU, characteristic depth (D) of 10 km, and thermal conductivity (K) of 6 mcal/(cm·s·°C) (eq. 3). Surface heat flow and reduced heat flow are shown at the bottom of each curve. Melting relations (after Wyllie, 1971) are shown for intermediate crustal rock by the curves GSS (granodiorite saturated solidus), GSL (granodiorite saturated liquidus), GDS (granodiorite "dry" solidus, Wyllie, type II), and GDL (granodiorite dry liquidus) and for basalt by BDS (basalt dry solidus), and BDL (basalt dry liquidus). In parentheses on the depth axis is shown the time constant for an overburden of thickness z (see text).

stable regions, curves constructed on this basis are probably reasonable throughout the crust; in active areas they may be useful down to those depths where convective transport or transients become important. Although the applicability of Figure 9-5 to near-surface conductive regimes is based upon several uncertain assumptions, it represents a virtual certainty in comparison to the conjectures required for discussion of thermal processes deeper in the lithosphere in tectonically active regions like the Basin and Range province.

DISCUSSION OF FIGURE 9-5

Major Assumptions

The scheme applied for downward extrapolation of temperatures from surface data in Figure 9-5 contains several assumptions that should be considered before we attempt to generalize it to accommodate convection. The more important ones are discussed below:

1. Systematic convective loss at the surface is neglected. We have assumed that after correction

for the contribution of crustal radioactivity, the average heat flux through the Earth's surface is q_r, determined from measurements of conductive flux. We have therefore neglected heat delivered to the surface convectively by volcanoes and hot and warm springs. The thickness of post-Oligocene volcanic rocks in the Great Basin probably averages on the order of 100 m (E. H. McKee, 1977, oral commun.). Averaged over time, the contribution of their heat to the combined surface flux is negligible ($\sim 10^{-2}$ HFU; see Fig. 9-15). With the exception of the Yellowstone system, the hotter known hydrothermal systems presently are discharging heat at a rate that would not significantly affect the regional crustal heat budget (Lachenbruch and Sass, 1977). However, details of the total hydrologic heat loss to the surface drainage from less conspicuous systems is unknown; this loss is neglected although it could be significant.

2. The materials are homogeneous, the geometry is quasi-one dimensional, and the heat production is given by equation 2. The first two are obvious simplifications that usually permit bracketing models without intuitive difficulty by selecting extreme values of the parameters. The assumption for radioactivity may be reasonable to crustal depths, although values for the lower crust are uncertain. If extended deeper, equation 2 underestimates heat production in the upper mantle and results in an underestimation of lithosphere thickness and overestimation of temperature. The effect is easily bracketed by reducing the assumed flux from the asthenosphere by the estimated heat production of the upper mantle and the possible underestimate by equation 2 for the lower crust; plausible adjustments are not likely to exceed about 0.3 HFU.

3. The materials are in a quasi-stationary thermal state. By this we mean that at any depth the temperature (and flow for convective models to be discussed) has only short-term variations about a steady mean value. To introduce the time context, we have shown on the ordinate axis (Fig. 9-5) the conductive time constant ($\tau = z^2/4\alpha$, α = thermal diffusivity) for the layer of thickness z. For conduction models the quasi-stationary condition is approached in the layer one or three time constants after a rapid change in temperature or heat flux (respectively) at depth z (Lachenbruch and Sass, 1977). (For example, the temperature is nearly steady throughout a 30-km crust 7 m.y. after a rapid temperature change at its base [Fig. 9-5].) If conditions on z change slowly over time periods large relative to the time constant, the stationary model can be a good approximation even though neither temperature nor flux is constant on z.

4. Heat transfer to the depth of extrapolation is predominantly by thermal conduction. This may be the most significant limitation of Figure 9-5 in tectonically active provinces like the Basin and Range. There we have abundant evidence of heat transfer by mass movement in the forms of hydrothermal activity, magmatism, and crustal extension. Under such conditions convection should not be neglected; it probably contains the explanation for the high heat flow, so laboriously documented.

Over periods $\gtrsim 10^6$ years the integrated effect on regional heat flow of circulatory hydrothermal convection in the upper few kilometres of the crust is probably unimportant (Lachenbruch and Sass, 1977), and we presume that this effect has been adequately filtered out by selecting modal values of q_r in constructing Figure 9-5. Hence, we focus on how magmatism and tectonic extension might affect the high heat flow observed.

Simple Magmatic Model for Elevated Surface Heat Flow

Figure 9-5 can be applied to a simple semiquantitative model for high heat flow. Suppose basalt rises through the lithosphere to some level H in the crust where it is impeded, perhaps by a viscous siliceous melt generated as the basalt exchanges its heat with indigenous rocks

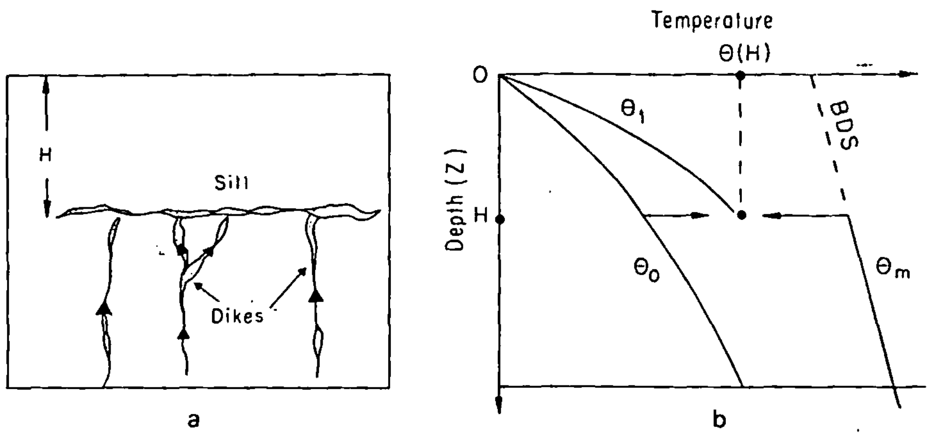


Figure 9-6. The simple intrusive model. A sill at depth H is maintained at average temperature $\theta(H)$ by dikes at temperature θ_m in a medium initially at temperature θ_o. The steady temperature in the conductive overburden is θ_1.

(Fig. 9-6a). Let the initial temperature of the lithosphere be θ_o, and the temperature of the rising basalt be θ_m (Fig. 9-6b). Suppose θ_o is curve C and θ_m is BDS, Figure 9-5. If the basalt supply were adequate to maintain the sill-like melt at a time-averaged temperature $\theta(H)$, for a time $\tau(H)$, a stationary conductive condition θ_1 would be established in the overburden (Fig. 9-6b). For example, if $H = 20$ km, $\theta(H) = 900°C$, then after 3 m.y. (τ (20 km), Fig. 9-5) θ_1 would be the curve F, Figure 9-5, typical of the Battle Mountain High. Downward extrapolation from surface observations would correctly identify the magmatic temperature at depth H, but extrapolation to greater depth (for example, for curve F) would not be valid because there the temperature could range, according to position, between θ_m and θ_o. To maintain the silicic melt at 900°C, the rising basalt would, on the average, need to convect heat to the 20-km depth at the rate of 1.3 HFU (the difference between q_r for curves C and F) to supply the upward heat loss, and in addition such heat as might be required to approach a quasi-stationary state beneath H. The quasi-stationary state beneath H would develop if the intrusive mass flux, though intermittent, were uniform over times on the scale of the time constant τ at each depth. Under these conditions the average temperature at each depth would assure that the combined conductive and convective fluxes at that depth were just sufficient to supply the 2.5 HFU required to sustain curve F (plus the requirements for lateral convection if there were extension). We shall consider an analytical model of this quasi-stationary intrusive condition later. For the present, it is sufficient to note that in the stationary convecting zone the average gradient and temperatures will be lower than indicated by the curves of Figure 9-5. This is because the vertical gradient is proportional to the conductive component which is only a fraction of the combined flux.

Steady-State Conducting Lithosphere as a Limiting Case

There is one more point to be made from Figure 9-5 before proceeding with tectonic models of high heat flow. For such models we shall define the lithosphere in a thermal sense so that the temperature at its base is sufficiently high to generate substantial amounts of melt if the composition permits. Hence, we take the base of the lithosphere R to be at the dry solidus temperature. Thus,

$$\theta(R) = \theta_m(R) \tag{5a}$$

where

$$\theta_m(z) \equiv \theta_o + mz, \tag{5b}$$

$$\theta_o = 1050°C, \tag{5c}$$

and

$$m = 3°C/km. \tag{5d}$$

The parameters are chosen to coincide approximately with BDS, Figure 9-5, and we assume that this adequately represents the peridotite solidus in the upper mantle as well (see Fig. 8-4, Yoder, 1976). It is emphasized that we are defining the lithosphere R as the region with temperatures below the dry solidus because the large amounts of basalt required by the magmatic models (to be discussed) probably could not originate above the base of such a region (Wyllie, 1971). The lithosphere defined in terms of seismic behavior may be substantially thinner than R because of possible effects in the upper mantle of melting below the dry solidus, high temperature, or contamination by basaltic intrusion.

A formal extrapolation of the curves of Figure 9-5 to the solidus, θ_m, is shown in Figure 9-7. These curves underestimate the thickness R of the lithosphere in a stationary thermal state for three reasons: (1) They neglect convective transport, which as just discussed, would generally reduce gradients (for a given surface heat flow) and increase lithosphere thickness; (2) they are based upon an assumed uniform conductivity of 6 mcal/(cm·s·°C); the actual conductivity of the mantle is probably larger and the gradients would be correspondingly smaller; and (3) they are based upon the distribution of heat production given by equation 2, the effect of which has been discussed. That 9-7 gives an underestimate is supported by the value for the "stable" curve which is R = 94 km, substantially less than the values usually estimated for such regions. (Increasing K by one conductivity unit or decreasing q_r by 0.1 HFU to accommodate upper-mantle conditions would each increase the estimate of the stable R by about 20 km; these effects are less important for the thinner extending lithospheres that we shall be considering.)

SIMPLE MODELS OF A STEADILY EXTENDING LITHOSPHERE

Conditions in the Lithosphere

It is well known from the pattern of normal faulting observed at the surface that the Basin and Range province is extending.

If we view the extension as stretching in the homogeneous plastic sense (like pulling taffy), we expect the lithosphere to become thinner in the process. For a lithosphere whose base is defined by a temperature condition (eq. 5), thinning will increase the gradient and hence the heat loss to the surface; this loss, in turn, will be limited by the rate at which processes in the asthenosphere can supply heat to the lithosphere. If the extension rate of the lithosphere and the processes in the upper asthenosphere remain relatively uniform, the lithosphere will eventually reach a stationary thickness; the rate of accretion (that is, of descent of the basalt-melting isotherm) at its base will just compensate for the thinning. Two limiting cases of this model are illustrated in Figure 9-8a and 8b. In one (STR, Fig. 9-8a) the accreting material is all crystalline, and in the other (UPL, Fig. 8b) it is all liquid basalt which gives up its latent heat as it crystallizes at the base of the lithosphere. In a third model (INT, Fig. 9-8c) the extension is accommodated by intermittent intrusion of dikes that over long periods of time are homogeneously distributed throughout the lithosphere.

In the simple steady conduction model leading to Figure 9-7, the heat flow at the surface q is simply the sum of the heat conducted into the base of the lithosphere and the radioactive heat generation within the lithosphere. The latter, obtained from equation 2, is

$$\int_0^R A_o e^{-z/D}\, dz = A_o D - A_o D\, e^{-R/D}. \qquad (6)$$

The second term on the right is the heat generated by the distribution (eq. 2) at depths greater than R. Hence, for the model of Figure 9-7, heat conducted into the base of the lithosphere is

$$q_r + A_o D\, e^{-R/D} = q_r \quad , \quad R >> D = 10\ \text{km}. \qquad (7)$$

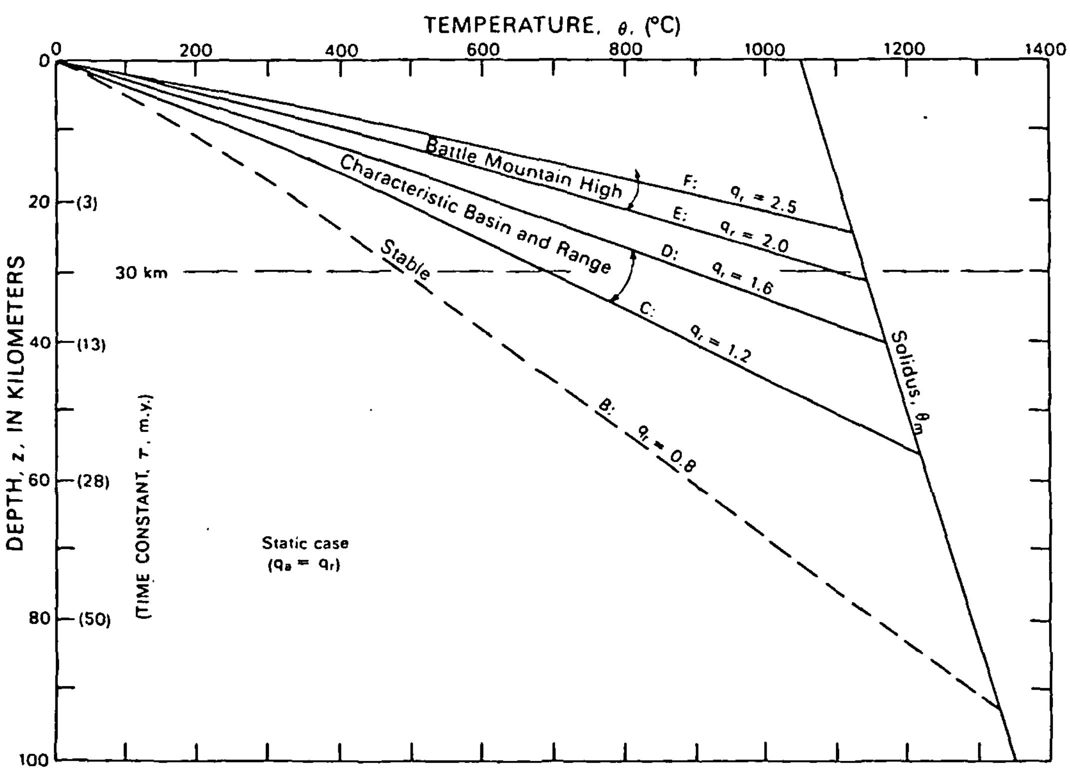


Figure 9-7. Model of the static conducting lithosphere obtained by extending the curves of Figure 5 (eq. 3) to the solidus (θ_m, eq. 5).

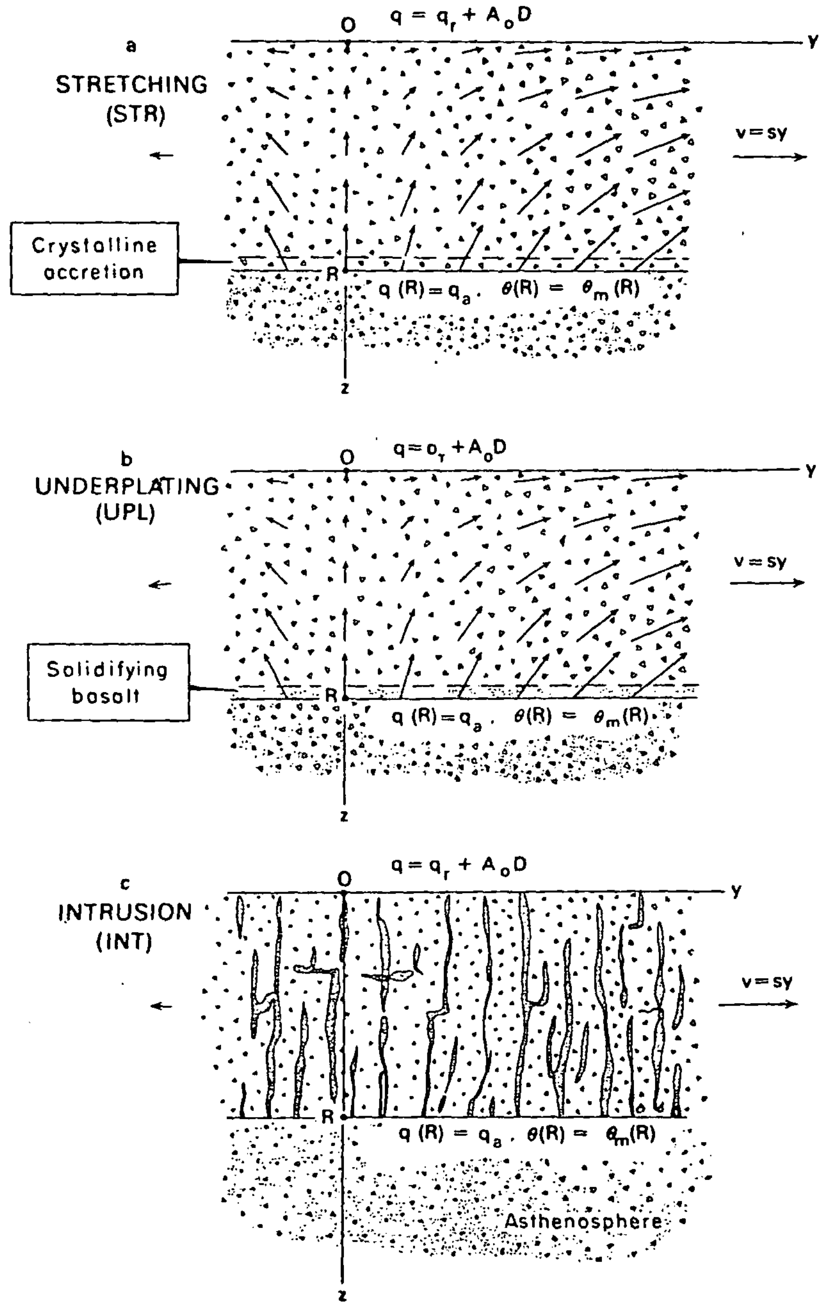


Figure 9-8. Simple thermomechanical models of a steadily extending lithosphere of thickness R with base at solidus temperature, $\theta_m(R)$. (a) Homogeneous stretching with accretion of crystalline material at the base (STR). (b) Homogeneous stretching with accretion of solidifying basalt at the base (UPL). (c) Extension by distributed dike intrusion (INT). Arrows in (a) and (b) are velocity vectors (v, w), and s is horizontal strain rate.

Thus, for the simple static model the heat conducted into the base of the lithosphere is, for practical purposes, the value of q_r observed at the surface. In tectonically active areas, however, q_r will generally contain contributions from heat both conducted and convected into the base of the lithosphere, and neither will be identifiable from thermal observations at the surface. (Their sum will not equal q_r because some heat is convected laterally in an extending lithosphere.) For completely specified mechanical models like those illustrated in Figure 9-8, the extension rate at the surface will determine the vertical velocity field in the lithosphere, and with equation 5 the convective input to a lithosphere of any thickness will be known. However, the conductive flux into the base of the lithosphere is still unspecified; we shall denote it by

$$q'_a + A_0 D e^{-R/D} \simeq q_a \quad , \quad R >> D = 10\,\text{km}. \tag{8}$$

(The radioactive distribution [eq. 2] is being retained to permit a simple comparison of results with the static model.) For convenience we shall refer to the conductive flux into the base of the lithosphere as q_a, although in the analysis the more complete expression on the left side of equation 8 will be used. In general, q_a will be less than q_r; the two quantities will approach one another as the extension rate goes to zero.

To determine the temperature distribution through an extending lithosphere and the relations among spreading rate, surface heat flow, and lithosphere thickness, we must know q_a. It is the only term in the thermal budget not determined by processes in the lithosphere. Hence, the surface heat flow contains information about asthenosphere processes only to the extent that it is sensitive to q_a and to the mechanical coupling at $z = R$ associated with extension.

Processes in the Asthenosphere and Limits to q_a

Although the lithosphere of the Great Basin is extending, it is in isostatic balance, and hence the mass per unit area is not decreasing (Thompson and Burke, 1974). It follows that mass must be moving upward in the asthenosphere above some depth at which it is replenished by lateral inflow. The flow pattern, which is fundamental to several of the tectonic models discussed in this volume, could take many forms. Consider three extreme cases: (1) buoyant rise of a massive diapir or "plume" producing an active asthenosphere in which the horizontal strain rate diminishes upward near the base of the lithosphere providing the viscous stress to pull the lithosphere apart; (2) a passive asthenosphere, dragged apart and stretched as the lithosphere falls apart, perhaps from regional gravitational stress, or (Scholz and others, 1971; Christiansen and McKee, this volume) from changing boundary stress at the plate margins; and (3) penetrative convection of the asthenosphere by the melted fraction through a relatively static crystalline framework; one source of melt might be the remnant of subducted material at depth. It is likely that (3) would operate simultaneously with (1) or (2), and the modes could change as the system evolves. For example, (1) and (3) could raise the temperature, and the topographic changes caused by thermal expansion or thinning of the lithosphere might generate gravitational stress operating in mode (2). The time for approach to a stationary thermal state could be on the order of 10^8 years. However, substantial heat transfer could occur in transient states, and the processes could have been in progress long before the initiation of basin-range faulting. Each of these modes has rather different implications for heat, mass, and momentum transfer in the asthenosphere, but quantitative modeling is difficult as it is sensitive to uncertain assumptions regarding chemical composition, mechanical properties, thermal conductivity, heat production, and choice of boundary conditions (for example, Froideveaux and Schubert, 1975); we shall not pursue it. Nevertheless, it is clear that the ultimate source of anomalous heat flow in the Basin and Range province must be the heat carried by mass moving upward in the asthenosphere, augmented perhaps by viscous dissipation in the flow.

Because of convection (Tozer, 1967), the coexistence of liquid and crystalline phases (Kay and others, 1970), and the role of radioactivity (Clark and Ringwood, 1964), the thermal gradient in the asthenosphere must generally be small relative to that in the lithosphere. Thus, a substantial proportion of the heat convected upward through the asthenosphere could be converted to internal energy by melting (and to a lesser extent the work of volume expansion). To take an extreme example, the excess heat convected across a layer with 100°C temperature drop could all be consumed by melting a 30% fraction (if such a large meltable fraction were present); the heat delivered to the base of the lithosphere might be only that conducted along a melting point gradient. For the numerical values we have assumed, that condition leads to $q_o \approx 0.18$ HFU, which is a lower limiting value for the models of Figure 9-8a and 8c; if q_o were less than 0.18, the geotherm would not intersect the melting curve as required by equation 5a. In any case, the upward movement of mass through the asthenosphere is likely to result in an increasing proportion of melt near its top (Green, 1973). The heat stored in this melt cannot be delivered to the surface unless the melt is allowed to cool to subsolidus temperatures, a process permitted by the "magmatic" models, Figure 9-8b and 8c. The rate of basalt production required by these models may be one of the more important constraints on asthenosphere flow imposed by heat-flow observations.

Additional limits to the value of q_o are imposed by the requirement that it reduce to q_r (or slightly less if we allow for the uncertain radioactivity of the lower crust and upper mantle) as the extension rate goes to zero, in which case the static model must obtain. If we believe that the high heat flow and lithosphere extension are causally related, then the value of q_o should approach the value characteristic of stable regions; $q_r \approx 0.8$ (or perhaps as little as 0.5, when we allow for neglected radioactivity). If we believe that high heat flow is not causally related to extension, q_o cannot exceed q_r in any case. Beyond that, it is difficult to generalize, and it is not obvious whether q_o would increase or decrease with increasing extension rate. With a thinner lithosphere characteristic of rapid extension, flowing material occurs higher in the upper mantle, probably reducing the gradient and conductive flux as discussed above. However, the estimate of q_o is complicated by the possibility of larger conductive flux in a boundary layer at $z = R$; this is likely to be controlled by the latent heat release, an extreme case of which is accommodated by the model of Figure 9-8b.

The Steady-State Assumption

For the idealized models of Figure 9-8, we assume that the extending layer is in a thermal and mechanical steady state. In terms of geological applications, this assumption is a mathematical fiction justified by the insight it yields through simple analytical results, and by the fact that alternative time-dependent models permit an enormous range of possibilities poorly constrained by our present knowledge. Surface manifestations such as faulting and extrusion tell us that movements of mass in the crust are likely to be episodic and nonuniformly distributed; each change in the velocity field will result in a time-dependent or "transient" response in the temperature field. We have assumed that short term variations in the velocity components average out to uniform values over periods of millions of years, although even average values will, in general, vary on all time scales. The time necessary for approach to a steady state in a layer extending at an average uniform rate depends upon the conductive time constant for the layer (τ, see Figs. 9-5, 9-7), the mechanical mode and rate of extension, and upon the history of thermal conditions at the lower boundary. This history depends upon little-known processes of heat and mass transfer at great depth, and they would have to be specified before we could describe the approach to equilibrium in the extending layer.

Nevertheless, it is possible to make rough estimates of geologic conditions under which steady-state results might reasonably be applied. For example, in the intrusive mode (Fig. 9-8c) it can be shown quite generally (Lachenbruch, unpub.) that if the basal temperature in a layer of thickness z' is held constant after the time ($t = 0$) that extension is initiated at a uniform strain rate s, then the transient temperature disturbance in the layer will decay as $\exp\{-[s\tau(z') + (\pi/2)^2]\, t/\tau(z')\}$. Similarly, if conductive flux at the base is held constant, the leading term in the Fourier expansion for the transient decays as $\exp\{-[s\tau(z') + (\pi/4)^2]\cdot t/\tau(z')\}$. In each case the boundary value may undergo a large initial change when extension commences. According to these relations the temperature change will generally exceed about 85% of its equilibrium value when the expressions following the minus signs exceed about 1.9. In the static case ($s = 0$), this occurs when $t \gtrsim \frac{3}{4}\,\tau(z')$ for constant boundary temperature and when $t \gtrsim 3\,\tau(z')$ for constant boundary flux, confirming the rule-of-thumb given in an earlier section. The first term in brackets, which represents the effects of convective transport, hastens the approach to equilibrium for both boundary conditions; the effect is important only for larger extension rates. For extension in the other modes the situation is more complicated; convection hastens the approach to a steady state for extension at constant basal temperature and retards it for extension at constant basal flux. However, for the range of conditions expected to apply regionally over periods of millions of years, the static rule-of-thumb applies reasonably well to all modes.

The adjustment of lithosphere thickness to its stationary value might significantly retard equilibrium, depending on the mechanism and initial condition assumed, and plausible boundary conditions that would cause the thermal steady state to be approached more slowly than in the constant flux case, or more promptly than in the constant temperature case, can be imagined. In general, however, if the time constant of the extending layer exceeds the period over which extension can reasonably be considered uniform, the applicability of steady-state results should be considered with some caution. The present episode of extension in the Great Basin has probably been in progress for about 17 m.y.; in other parts of the Basin and Range province, it probably started as much as 10 m.y. earlier (Christiansen and Lipman, 1972; Stewart, 1971). The layer thicknesses associated with time constants of such durations are 45 km and 60 km, respectively. As these are of the same general magnitude as the expected lithosphere thickness in the Basin and Range province, it is not unreasonable to expect steady-state results to give useful insight into average conditions there. Numerical details of the results, particularly for the thicker lithospheres, should, of course, not be taken too literally. [In another paper (Lachenbruch, in press), the theory is applied to only the crustal portion of an extending lithosphere, thereby avoiding the uncertainty associated with longer time constants.].

ANALYTICAL RESULTS

The model of Figure 9-8a (abbreviated STR) represents homogeneous stretching of a lithosphere whose thickness is maintained constant by accretion of crystalline material on its base. The model of Figure 9-8b is the same except that the accreting material is all liquid basalt which gives up its latent heat, a process we shall call "underplating" (abbreviated UPL). In these models convective transport in the lithosphere is in the solid state. In the model of Figure

9-8c (abbreviated INT), vertical convective transport is by fluid basalt in dikelike intrusions which, over long time periods, generate an average stationary thermal state. The intrusion accommodates lithosphere extension without vertical solid-state convection. Models similar to this one have been used by Bodvarsson (1954) and Palmason (1973) to describe conditions in Iceland.

We let w be the average upward velocity (in the negative z direction) and let v be the horizontal velocity (in the y direction) at any level in the lithosphere. The horizontal strain rate, denoted by s, is assumed to be uniform in the lithosphere. Thus for an incompressible lithosphere, the two-dimensional continuity condition is

$$\frac{\partial w}{\partial z} = \frac{\partial v}{\partial y} = s. \tag{9}$$

Taking the origin at an arbitrary point ($y = 0$) on the surface $z = 0$, we obtain for the velocity components

$$w = sz \tag{10a}$$

$$v = sy. \tag{10b}$$

For the intrusive model, w is average upward velocity of basalt at any depth in the lithosphere, that is, the vertical volume flux of basalt. Although we have given equations 9 and 10 in two-dimensional form, the thermal models are quasi-one dimensional, and s can be viewed more generally as horizontal areal strain rate.

For simplicity in these models, we assume the thermal conductivity $[K = 6\ \mathrm{mcal/(cm \cdot s \cdot {}^\circ C)}]$ and volumetric specific heat $[\rho c = 0.6\ \mathrm{cal/(cm^3 \cdot {}^\circ C)}]$ of all materials, liquid and solid, are the same. Effects of these assumptions are unimportant for the present purpose; they can easily be evaluated. The latent heat parameter L/c is assumed to be 350°C.

As in the simple conductive model, we assume the distribution of heat production is given by equation 2 with $A_o = 5$ HGU, $D = 10$ km. A minor modification of the following results would allow for the finite heat production of the lower lithosphere, and this modification, and an adjustment of mantle conductivity should be made if interest centers on lithosphere thickness for small extension rates. An additional modification of the following equations can account for mechanically generated heat. However, for the strain rates ($\lesssim 10^{-15}\ \mathrm{s^{-1}} \approx$ 3%/m.y.) and deviatory stresses ($\lesssim 1$ kb) of interest, the effect is unimportant.

Stretching with Crystalline Accretion (STR) or Underplating (UPL)

The differential equation of heat transfer for both cases is

$$K \frac{d^2\theta}{dz^2} + w\rho c \frac{d\theta}{dz} = -A_o e^{-z/D}. \tag{11}$$

The terms from left to right represent, respectively, conduction, convection, and radioactive heat production. We introduce the notation

$$\beta^2 = \frac{K}{s\rho c} \tag{12a}$$

$$\varepsilon(z) = \frac{z^2}{2\beta^2}, \tag{12b}$$

where β is a characteristic length. In general, conductive or convective transfer will predominate according to whether β is respectively large or small relative to R. (In our applications the two quantities are generally of the same order of magnitude, and both forms of transport are important.) The quantity ε is introduced into the exponent in equation 11 (with no important physical consequence) to obtain a simple analytical solution. Introducing equations 10a, 12a, and 12b into equation 11, we obtain

$$\frac{d^2\theta}{dz^2} + \frac{z}{\beta^2}\frac{d\theta}{dz} = -\frac{A_o}{K}e^{-z/D-\varepsilon(z)}. \tag{13}$$

Boundary conditions are

$$\theta = 0 \quad , \quad z = 0 \tag{14a}$$

$$K\frac{d\theta}{dz} = q_a + A_o D\, e^{-R/D-\varepsilon(R)} + \frac{LR}{c\beta^2}K \quad , \quad z = R. \tag{14b}$$

The temperature as a function of depth z for lithosphere thickness R, spreading rate s (related to β through eq. 12a), and basal conductive flux q_a is

$$\theta(z;R,\beta,q_a) = e^{R^2/2\beta^2}\left[q_a + \frac{LR}{c\beta^2}K\right]\frac{\beta}{K}\left(\frac{\pi}{2}\right)^{1/2} erf\left(\frac{z^2}{2\beta^2}\right)^{1/2}$$

$$+\frac{A_o D^2}{K}\left[1 - e^{-z/D} + 0(\varepsilon(D))\right]. \tag{15}$$

The heat flow is

$$q(z;R,\beta,q_a) = \left[q_a + \frac{L}{c}\frac{R}{\beta^2}K\right]e^{(R^2-z^2)/2\beta^2} + A_o D e^{-z/D-\varepsilon(z)}, \tag{16a}$$

and at the surface $z = 0$

$$q(0;R,\beta,q_a) = \left[q_a + \frac{LR}{c\beta^2}K\right]e^{R^2/2\beta^2} + A_o D. \tag{16b}$$

Comparing equations 16b and 4, we see that the first term (including the brackets) in 16b represents reduced heat flow q_r. Equation 15 is a generalization of the static conduction model

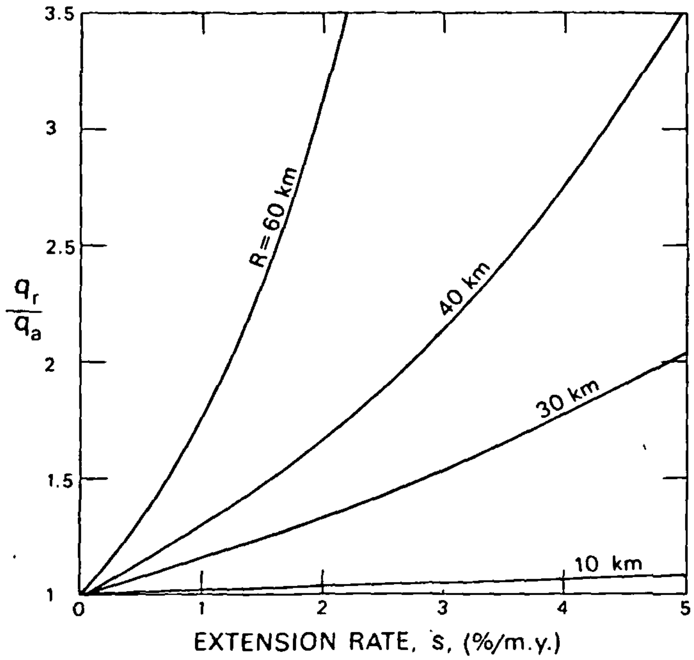


Figure 9-9. Effect on heat flow of homogeneous stretching, STR, of a lithosphere of thickness R. Reduced heat flow is q_r, conductive flux from the asthenosphere is q_a, and extension strain rate is s (see eq. 16b).

(eq. 3) to which it reduces when $s \to 0$ (that is, when $\beta \to \infty$). Equations 15 and 16 represent the case STR when $L = 0$ and the case UPL otherwise. The enhancement of q_r relative to q_a caused by stretching of the lithosphere is shown graphically in Figure 9-9 for the case $L = 0$.

Stationary Intrusive Model (INT)

In this case basalt rises through dikelike fractures at the temperature θ_m (eq. 5). The differential equation for the average temperature θ of the lithosphere at depth z is

$$K\frac{d^2\theta}{dz^2} = -A_o e^{-z/D} + s\rho c\left[\theta - \left(\theta_m + \frac{L}{c}\right)\right] - w\rho c\frac{d\theta_m}{dz}. \tag{17}$$

The second term on the right (including the brackets) represents heat given up by solidification and cooling of the magma in place. The last term represents heat given up by the magma during its rise; the term can be modified to accommodate extrusion, but that has been judged to be unimportant to the heat budget in the Great Basin. Introducing equations 5b, 10a, and 12a into equation 17, we obtain

$$\frac{d^2\theta}{dz^2} = -\frac{A_o}{K}e^{-z/D} + \frac{1}{\beta^2}\left[\theta - \left(\theta_o + \frac{L}{c}\right)\right] - \frac{2m}{\beta^2}z. \tag{18}$$

Boundary conditions are

$$\theta = 0 \quad , \quad z = 0 \quad , \tag{19a}$$

$$K\frac{d\theta}{dz} = q_a + A_o D e^{-R/D} \quad , \quad z = R. \tag{19b}$$

The average temperature at any depth z for given R, s (obtained from β), and q_a is then

$$\begin{aligned}\theta(z;R,\beta,q_a) = {} & A_o\frac{D^2}{K}\left(1-\frac{D^2}{\beta^2}\right)^{-1}\left(\frac{\cosh\frac{R-z}{\beta}}{\cosh\frac{R}{\beta}} - e^{-z/D}\right) \\ & + \left(\theta_o + \frac{L}{c}\right)\left(1 - \frac{\cosh\frac{R-z}{\beta}}{\cosh\frac{R}{\beta}}\right) \\ & + \frac{\beta}{K}\left[q_a - A_o\frac{D^3}{\beta^2}\left(1-\frac{D^2}{\beta^2}\right)^{-1} e^{-R/D} - 2mK\right]\frac{\sinh\frac{z}{\beta}}{\cosh\frac{R}{\beta}} \\ & + 2mz.\end{aligned} \tag{20}$$

The heat flow at the surface $z = 0$ is given by

$$\begin{aligned}q(0;R,\beta,q_a) = {} & A_o D\left(1-\frac{D^2}{\beta^2}\right)^{-1}\left(1-\frac{D}{\beta}\tanh\frac{R}{\beta}\right) \\ & + \frac{K}{\beta}\left(\theta_o + \frac{L}{c}\right)\tanh\frac{R}{\beta} \\ & + \left[q_a - A_o\frac{D^3}{\beta^2}\left(1-\frac{D^2}{\beta^2}\right)^{-1} e^{-R/D} - 2mK\right]\frac{1}{\cosh\frac{R}{\beta}} \\ & + 2mK.\end{aligned} \tag{21}$$

Reduced heat flow q_r is obtained from equation 21 by subtracting $A_o D$ (see eq. 4). Like equation 15, equation 20 is a generalization of the static conduction model (eq. 3), to which it reduces as $s \rightarrow 0$.

Procedure for Applying the Analysis

The foregoing results satisfy the conditions for heat and mass flux at the base of an extending lithosphere whose thickness R is arbitrary. We can therefore adjust R to satisfy the temperature condition (eq. 5a). We are then left with the four parameters—surface heat flow, asthenosphere flux, extension rate, and lithosphere thickness—any two of which must be known to specify the lithosphere regime completely for each spreading mode. Of these, the surface heat flow is the most observable, and the radioactive contribution to it ($A_o D$) is relatively unimportant. We shall therefore investigate the lithosphere conditions associated with each of the standard heat-flow regimes, C, D, E, and F (Fig. 9-7), representing reduced heat flows of 1.2, 1.6, 2.0, and 2.5, respectively. The actual surface heat flows for which the calculations are made are each greater than q_r by the radioactive contribution, 0.5 HFU; most of the results do not change in important ways for different radioactive contributions. With q_r specified, assigning any one of the parameters s, q_a, or R will determine the other parameters as well as the thermal regime $\theta(z)$ for each extension mode.

DISCUSSION OF THE ANALYTICAL RESULTS

Figure 9-10 shows the model-dependence of attempts to deduce lithosphere conditions from a knowledge of reduced heat flow. For example, the three curves that converge near the letter F, Figure 9-10a, show the combinations of s and q_a, for each extension mode, that are consistent with the reduced heat flow of 2.5 HFU, typical of the Battle Mountain High. As the extension rate s approaches zero, the asthenosphere flux q_a must approach the reduced heat flow q_r, and the curves converge to $q_a = q_r = 2.5$ HFU as required by the static model (eq. 3, Fig. 9-7). As spreading rate s increases, the required reduced heat flow can be supplied with a progressively smaller asthenosphere contribution q_a; the difference is made up by heat transport associated with vertical mass movement within the extending lithosphere. Lithosphere convection in the INT mode is the most effective in the sense that it can produce a given surface heat flow with the least extension rate; STR requires the greatest. The depth to the source of basaltic melt R is therefore greatest for the INT mode for a given spreading rate (Fig. 9-10b); the efficient convective transport greatly reduces thermal gradients in the lower lithosphere. For a given extension rate, STR and UPL yield the same R (Fig. 9-10b), but less asthenosphere flux is required by UPL (Fig. 9-10a or 10c) because of the contribution of latent heat at its base. The value of this contribution is the difference between the ordinates for STR and UPL in Figure 9-10a and 10c.

We shall refer to INT and UPL as the "magmatic modes." For both modes the volume increase of the extending lithosphere is accommodated by a magmatic increment W that must be supplied to the base of the lithosphere at the rate sR (eq. 10a). Hence,

$$W = sR \tag{22}$$

is the rate of basalt production (per horizontal unit area) required of the asthenosphere to sustain these modes. It is seen from Figure 9-10d that for a given asthenosphere flux the basalt production required by any surface heat flow is approximately the same for each magmatic mode; R is greater for INT, but s is greater for UPL, and the product sR (eq. 22) is approximately the same for each. (The dotted curves in Figure 9-10d represent a combination model to be discussed.)

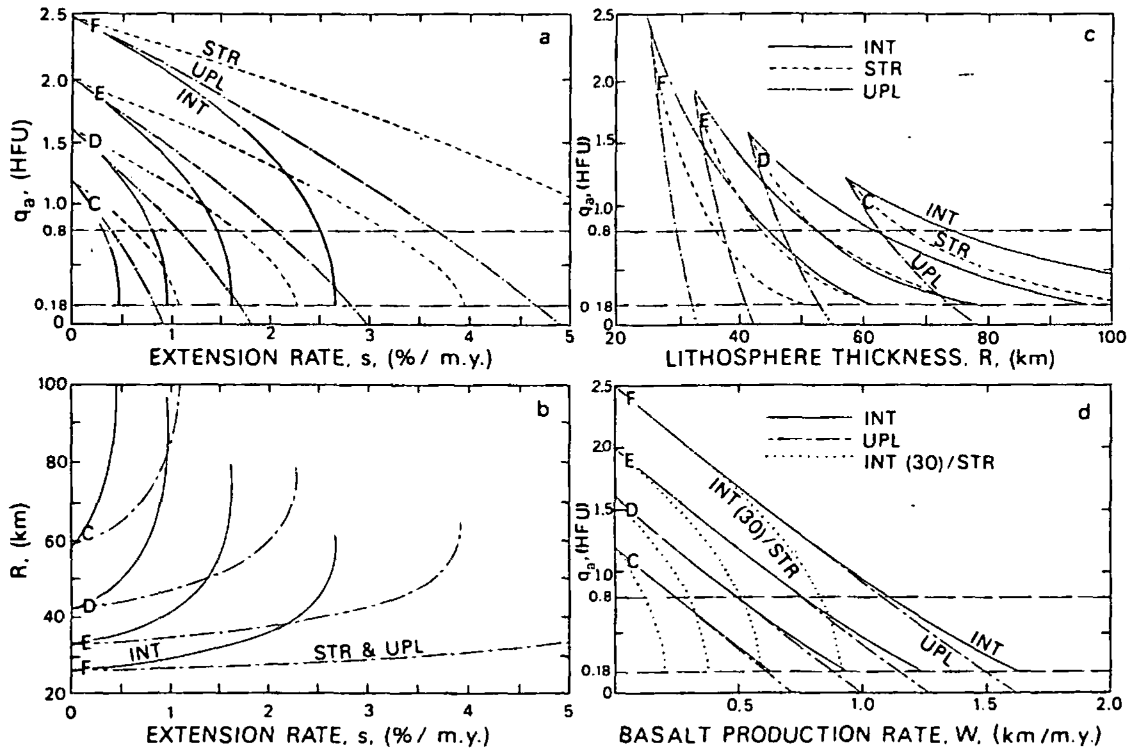


Figure 9-10. Relations among (a) asthenosphere flux and extension rate, (b) lithosphere thickness and extension rate, (c) asthenosphere flux and lithosphere thickness, and (d) asthenosphere flux and basalt production for STR (dash), UPL (dash-dot), and INT (solid). Each set of three curves labeled F represents a reduced heat flow of $q_r = 2.5$ HFU; those labeled E are for $q_r = 2.0$; D are for $q_r = 1.6$; and C are for $q_r = 1.2$. Heavy portions of curves in part (a) represent conditions satisfying relation 23.

Depth to the Basaltic Source or "Lithosphere Thickness" *R*

Figure 9-11 illustrates the relation between reduced heat flow and *R* for each of the three modes for an assumed asthenosphere flux q_a of 0.8 HFU. (Values of *R* for other values of q_a can be read from Fig. 9-10c.) As explained previously, 0.8 HFU is close to the value of q_a expected in stable regions, but we do not know a priori whether q_a might increase or decrease with extension rate, or even if the two quantities should be functionally related. The static case $q_a = q_r$ (dotted Fig. 9-11) represents an upper limit to q_a for all three modes; it provides a lower limit to *R*. Thus, steady extension of the lithosphere can result in a substantial increase in the estimate of thickness; the amount of increase is sensitive to the mode of extension and to the value of asthenosphere flux. However, even in the static case for characteristic Basin and Range province conditions (C to D, Fig. 9-11), *R* is at least 40 to 60 km—considerably greater than the 30 km of crust with which the lithosphere of the Basin and Range is sometimes identified. For reasons presented earlier, however, the depth to dry basalt melting might be substantially greater than the thickness of a seismically defined lithosphere, and the contradiction, if it exists, might be one of definition.

It is seen from Figures 9-10 and 9-11 that increasing reduced heat flow does not necessarily imply decreasing lithosphere thickness or increasing asthenosphere flux q_a. If the extension

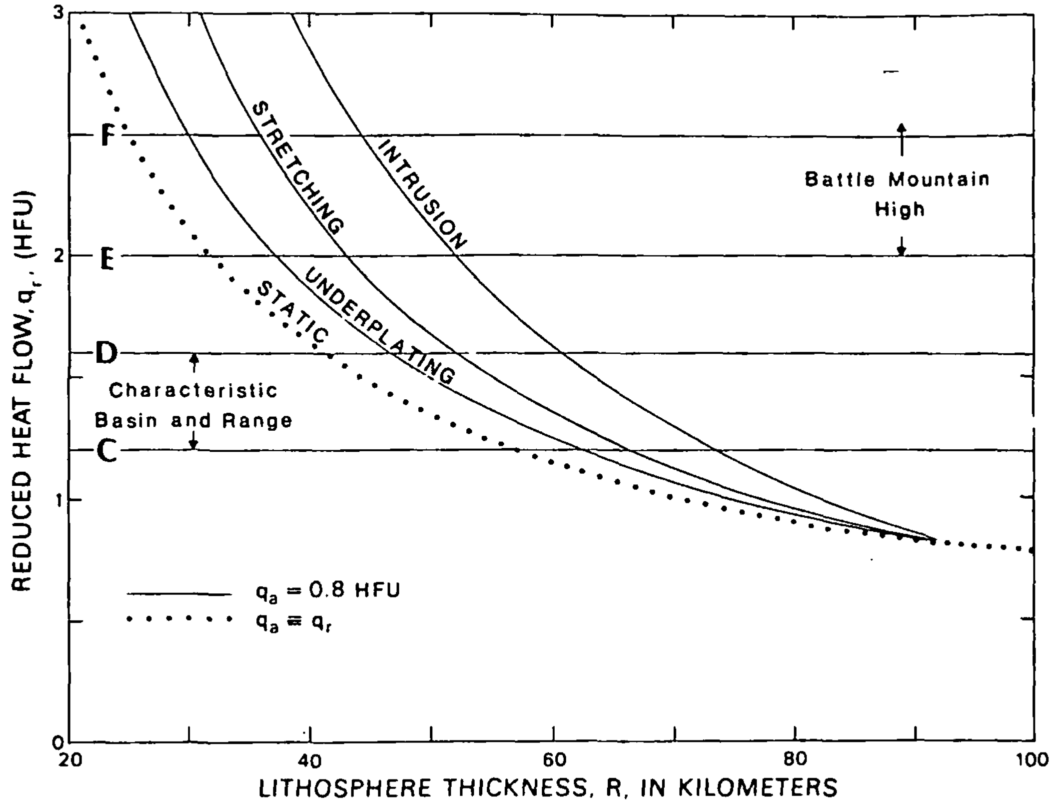


Figure 9-11. Relation between reduced heat flow and lithosphere thickness at constant asthenosphere flux (q_a = 0.8 HFU) for the three simple extension modes (solid curves). Dotted curve is limiting static case ($q_a = q_r$).

mode changes (for example, from UPL to INT), it is quite possible for q_r to increase while lithosphere thickness increases and/or asthenosphere flux q_a decreases.

Steady Temperatures in an Extending Lithosphere

The four solid curves in each part of Figure 9-12 show temperature profiles for each of the surface conditions C, D, E, and F in an extending lithosphere. Solid curves in Figure 9-12a, 12b, and 12c show each mode for the intermediate value q_a = 0.8 HFU. Solid curves in Figure 9-12d, 12e, and 12f show each mode for the lower limiting value q_a = 0.18, HFU, and the dashed curves on each figure represent the upper limiting case $q_a = q_r$, reproduced from Figure 9-7. The extension rate (s) compatible with each case is shown beside the solid curves; the value of s for each dashed curve is, of course, zero. Comparison of the dashed curves with the corresponding solid ones illustrates how steady convective transport within the lithosphere reduces estimates of average temperature (for a given q_r) at each depth and increases the depth R to the basaltic source.

The static model and the six interpretations of the extending lithosphere are compared for average conditions in the Battle Mountain High (regime F) in Figure 9-13a and for a characteristic Basin and Range condition (regime D) in Figure 9-13b. Upper crustal temperatures

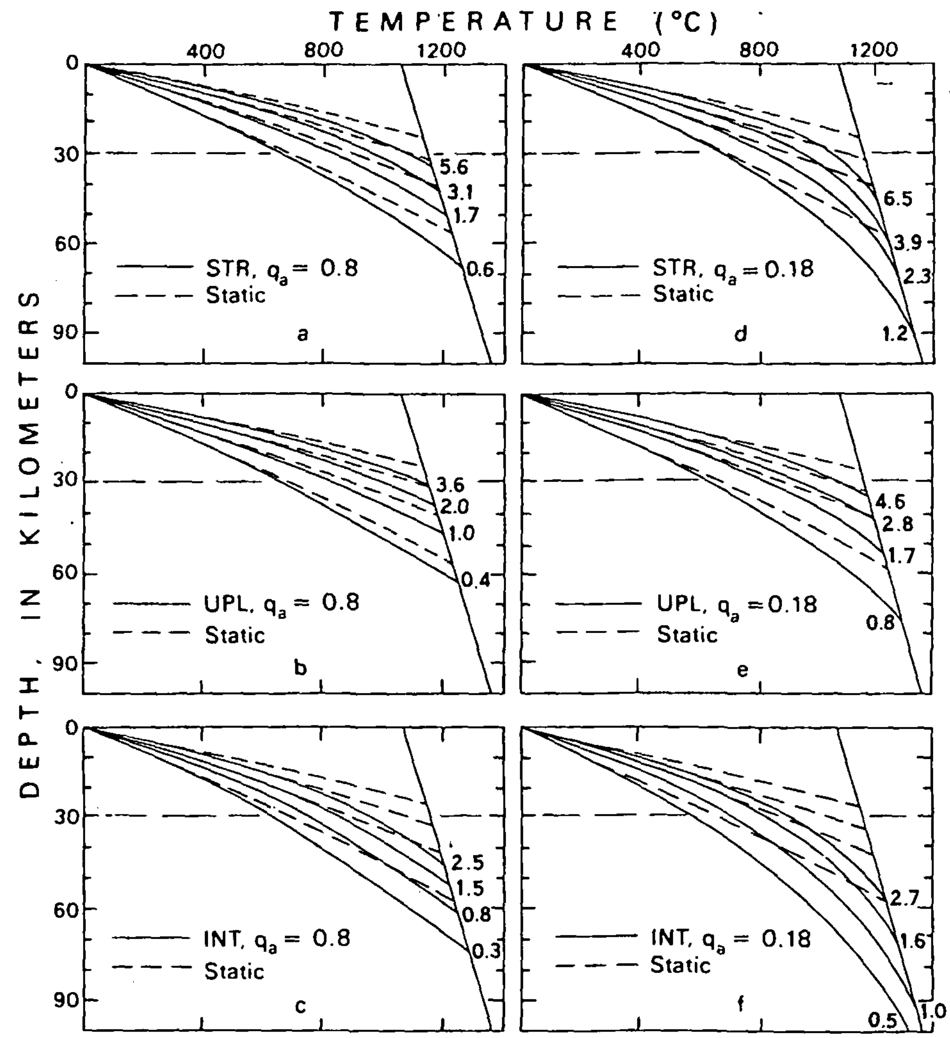


Figure 9-12. Geotherms for lithospheres extending in the three simple modes, STR (a and d), UPL (b and e), and INT (c and f). Dashed curves are for the static case ($q_a = q_r$) reproduced from Figure 9-7. Solid curves in (d), (e), and (f) are for the lower limiting value $q_a = 0.18$ HFU; in (a), (b), and (c) they are for $q_a = 0.8$ HFU. Each set of four curves represents (from top to bottom) reduced heat flows of 2.5, 2.0, 1.6, and 1.2 HFU. Numbers after each solid curve denote extension rates in percent per million years.

are reasonably similar among each set of models; variations are up to perhaps 100°C at mid-crustal levels ($z \sim 15$ km). Temperatures near the base of the crust ($z \sim 30$ km) vary almost 300°C among models for the Battle Mountain High (Fig. 9-13a) and almost 200°C among those for the characteristic Basin and Range condition (Fig. 9-13b). UPL gives higher temperatures and a thinner lithosphere than INT; for UPL the magmatic source occurs at the base; for INT it is distributed throughout the lithosphere. STR requires very large extension rates because it has no magmatic source. It is seen that for both regimes (F and D) the depth to basalt melting R varies by a factor of 2, even when the static model is excluded. Comparison of Figure 9-13 with the melting relations in Figure 9-5 shows that partial melting of crustal rocks

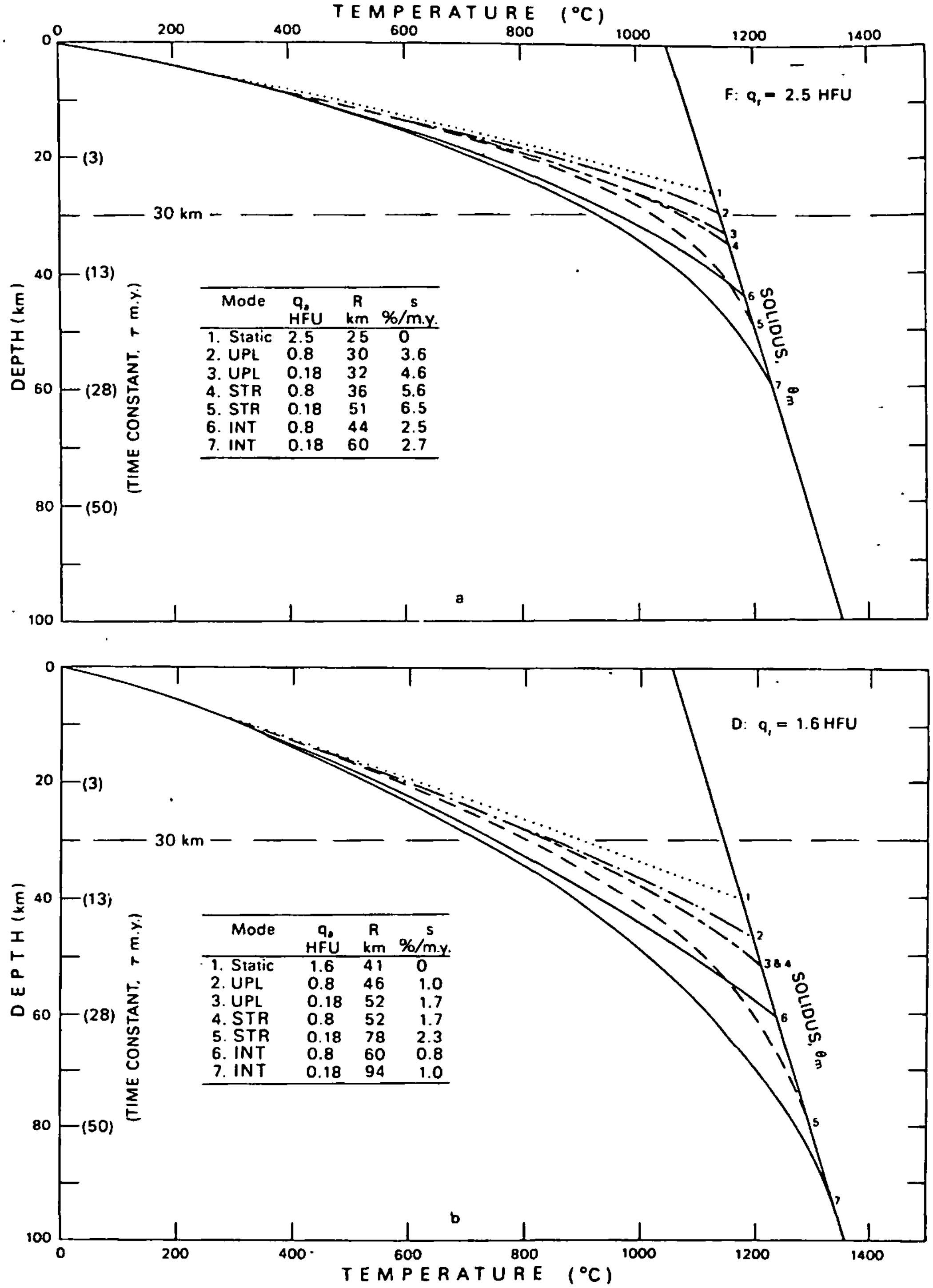


Figure 9-13. Comparison of geotherms compatible with a given reduced heat flow (a) for average Battle Mountain High conditions (F) and (b) for a characteristic Basin and Range condition (D). Number after each curve refers to location in the table (inset) where curve is described.

is possible in the Basin and Range province even under the reduced temperatures given by steady lithosphere extension.

Relation Between Reduced Heat Flow and Extension Rate

The solid curves of Figure 9-14 illustrate how extension affects reduced heat flow in a lithosphere extending under constant asthenosphere flux q_a assumed to be 0.8 HFU. The dashed curve is for the intrusive mode with q_a at its lower limiting value, 0.18 HFU. The proximity of the two curves for INT shows the insensitivity to q_a of the relation between q_r and s for that mode. This insensitivity is illustrated more generally in Figure 9-10a by the near-vertical lower portions of the INT curves. If we knew extension was in the INT mode and that q_a did not increase rapidly with s, then heat flow q_r would be a good measure of spreading rate s.

In considerations of lithosphere temperature (for example, Fig. 9-12) or thickness (Fig. 9-11) the static case gave a useful limit. This is not so in considerations of spreading rate which, of course, goes to zero as $q_a \rightarrow q_r$. In an attempt to abstract some rule-of-thumb from the range of possibilities in Figure 9-10, we have shaded the region in Figure 9-14 in which the reduced heat flow increases from a characteristic stable value of 0.8 HFU at the rate of 1 HFU for every 1% to 2%/m.y. increase in spreading rate. The relation is

$$q_r(\text{HFU}) \sim 0.8 + \overset{1/2}{\not 1} \text{ to } \overset{1}{\not 2} \times s\,(\%/\text{m.y.}). \tag{23}$$

This region encloses a substantial range of plausible models, particularly if a portion of the extension is accommodated by dike intrusion. The range of conditions falling within the region described by the relation 23 is shown by the darkened portions of curves in Figure 9-10a.

Basalt Production

The relations among reduced heat flow q_r, asthenosphere flux q_a, and basalt production W shown in Figure 9-10d for both UPL and INT can be represented quite well by the dimensional relation

$$(q_r - q_a)\ [\text{HFU}] \simeq 1.6\ W\ [\text{km/m.y.}]. \tag{24}$$

This relation can be viewed simply in terms of Figure 9-15 which shows the steady heat flux Δq from the surface of the lithosphere that would be produced by a volume flux of basalt W into its base. We assume that basalt enters at $\theta_m(R)$ and loses its heat at the average ambient temperature θ'. Thus,

$$\Delta q = \rho c \left[\theta_m(R) - \theta' + \frac{L}{c} \right] W. \tag{25}$$

We assume $\theta_m(R) = 1200°\text{C}$, $\rho c = 0.6\ \text{cal}\cdot\text{cm}^{-3}\cdot°\text{C}^{-1}$, and $L/c = 350°\text{C}$. The slope for the curve $\theta' = 700°\text{C}$ in Figure 9-15 is about 1.6 HFU per km/m.y. This is the same as the slope in equation 24, generalized for INT and UPL from Figure 9-10d. Thus, in the INT mode, for which all of the convected heat is carried by basalt, the basalt must lose its heat to the lithosphere at an average temperature of about 700°C. For UPL the basaltic heat is

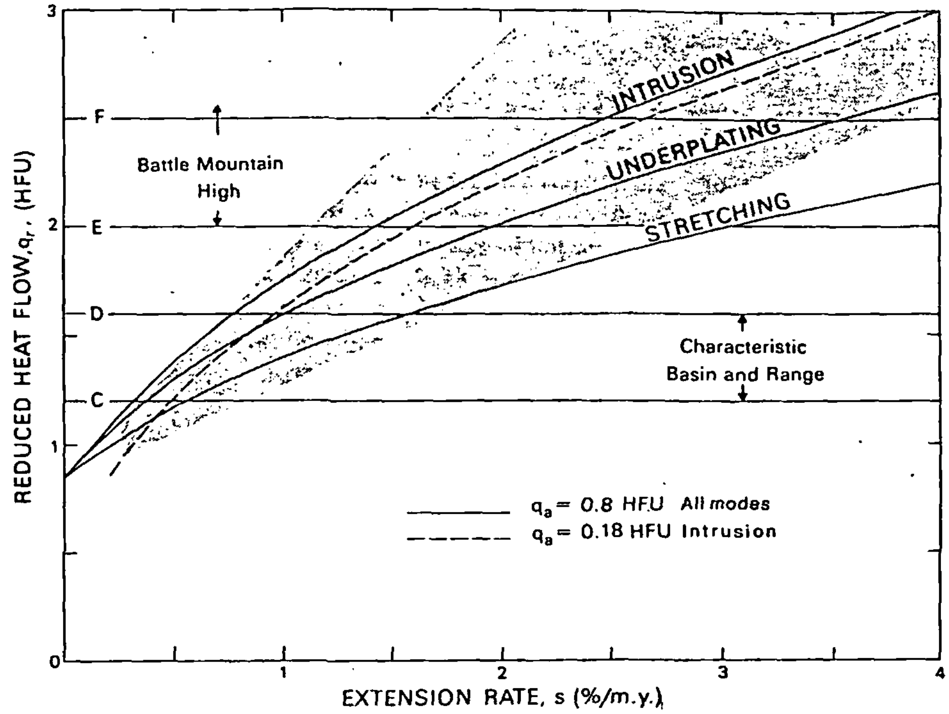


Figure 9-14. Variation of reduced heat flow q_r with extension rate s in each of the three simple modes for an assumed asthenosphere flux q_a = 0.8 HFU (solid curves), and for the INT mode for q_a = 0.18 (dashed curve). The limiting static case coincides with the ordinate axis. Shaded region corresponds to relation 23 in text.

given up at $\theta_m(R)$, a condition represented approximately by the curve $\theta' = 1200°C$ (Fig. 9-15). As the curves for UPL and INT coincide in Figure 9-10d, the difference between ordinates of the curves for 1200°C and 700°C, Figure 9-15, must represent the contribution of solid-state convection (that is, vertical motion due to stretching) in the UPL mode.

Applying equation 22, we see that equation 24 yields an increase in heat flow with spreading rate at the rate of 1%/m.y. per HFU for R = 62.5 km and 2%/m.y. per HFU for $R \simeq 31$ km. These are reasonable values consistent with relation 23 and with a simple version of the INT model presented elsewhere (Lachenbruch and others, 1976) and with a special case considered by Oxburgh and Turcotte (1971).

The rates of basalt production required by extension in the magmatic modes are very large. Even if we assume the asthenosphere flux is 1.2 HFU (a static condition for regime C), the average production required in the characteristic Basin and Range regime (C to D) is ~0.1 km/m.y.; for q_a = 0.8 it is greater by a factor of 3 (Fig. 9-10d). For the average Battle Mountain High regime (F, Fig. 9-10d), basalt production at the rate of about 1 km/m.y. is required for q_a = 0.8, and 0.6 km/m.y. even if q_a is large as 1.5 HFU. For comparison, the Columbia basalt flows, with an average thickness of 1 to 2 km emplaced in 2 to 3 m.y., represent a rate of supply (per unit area) of 0.3 to 1 km/m.y. (Baksi and Watkins, 1973; Swanson and others, 1975). Thus, if the high heat flow in the Basin and Range province is due primarily to basaltic additions to a steadily extending lithosphere, basalt must be supplied in the large hotter subregions at a rate comparable to that of the Columbia Plateau extrusion for many millions of years, and throughout the province as a whole at a rate less only by a factor of perhaps 3 to 5. The basalt requirement can, of course, be reduced (or eliminated) if it is assumed that part (or all) of the lithosphere is extending in the non-magmatic mode (STR).

(It is interesting to note from Figure 9-15 that magmatic heat delivered by extrusion during the Columbia Plateau events represents 1 to 3 HFU; for intrusion in the INT and UPL modes at comparable rates, the magmatic contribution to heat flow would be less by factors of about 2 and 4, respectively.)

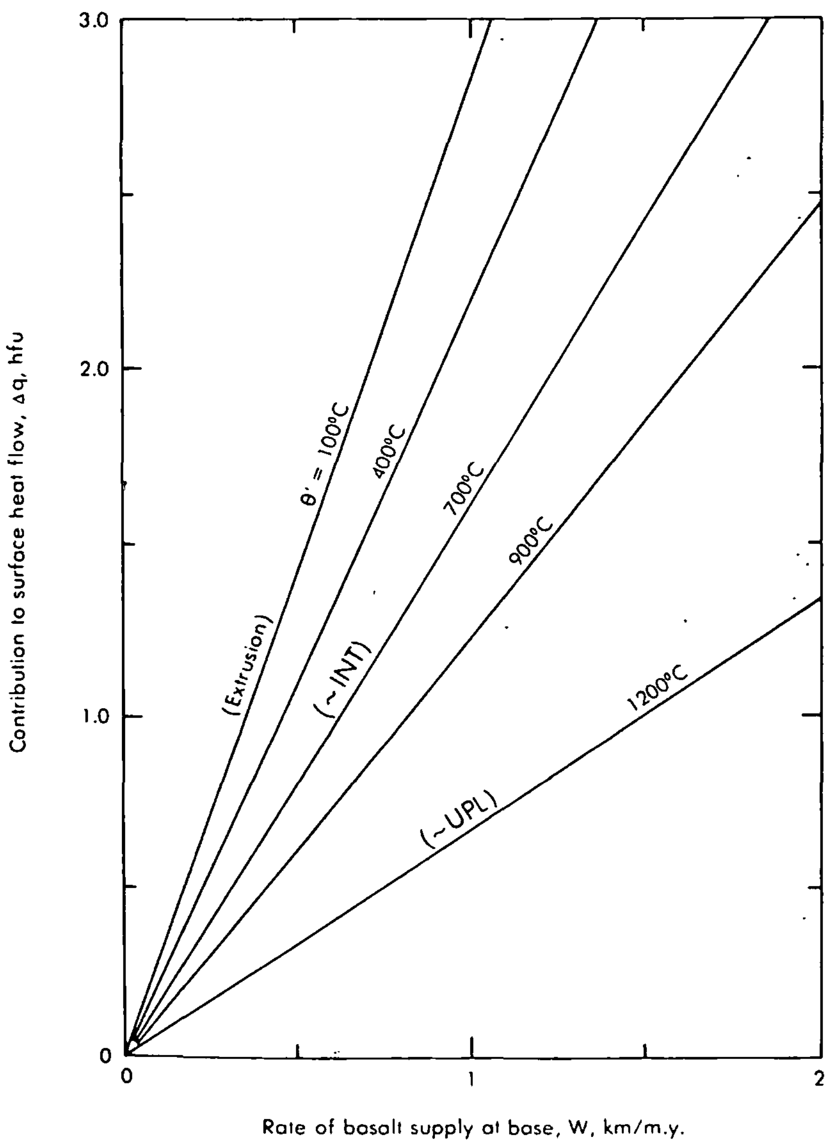


Figure 9-15. Steady surface heat loss Δq from a layer receiving basalt through its base at the rate W at 1200°C; the basalt's heat is lost to the layer at the average ambient temperature θ'.

Combined Models

Although the simple extension modes of Figure 9-8 yield useful limiting cases, it is of interest to combine them in various ways to describe more meaningful geologic models. There are two simple combination schemes: (1) to allow more than one mode to operate at each depth, or (2) to allow one mode to operate in a layer extending from the surface to depth H and a second to operate in the region between H and R. The first scheme was implicit in the foregoing discussion of limiting special cases. In this section we consider a few examples of the second scheme. Results are obtained by modifying the equations to match the temperature and conductive flux at the interface $z = H$. As the velocity fields are the same for all modes (eq. 10), the continuity of mass flux and convective flux at the boundary is assured. In the layered models, we can generally accommodate any estimated departure from steady conditions in the lower layer by adjusting our estimate of q_o, which is unknown in any case.

Dike Intrusion Overlain by Underplating

This model denoted by UPL(H)/INT, and illustrated in Figure 9-16d, provides one quantitative version of the "simple magmatic model" illustrated in Figure 9-6. Extension of the lower lithosphere (below H) is accommodated by dike intrusion, and above H by solid-state stretching;

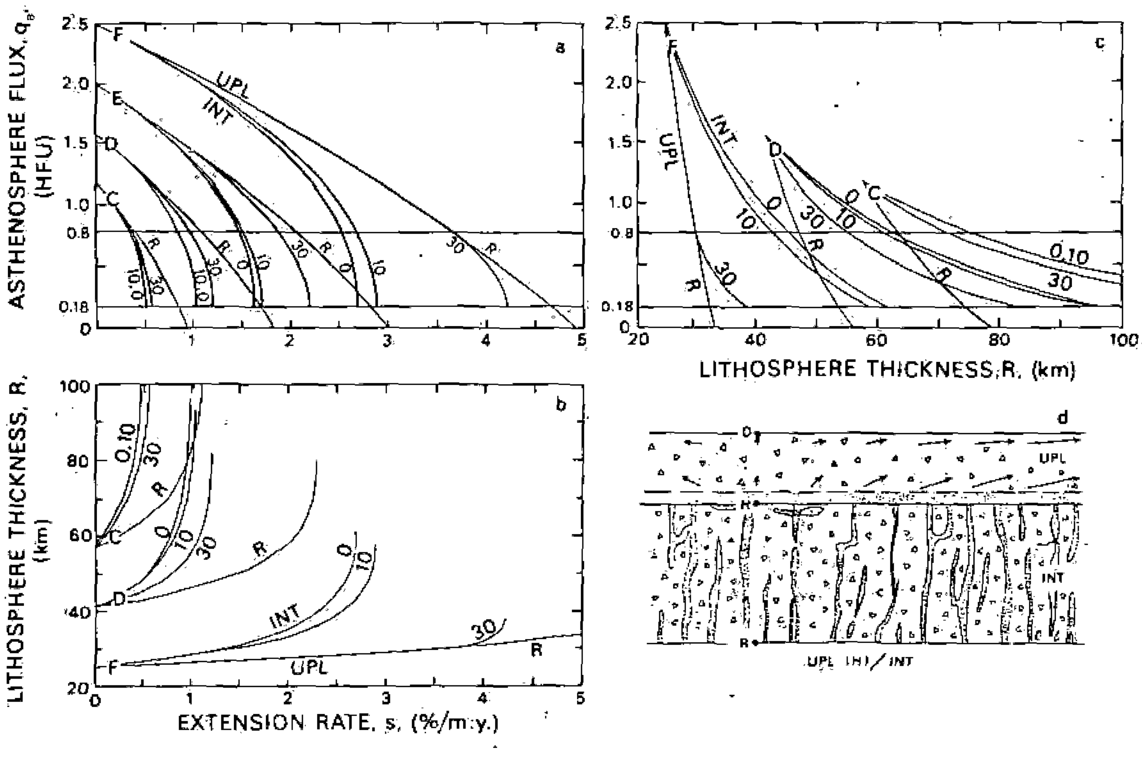


Figure 9-16. Combinations of asthenosphere flux q_a, extension rate s, and lithosphere thickness R, compatible with the characteristic reduced heat flows (regimes C, D, E, and F) for the mode UPL(H)/INT, shown schematically in part (d). Values on curves represent H in kilometres; the curves $H = 0$ and $H = R$ represent, respectively, INT and UPL reproduced from Figure 9-10. Heavy portions of curves in part (a) represent conditions satisfying relation 23.

for example, normal faulting. The thinning of the upper layer is compensated by slow sill formation at depth H. (For this model, it is necessary to replace L/c in equations 14 to 16 by $[L/c + \theta_m(H) - \theta(H)]$ to account for sensible heat released by the basaltic contribution to the sill.)

Figure 9-16a, 16b, and 16c illustrates two cases, $H = 10$ km and $H = 30$ km, both of which are bracketed in all three representations by the simple modes INT and UPL, to which the combined mode reduces when $H = 0$ and $H = R$, respectively. As both modes are magmatic, basalt production (Fig. 9-10d) is not sensitive to the value of H.

The case $H = 10$ approximates the model of the Basin and Range province by Thompson and Burke (1974) wherein extension in the upper 10 km is accommodated by normal faulting and at greater depths by dike intrusion. It is seen from the curves $H = 10$, Figure 16a, 16b, and 16c, that departures from INT caused by the layer of normal faulting are generally unimportant.

The case $H = 30$ km represents a crust extending by underplating above an upper mantle extending by dike intrusion. For the hottest regimes, it is approximated well by UPL, and for the coolest it is closer to INT. Temperatures can be estimated from Figures 9-12 and 9-13.

Dike Intrusion Underlain by Stretching

The large basalt production required of UPL and INT stems from the requirement that the volume change on extension be made up by magmatic contributions throughout the entire lithosphere of depth R. In this model (denoted by INT(H)/STR and illustrated in Fig. 9-17d), basalt, originating at R, rises through the lower region (below H), but it does not reside there. For example, the basalt might rise as lenticular dikelike bodies that pinch off on their lower ends as first suggested by Weertman (1971; see also Secor and Pollard, 1975). The basalt forms dikes in the layer above H which we shall take to represent the crust by setting $H = 30$ km. Below H the upper mantle (down to the depth R of basalt melting) extends by homogeneous stretching; this region can be viewed as part of either the lithosphere or the asthenosphere.

In this case we must distinguish between the volume flux of the rising basalt w_i and the vertical velocity associated with stretching w_s. Hence,

$$w = sz \qquad (26a)$$

$$= w_i + w_s \qquad (26b)$$

where

$$w_i = sz, \quad 0 < z < H \qquad (27a)$$

$$= sH, \quad H < z < R \qquad (27b)$$

and

$$w_s = 0, \qquad 0 < z < H \qquad (27c)$$

$$= s(z - H), \quad H < z < R. \tag{27d}$$

As basalt masses rise from R to H, maintaining their melting temperature θ_m, they will cool and release heat at the rate

$$\rho c w_i \frac{d\theta_m}{dz} = \frac{K}{\beta^2} Hm, \quad H < z < R. \tag{28}$$

The influence of this constant source has been added to equations 15 and 16 to accommodate this small effect in the calculations.

For conditions illustrated in Figure 9-17a and 17b, the combined model is bracketed by STR and INT, to which the model reduces when $H \rightarrow 0$ and R, respectively. On physical grounds the curve $H = 30$ must pass to the curve INT as a progressively increasing proportion of the basalt freezes in transit through the upper mantle. Hence, the region bounded by these two curves ($H = 30$ and INT, Fig. 9-17a, 17b, and 17c) may represent a range of plausible conditions. The region satisfies the relation 23 over a broad range of parameters (darkened portions of curves, Fig. 9-17a). It is interesting that this combined model yields an equilibrium depth to basalt melting (Fig. 9-17c) even greater than INT; for $q_a = 0.8$ HFU, R varies from 48 km in regime F to 75 km in regime C. As only the crust (of thickness $H = 30$) is extending

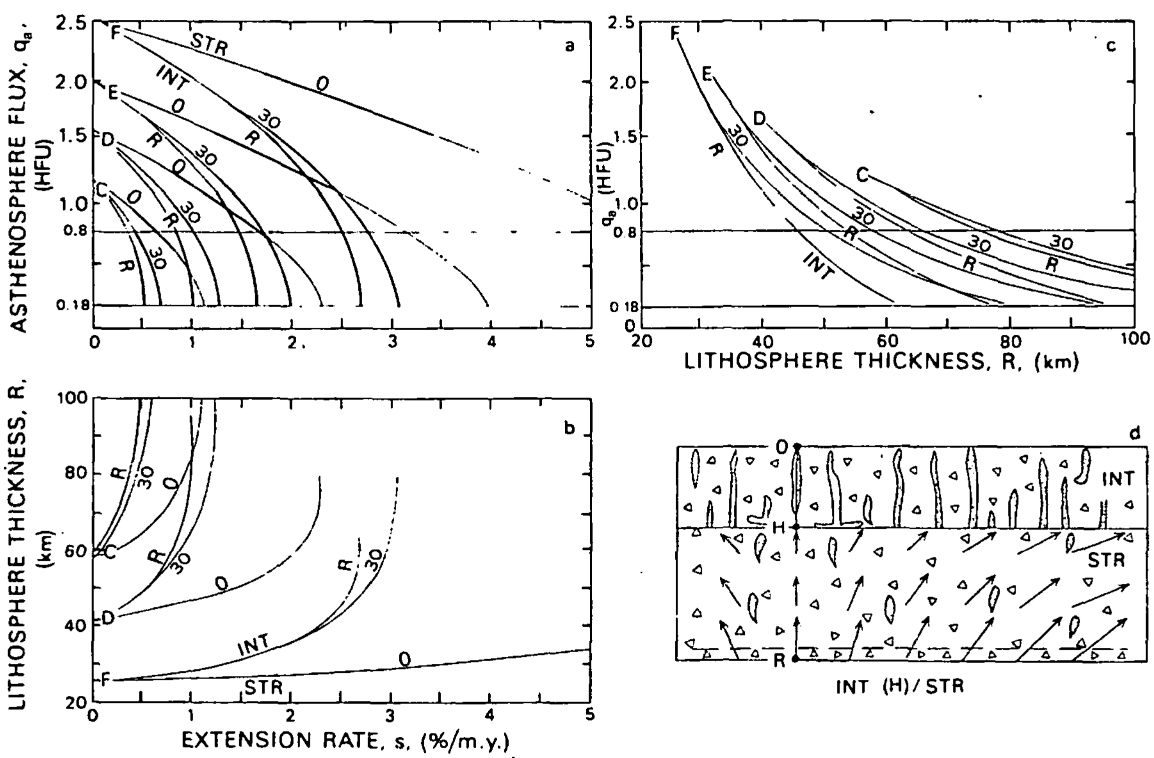


Figure 9-17. Combinations of asthenosphere flux q_a, extension rate s, and lithosphere thickness R compatible with the characteristic reduced heat flows (regimes C, D, E, and F) for the mode INT(H)/STR shown schematically in part (d). Values on curves represent H in kilometres; curves $H = 0$ and $H = R$ represent, respectively, STR and INT reproduced from Figure 9-10. Heavy portions of curves in part (a) represent conditions satisfying relation 23.

in a magmatic mode, basalt production W is given by sH, shown by the dotted curves in Figure 9-10d. Although it is still substantial in this combined model, the basalt production is considerably less than that required by the pure magmatic modes.

Temperatures for this combined model with $q_a = 0.8$ HFU are shown in Figure 9-18; they could have been anticipated fairly well from the information in Figure 9-17 and the curves of Figure 9-12. Extension rates required by the model are shown by numbers on the curves of Figure 9-18; they satisfy relation 23.

Other Modes

It has been shown that the three simple modes of Figure 9-8, individually and in combination, are sufficient to indicate the thermal effects of uniform extension of a lithosphere of constant thickness under a variety of conditions of sill and dike intrusion and stretching. However, these modes do not complete the possibilities. For example, we could consider a fourth mode, "overplating," wherein sill injection at the top of a layer is compensated by stretching of the layer, and solid-state convection is downward. This case can be treated by a simple modification of the foregoing results. Unlike stretching and dike intrusion, sill intrusion does not require extension. Thus, plausible magmatic models of elevated heat flow in a non-extending lithosphere might involve the steady supply to a sill at the rate W(km/m.y.) at some depth

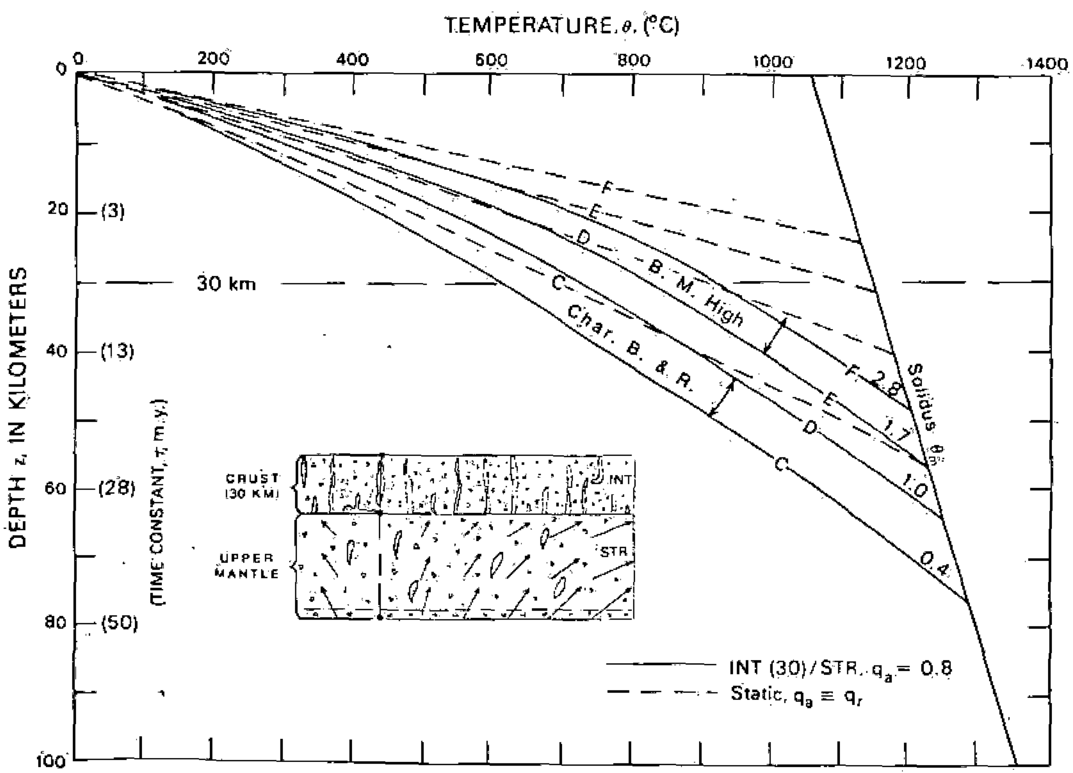


Figure 9-18. Comparison of geotherms for the static (dashed) and INT(30)/STR (solid curves) models for regimes C, D, E, and F. Numbers on solid curves are extension rate in percent per million years. Physical model is shown schematically by inset.

where the rising magma spreads laterally (perhaps because of loss of buoyancy or formation of viscous melts in the light crustal rocks). For such cases, the contribution of magmatic heat to surface heat flow can be estimated roughly from Figure 9-15, and the attenuation of asthenosphere flux from below (by downward convection in the vertically displaced lower lithosphere) can be estimated from results like equation 10 of Lachenbruch and Sass (1977). Although such stationary models, and their transient generalizations, are probably appropriate for describing some heat-flow anomalies, we have not considered them here, as we are investigating the thermal implications of tectonic extension.

DISCUSSION AND APPLICATIONS

In the stable Eastern United States, the reduced heat flow is about 0.8 HFU; in the Basin and Range province, reduced heat flow is characteristically greater by 50% to 100%, and in the Battle Mountain High subprovince by 300%. We surmise that these high heat flows are caused in some way by lithosphere extension and magmatism, for which there is abundant evidence in the province. What do the high heat flows tell us about these processes and about the temperature and thickness of the underlying lithosphere? The answer depends upon the mechanical mode of extension, the conductive flux from the asthenosphere q_a and the thermal history, all of which are unknown. We have investigated the question with simple steady-state thermomechanical models of extension and arbitrary asthenosphere flux. The lithosphere would be hottest and thinnest if the reduced heat flow q_r (with a small correction for neglected radioactivity) were equal to the asthenosphere flux q_a. Strictly speaking, however, in that case (Fig. 9-7) there could be no extension or magmatism, and it is precluded by the geologic observations. Heat convection across a steadily extending lithosphere requires that more heat be conducted out of the top (q_r) than into the bottom (q_a), unless there is significant undetected convective discharge at the Earth's surface. However, if extension were very slow and in a thermally inefficient mode (for example, solid-state stretching, STR) the difference between q_r and q_a would be small, and the large values of q_r could simply be mimicking large values of q_a. In that case heat would have to be conducted across a boundary layer at the base of the lithosphere at rates approaching q_r. Although we have not investigated heat transfer in the asthenosphere, such high values of q_a seem unlikely; for the oceanic asthenosphere they are precluded by heat-flow evidence. Furthermore, the abundant evidence for basaltic activity in the Basin and Range province suggests that extension there is occurring (in part at least) in the magmatic modes, that is, those for which the volume increase of the extending lithosphere is made up largely by magmatic additions as dikes (INT and its combinations) or sills (UPL and its combinations). They are more efficient in the sense that they produce a larger difference between q_r and q_a for a given extension rate. Hence, we consider it probable that much, if not most, of the observed regional variation in q_r results from variation in convective transport within the extending lithosphere.

The range of possibilities for lithosphere temperature and thickness, extension rate, basalt production, and asthenosphere flux permitted by the simple steady-state models underscores the ambiguity of interpretations of reduced heat flow in regions of extensional tectonics. We have attempted to present results in a form sufficiently general that they may be used to test the implications of specific models suggested by evidence from other sources. As we have made no systematic attempt to examine such evidence, it is premature to suggest a preferred model. Nevertheless, the analysis suggests some generalizations:

1. The lithosphere defined as the region overlying the basalt (or peridotite) dry solidus

in the Basin and Range province generally includes a great deal more than the crust. Any discrepancy with the lithosphere defined from seismic data may be semantic, relating to the effects on seismic propagation of melting below the dry solidus, high temperature, or contamination by basaltic intrusion in the upper mantle.

2. Temperature estimates based on heat-flow observations are reduced by the effects of lithosphere extension but are still consistent with substantial partial melting of crustal rocks in the warmer parts of the Basin and Range province.

3. If the steady volume increase of at least the crustal part of the extending lithosphere is supplied by distributed dike intrusion (INT), the surface heat flow is insensitive to asthenosphere flux q_o, so long as the latter does not exceed about 1 HFU.

4. For the foregoing case and a number of other plausible steady-state models, the anomalous heat flow increases about 1 HFU for each 1% to 2%/m.y. increase in extension rate. The high regional heat flow and its variations throughout the Basin and Range province can be accounted for by modest rates of lithosphere extension; there is no need to invoke high or variable conductive flux from the asthenosphere.

5. The ultimate source of high heat flow in the Basin and Range province must be upward convective transport in the asthenosphere.

Ambiguities regarding q_o and extension mode may not be resolved until we understand the flow in the asthenosphere. However, surface observations of relations among heat flow, volcanic activity, and extension rate may give some clues. We shall conclude with a few remarks about them.

Silicic Volcanic Centers

Since the start of Basin and Range tectonism in early Miocene time, silicic volcanic activity in the province has generally been associated with basaltic activity (Christiansen and Lipman, 1972). During periods when silicic magma chambers existed in the upper crust, basaltic extrusion often appeared around their edges (Eaton and others, 1975; Bailey and others, 1976). Such observations have led to the belief that basaltic intrusion of the lithosphere might be a primary source of heat for this "bimodal" crustal magmatic activity and that the throughflow of basalt to the surface might commonly be blocked by the viscous silicic melts that the basalt's heat creates (Smith and Shaw, 1976; Bailey and others, 1976; Christiansen and Lipman, 1972). In this connection it is enlightening to consider the heat and mass budget of these volcanic centers.

For the volcanic center at Long Valley, California (LV, Fig. 9-1a), it has been estimated (Sorey and Lewis, 1976; Lachenbruch and others, 1976) that an upper crustal magma chamber ~20 km in diameter resulted in a combined (hydrothermal and conductive) anomalous flux of at least 10 HFU in excess of the ambient regime for at least 2 m.y. The supply of this steady loss for 2 m.y. would require a heat input equivalent to that of a 14-km layer of basalt of comparable area, quenched to the magma temperature (assumed to be 800°C, see Fig. 9-15). To warm the underlying rock to magmatic temperatures would take perhaps 5 or 6 km more, and an additional 1 or 2 km would be required to supply the heat lost from extruded rock. It is difficult to imagine a mechanism for this mass influx and cooling that does not incorporate rapid local crustal spreading. Furthermore, it is difficult to imagine thermomechanical processes that could sustain such intense heat discharge other than those associated with an influx of basalt. Because of its low viscosity (Shaw, 1965; Shaw and others, 1968), high melting temperature, and large latent heat, basalt is the most efficient heat transfer fluid available. It could rise freely through narrow conduits in the lower lithosphere, and at crustal levels, give up its heat of crystallization and much sensible heat at temperatures high enough to mobilize or melt in place the indigenous silicic material (see Fig. 9-5). (The rapid heat loss from the magma chamber to the surface must, in turn, depend on vigorous hydrothermal transport.)

The most reasonable conclusion seems to be that these bimodel silicic volcanic centers exist because they are at places where the lithosphere is pulling apart rapidly, drawing up basalt from below to fill the void (Lachenbruch and others, 1976). Such a process has been suggested on the basis of structural arguments by Wright and Troxel (1968) and Carr (1974). If these processes took place directly beneath the Long Valley magma chamber, an increase in area of 35% or more would be required for a lithosphere 50 km thick. If the strain were accommodated by east-west extension, it would amount to 7 or 8 km of displacement, which could account for the observed ellipticity of the caldera structure; the displacement could, of course, be distributed over a larger area and longer time. Direct evidence for east-west extension of this sort has recently been obtained from a study of seismicity at the Coso Volcanic Center, another Quaternary silicic volcanic center about 200 km south of Long Valley (Weaver and Hill, 1978).

Lithosphere Extension and Passive Intrusion

The foregoing considerations suggest processes related to extension in the magmatic modes, and they invite speculation that the primary source of heat for high regional heat flow in the Basin and Range province, like that for its volcanic centers, might be basalt passively intruding the extending lithosphere. It has been pointed out that extension of the lithosphere and isostatic balance imply upflow of mass in the asthenosphere, and that this will generally result in an upward increase in melted fraction toward the base of the lithosphere. The pressure on the asthenosphere melt will be the overburden pressure, but at least one horizontal stress in the rigid portion of the extending lithosphere will be consistently less. This would be an unstable condition if the rigid layer behaved brittlely; the melt could passively invade the layer, in effect by "hydrofracturing" it. The through-flow of basalts to the surface might generally be impeded by solidification in transit, by the formation of viscous silicic melts as heat is exchanged with the crustal rocks, and by loss of buoyancy at crustal levels. Above some depth of intense intrusion (for example, H in mode UPL(H)/INT), extension might be mainly by normal faulting (a form of "stretching") and the heat transfer mainly by conduction, modified by localized and transient silicic intrusion and hydrothermal effects. This view is generally consistent with many structural accounts of the Basin and Range province, although they vary in other respects (see, for example, Hamilton and Myers, 1966; Pakiser and Zietz, 1965; Thompson and Burke, 1974; Scholz and others, 1971).

"Hydrofracturing" by basaltic magma differs in two important ways from the more familiar hydrofracturing by water; basalt has a viscosity ($\sim 10^3$ poise) greater by a factor of $\sim 10^5$ than water, and for basalt the ambient temperature is below the freezing temperature. The fracture width is determined primarily by the elasticity of the rigid lithosphere, the extensional tectonic stress, and the buoyancy of the basalt; widths could be only on the order of metres for cracks tens of kilometres in length. If the crack travels too fast, viscous forces will reduce the pressure in the magma and arrest propagation (see, for example, Newman and Smyrl, 1974; Lachenbruch, 1973, eq. A-14); if it travels too slowly the basalt will freeze. Estimation of these limiting propagation velocities is a very complex problem (for a recent review see Anderson and Grew, 1977), but order-of-magnitude calculations (Fedotov, 1976;

Maaloe, 1973; Lachenbruch, 1977, unpub.) suggest that for modest extensional stresses there may be a substantial "velocity window" through which basaltic dikes could traverse a brittle lithosphere without freezing. If this is true and if the yield stress of the lithosphere exceeds the stress needed for "hydrofracturing," distributed spreading of the lithosphere might be largely in the INT mode, rate-limited by the availability of basalt from the asthenosphere.

The other magmatic mode (UPL) might also facilitate distributed extension. If the basalt supply were depleted and the extension rate remained the same, the UPL mode would pass to the STR mode, and solid-state flow would remain unchanged. However, the basaltic heat contribution would vanish, and the lithosphere would thicken and cool toward the new and stronger steady-state configuration (STR) (for example, if $q_a = 0.8$ HFU and $s = 2\%/\text{m.y.}$, then q_r would decrease by 0.3 HFU, Fig. 9-14, and R would increase by 30%, Fig. 9-11; equilibrium temperatures at 30 km would drop from 1000°C, Fig. 9-12b, to ~875°C). Unless the tectonic stress or q_a increased, spreading rate would decrease. This would further cool and strengthen the lithosphere and eventually arrest the extension process. Hence, either magmatic mode (INT or UPL) could facilitate distributed extension of the lithosphere; basalt production by the asthenosphere might even be a necessary condition for distributed extension.

It has been shown (Fig. 9-10d) that for a moderate asthenosphere flux the rate of basalt production by the asthenosphere required to sustain the magmatic modes can be quite substantial. For a given spreading rate, the basalt flux is proportional to the thickness of that portion of lithosphere extending in a magmatic mode (for example, R for INT or UPL, H for INT(H)/STR). If, for example, that portion should be 30 km thick, then the basalt required to produce a unit area of new surface would be greater by six times than the corresponding quantity for an ocean-spreading center where the basaltic crust is about 5 km thick. If the entire Great Basin were extending at the rate of about 1 cm/yr, the asthenosphere beneath it would have to supply basalt at the same rate as that beneath an oceanic spreading center with a spreading half rate of 3 cm/yr.

At ocean-spreading centers, lithosphere more than 60 km thick must be created, and less than 10% of it, the crustal part, is supplied by basalt. Consequently, very viscous ($\sim 10^{20}$ poise) ultramafic material must rise. Because of the large viscosity and small buoyancy of this material, the conduits through which it rises must be very wide (Lachenbruch, 1973, 1976) to accommodate appreciable extension rates. Furthermore, the walls of these conduits must separate rapidly to maintain the temperature of the passively rising ultramafic material appreciably above ambient. Such conduits must therefore accommodate extension over large areas and consequently there should be few of them. Hence, lithosphere production that requires ultramafic intrusion favors localized or plate-tectonic extension as distinguished from distributed tectonic extension, which we suggest might be sustained by an abundant supply of the less viscous basalt. Perhaps the localized thermal anomaly at Yellowstone Park, Wyoming (Fig. 9-1b), results from the fact that the lithosphere there is very thick (Iyer, 1975) and its spreading requires the ascent of very viscous asthenosphere material in a single wide conduit region, the opening of which must accommodate strain accumulation over a large area.

Heat Flow and Distributed Spreading in Back-Arc Basins

The tectonic setting of the Basin and Range province is often compared to that of marginal oceanic basins that occur behind island arcs and associated subduction zones (for references, see Thompson and Burke, 1974, p. 234). In each setting, lithosphere extension seems to be distributed through the province rather than being concentrated along an axis as at an oceanic spreading center. Watanabe and others (1977) have noted that newly formed back-arc basins cool toward a steady heat flow of about 2.2 HFU which they seem to maintain with a thin lithosphere (40 to 50 km) for tens of millions of years. Thereafter, a heat source is apparently removed and a second stage of cooling results in an approach to the flux typical of the old Pacific plate. Perhaps the first steady-state results from a phase of distributed extension, and the additional heat source represents convective transport through the lithosphere. For example, if q_a were constant at 0.8 HFU, distributed extension at the rate of 1.5%/m.y. in the INT mode would yield a reduced heat flow of 2.0 HFU (Fig. 9-10a, regime E); for the UPL mode, 2%/m.y. would be required. This would result in total spreading across a 500-km basin at rates of 7.5 and 10 mm/yr and lithosphere thicknesses (Fig. 9-10c) of 52 and 38 km for INT and UPL, respectively. When extension stopped, possibly because of depletion of the asthenosphere basalt required by the magmatic modes, the lithosphere would cool conductively toward the static condition associated with $q_a = q_r$ ~0.8 HFU as observed (see, for example, curve B, Fig. 9-7).

Regional Heat Flow and Rate of Extension in the Basin and Range Province

The present width of the Basin and Range province across central Nevada-Utah is about 800 km. If the crustal strain is accommodated by east-west extension and the mean reduced heat flow is 1.4 HFU (the average of regimes C and D), then relation 23 yields an extension rate of 0.6% to 1.2%/m.y. and a spreading rate for the province of 5 to 10 mm/yr. On the assumption that the present is typical of the past 17 m.y., we multiply to obtain a total extension of 80 to 160 km. Refinements such as allowing for growth by encroachment on the Sierra Nevada and Colorado Plateau provinces or for local effects at volcanic centers hardly seem warranted in view of the tenuous basis for relation 23. It is encouraging, however, that this result is generally consistent with independent estimates made from geometric considerations of fault displacements (for a discussion, see Thompson and Burke, 1974).

According to relation 23, the rate of crustal extension in high heat-flow subprovinces like the Rio Grande rift and the Battle Mountain High might be much greater than that for the Basin and Range province as a whole. This is consistent with frequently stated views of spreading in the Rio Grande rift (for example, Hamilton and Myers, 1966; Reiter and others, 1975), but the tectonic implications of the Battle Mountain High deserve comment. For the reduced heat flow of 2.5 HFU (regime F), relation 23 suggests that the area of the Battle Mountain High may be increasing ~1.7% to 3.4%/m.y. If the strain were relieved by displacement (across its 150± km width) normal to the northeasterly axis, we would obtain a total local spreading rate of 2½ to 5 mm/yr. For other directions of uniaxial strain, the total rate would be greater. Although historic seismicity in the area is low, the thermal result is supported by Slemmons' (1967) study of Pliocene and Quaternary crustal movements, which shows an intense concentration of faulting in the Battle Mountain High region throughout the recent past. The nearly north-south trend of normal faults, predominant in much of the Great Basin, seems to swing to a more northeasterly trend in the Battle Mountain High (Stewart, 1971), more or less parallel to the long axis of the Battle Mountain High and its extension through the eastern Snake River Plain to Yellowstone Park, Wyoming (Fig. 9-1b). Perhaps the distributed extension inferred from high heat flow in the Battle Mountain High and the more localized rifting in the Snake River Plain (Hill and Pakiser, 1966; Hamilton and Myers, 1966) represent contrasting responses of two different crustal provinces to the same regional tectonic system of stress.

ACKNOWLEDGMENTS

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APPENDIX 1. LIST OF SYMBOLS

θ	=	temperature
θ'	=	average ambient temperature at which basalt loses its heat
z	=	depth
y	=	horizontal distance
v	=	horizontal velocity
w	=	average vertical velocity at any depth (vertical volume flux)
W	=	volume flux of basalt at base of lithosphere
s	=	$\frac{\partial v}{\partial y}$, horizontal strain rate
K	=	thermal conductivity
ρ	=	density
c	=	specific heat
L	=	latent heat of melting for basalt (per unit mass)
β	=	$(K/s\rho c)^{1/2}$, characteristic length for lithosphere convection
$A(z)$	=	radioactive heat production at depth z
A_o	=	radioactive heat production at surface ($z = 0$)
D	=	characteristic depth for distribution of radioactive heat production
$q(z)$	=	conductive heat flow at depth z
q	=	conductive heat flow at surface
q_r	=	$q - A_oD$, reduced heat flow
$\theta_m(z)$	=	$\theta_o + mz$, temperature of basalt dry solidus at depth z
R	=	"lithosphere thickness" (depth to θ_m).
q_o	=	conductive flux from asthenosphere (see eq. 8)

INT = mode of lithosphere extension by distributed dike intrusion (Fig. 9-8c)

UPL = mode of lithosphere extension by stretching and underplating (Fig. 9-8b)

STR = mode of lithosphere extension by stretching (Fig. 9-8a)

C = lithosphere regime for q_r = 1.2 HFU

D = lithosphere regime for q_r = 1.6 HFU

E = lithosphere regime for q_r = 2.0 HFU

F = lithosphere regime for q_r = 2.5 HFU

HFU = heat-flow unit, 10^{-6} cal·cm^{-2}·s^{-1} = 41.8 mW·m^{-2}

HGU = heat generation unit, 10^{-13} cal·cm^{-3}·s^{-1} = 0.418 μW·m^{-3}

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RESISTIVITY INVERSION WITH RIDGE REGRESSION

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The problem of direct interpretation of apparent resistivity curves from horizontally layered earth models is solved by using the ridge regression estimator. This ridge regression estimator is more stable than the generalized linear inverse estimator that was advocated in a previous paper. The generalized linear inverse method is unstable if the problem is nearly singular.

The problem of estimating the standard deviations of the estimated parameters is analyzed. In some layered models the covariance matrix is an accurate estimate of the standard deviations. However, in problems where there is high correlation between parameters, the covariance matrix is not always an accurate estimate. Confidence regions can be contoured in selected parameter spaces to give an accurate estimate of the range of possible layered models that fit the data.

Five soundings were chosen to test the inversion scheme. Two of the soundings were theoretical, and the remaining three were field cases. The method works well since it is possible to find models that fit the data, indicate the accuracy of fit relative to the noise in the data, and predict the accuracy with which each parameter is estimated.

INTRODUCTION

It has been determined that the method of inversion, using the generalized inverse theory, proposed in a paper by Inman et al (1973) is unsatisfactory if some of the parameters in the problem are nearly linearly dependent. Linear dependence between parameters can cause the system matrix to be nearly singular. Only very simple resistivity structures do not present a system matrix which is nearly singular. The presence of thin layers, which are poorly represented in the data, destroys the orthogonality of the problem.

Marquardt (1970) and Hoerl and Kennard (1970a, 1970b) propose a method called "ridge regression" that yields a better estimate of the unknown parameters than the method of least squares. Marquardt (1970) shows the similarities between the method of ridge regression and the method of the generalized inverse. He concludes that the method of ridge regression is preferable for problems with some very small eigenvalues, while the method of the generalized inverse is preferable for problems with some zero eigenvalues. Most resistivity problems involve small, but rarely zero, eigenvalues; hence I have abandoned the method of the generalized inverse for the more stable ridge regression method. However, the concepts of the information density matrix and the parameter resolution matrix as discussed by Inman et al (1973) and Glenn et al (1973) remain viable.

Apart from the problem of determining a model that fits the data, there exists the problem of estimating the accuracy of the parameters. In many soundings there is a *range* of parameters of a given n-layered model that fit the data accurately. While it is not always possible to predict exactly this range of the parameters, we present here a method which yields a good estimate of the range.

The method of direct interpretation works well for field data. Three field cases are presented. The three soundings were chosen not

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because they were easy to analyze using the ridge regression method, but because they were very difficult to interpret with any method.

THEORY

As was shown in the paper by Inman et al (1973), the problem of Schlumberger sounding over a plane-layered earth is nonlinear in the unknown parameters, namely, the resistivity and thickness of each layer. The expression for apparent resistivity (Sunde, 1949, p. 55)

$$\rho_s = \rho_1 L^2 \int_0^\infty k(\lambda)_{1..n} J_1(\lambda L)\lambda d\lambda, \qquad (1)$$

is linearized with respect to the unknown parameters. Here

$$k(\lambda)_{12..n} = \frac{1 - \mu_{12..n} e^{-2\lambda t_1}}{1 + \mu_{12..n} e^{-2\lambda t_1}},$$

$$\mu_{12..n} = \frac{\rho_1 - \rho_2 k_{23..n}}{\rho_1 + \rho_2 k_{23..n}},$$

$$\vdots \qquad \vdots$$

$$k_{(m-1)m..n} = \frac{1 - \mu_{(m-1)m..n} e^{-2\lambda t_{m-1}}}{1 + \mu_{(m-1)m..n} e^{-2\lambda t_{m-1}}},$$

$$\mu_{(m-1)m..n} = \frac{\rho_{m-1} - \rho_m k_{m(m+1)..n}}{\rho_{m-1} + \rho_m k_{m(m+1)..n}},$$

$$\vdots \qquad \vdots$$

$$k_{(n-1)n} = \frac{1 - \mu_{(n-1)n} e^{-2\lambda t_{n-1}}}{1 + \mu_{(n-1)n} e^{-2\lambda t_{n-1}}},$$

$$\mu_{(n-1)n} = \frac{\rho_{n-1} - \rho_n}{\rho_{n-1} + \rho_n},$$

ρ_i = resistivity of the ith layer,
t_i = thickness of the ith layer,
$L = \frac{AB}{2}$ for Schlumberger sounding,
n = number of layers including lower half-space,
ρ_s = Schlumberger apparent resistivity.

A Taylor's series expansion of first order in the unknown parameters is given as

$$\Delta \mathbf{G} = \mathbf{A}\,\Delta \mathbf{P} + \boldsymbol{\varepsilon}, \qquad (2)$$

where

$$[\Delta G]_i = G(\mathbf{P}, x^i) - G(\mathbf{P}^0, x^i);\ i = 1, N,$$

$$[A]_{ij} = \left.\frac{\partial G(\mathbf{P}, \mathbf{x})}{\partial P_j}\right|_{\mathbf{x} = \mathbf{x}^i,\ \mathbf{P} = \mathbf{P}^0},$$

$$[\Delta P]_j = P_j - P_j^0;\ j = 1, M,$$

$\mathbf{P}$ = the vector of unknown parameters,
$\mathbf{P}^0$ = the initial guess for these parameters,
$\mathbf{x}^i$ = the known parameters such as the electrode spacing $AB/2$,
$G(\mathbf{P}^0, \mathbf{x}^i)$ = the apparent resistivity at the ith spacing for the layered structure indicated by $\mathbf{P}^0$,
$G(\mathbf{P}, \mathbf{x}^i)$ = the measured apparent resistivity, and
$\boldsymbol{\varepsilon}$ = the vector of errors in the data points.

The least-squares estimate, $\Delta\hat{\mathbf{P}}$, of $\Delta \mathbf{P}$ is

$$\Delta\hat{\mathbf{P}} = (\mathbf{A}'\mathbf{A})^{-1}\mathbf{A}'\,\Delta\mathbf{G}. \qquad (3)$$

Hoerl and Kennard (1970a, p. 56) show that when $\mathbf{A}'\mathbf{A}$ is nearly singular the average value of the squared distance from $\Delta\hat{\mathbf{P}}$, the estimate, to $\Delta\mathbf{P}$, the true parameter change becomes very large as also does the variance of the least-squares estimator. The ridge regression estimate of $\Delta\mathbf{P}$ is

$$\Delta\hat{\mathbf{P}}^* = (\mathbf{A}'\mathbf{A} + k\mathbf{I})^{-1}\mathbf{A}'\,\Delta\mathbf{G}, \qquad (4)$$

where $\mathbf{I}$ is the identity matrix and $k \geq 0$.

The eigenvalues of $(\mathbf{A}'\mathbf{A} + k\mathbf{I})$ are $(\lambda_i^2 + k)$, where λ_i^2 are the eigenvalues of $\mathbf{A}'\mathbf{A}$. Any very small eigenvalues of the least-squares estimator will be increased in the ridge regression estimator by the factor k. Hence the inversion of the matrix $(\mathbf{A}'\mathbf{A} + k\mathbf{I})$ will be more stable. Increasing the size of all the eigenvalues results in a significant decrease of (a) the mean of the squared length between $\Delta\mathbf{P}$ and $\Delta\hat{\mathbf{P}}^*$ and (b) the variance of the estimated solution. So, in some cases, the solution $\Delta\hat{\mathbf{P}}^*$ is much closer to $\Delta\mathbf{P}$ than the least-squares solution $\Delta\hat{\mathbf{P}}$. The residual sum of squares for the ridge regression solution is given by

$$\phi^* = (\Delta\mathbf{G}^*)'\,\Delta\mathbf{G}^*, \qquad (5)$$

where $\Delta\mathbf{G}^*$ is the measured resistivity minus the apparent resistivity predicted by equation (1) using the values $\mathbf{P}^* = \mathbf{P}^0 + \Delta\hat{\mathbf{P}}^*$. For a *linear system*, the residual sum of squares given by the ridge regression solution is greater than the residual sum of squares given by the least-squares solution. I have found this not to be true for nonlinear systems. I have encountered many examples where the least-squares method diverges to give a very large residual sum, while the ridge regression method converges to an acceptable residual sum. Figure 1 illustrates some of these relationships for a general problem. The figure indicates the bias and the variance of the ridge regression estimator as functions of the parameter k. The point labeled "least squares" and the line labeled "ridge regression" are the squared distances from $\mathbf{\Delta P}$ to $\mathbf{\Delta \hat{P}}$ and to $\mathbf{\Delta \hat{P}}^*$, respectively. The sum of the square of the bias plus the variance of the ridge regression estimator is equal to the squared distance from $\mathbf{\Delta \hat{P}}^*$ to $\mathbf{\Delta P}$. The figure shows that by allowing a small amount of bias in the solution we can realize a major reduction in the variance. For some values of k the ridge regression solution is much closer to $\mathbf{\Delta P}$ than the least-squares solution. This figure was drawn in reference to a linear problem, but the same behavior occurs for a nonlinear problem.

An important consideration is the choice of a value of k. In a linear problem the optimum value of k is that which gives the minimum mean-square error; namely, the value k^* in Figure 1. However, this value cannot be determined unless the solution is known. Hoerl and Kennard (1970b) use a number of different values of k and then plot the solution versus k. They call this plot the "ridge trace"; the value of k for which it stabilizes is chosen as the optimum value. However, in the nonlinear problem several iterations may be necessary before a solution is obtained, and each iteration may require a different value of k. Marquardt's (1963) algorithm determines the smallest value of k for which the ridge regression estimator of equation (4) will yield a new model that better fits the field data. As the inversion process nears a solution or a minimum in the residual sum of squares [equation (5)], successively smaller values of k are used. It is worth noting that as k approaches infinity the ridge regression estimator in equation (4) approaches the gradient method. Convergence to a local minimum in the residual sum of squares is always possible with the gradient method (Ralston, 1965, p. 441–442), but convergence is slow near the minimum. As k approaches zero, the ridge regression estimator becomes the least-squares estimator, equation (3), which is equivalent to the Newton-Raphson optimization technique. The Newton-Raphson technique converges very rapidly if it is near a minimum, but it may diverge if it is far from any minimum. One can see therefore that an optimum algorithm would be one that resembles the gradient method when the estimator is far from the minimum and resembles the Newton-Raphson technique when the estimator is near the minimum. The ridge regression estimator has this property.

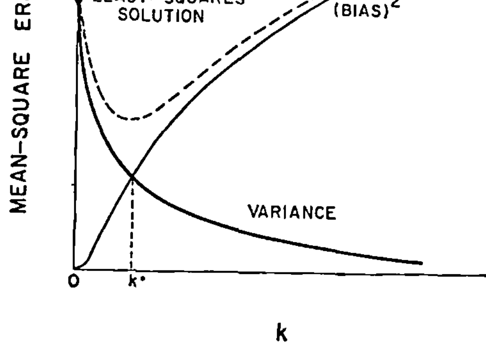

FIG. 1. Mean-square error functions for the ridge regression estimator (after Hoerl and Kennard, 1970a).

The similarities between the ridge regression and generalized inverse methods are given by Marquardt (1970). The generalized inverse method as applied to resistivity and electromagnetic sounding was described in the papers by Inman et al (1973) and Glenn et al (1973). The method begins by calculating the eigenvalues of the matrix $(\mathbf{A'A})$. Small eigenvalues indicate a near-singular system, which is unstable in the presence of noisy data. The reason is that, when the inverse operation in equation (3) is performed, the eigenvalues are inverted; hence, the small eigenvalues have a large effect in the inverse solution. These small eigenvalues could result in a parameter change vector, $\mathbf{\Delta \hat{P}}$ in equation (3), that is so large that the linearization of equation (1) is no longer accurate. This usually results in an increase of the residual sum of squares. For this reason the generalized inverse method works best when some of the very small eigenvalues are not included in the estimator. The addition of k to the diagonal elements of $(\mathbf{A'A})$, as is done in the ridge regression estimator, actually increases the value of each eigenvalue by the amount k, thereby increasing the size of any very small eigenvalues. By increasing k, we have effectively reduced the number of eigenvalues included in the solution.

As shown by Inman et al (1973), the data eigenvectors associated with the large eigenvalues tend to be smooth averages of all the data points, while the data eigenvectors associated with the small eigenvalues tend to represent averages of small groups of data points that correspond to detailed features in the sounding curve. If the small eigenvalues and their associated data eigenvectors are included in the estimator, the estimator will attempt to fit the more detailed features of the sounding curve as well as the broad features. However, if the residual sum of squares is far from a minimum and an attempt is made at the outset to fit the detailed features before obtaining a good fit of the broad features, the least-squares estimator will often diverge. Good results have been obtained using Marquardt's (1963) technique with a large value of k (on the order of 1.0) when the initial guess is far from the solution. A smaller value for k (on the order of .01 or less), which is equivalent to including the smaller eigenvalues in the estimator, is used near the solution.

NUMERICAL CONSIDERATIONS

Evaluation of integrals

The system matrix **A**, equation (2), is comprised of derivatives of apparent resistivity with respect to the resistivity and thickness of each layer in the hypothesized model. A method similar to that of Mooney et al (1966) was used by Inman et al (1973) for evaluating both the forward problem and the derivatives. Although the method was relatively fast for two- and three-layer problems, it was too slow for four or more layers.

Several alternate methods are described by Cornille (1972) for evaluating Hankel transforms, such as equation (1). The method used here is to integrate numerically between zeros of the appropriate Bessel function and then sum the resulting terms which form an alternating series. If the resultant series is slow to converge, then Euler's transformation is performed. In all problems encountered to date, it has never been found necessary to use more than thirty zeros of the Bessel function.

Weighting

When the data are weighted, a relative degree of importance is assigned to each value. Such weighting may be used to remove a bias inherent within the data or to bias the least-squares fit so that it is more accurate in one area of the curve than another.

If there is a large numerical difference between the values of the data in different regions of the curve, an undesirable bias may be introduced into the final solution. The bias is such as to cause the ridge regression estimator to be biased toward the large values while forgetting the smaller values, which may be as accurate and may contain some very important information. For example, consider a simple two-layer model with a top layer resistivity of 10 ohm-m and a bottom half-space resistivity of 1000 ohm-m. The resistivity curve has two asymptotes with a large difference in numerical values. A ridge regression estimator and a least-squares estimator react to differences between the field curve and the curve generated from the estimated model. These differences would be greatest at the large array spacings merely because of the large numerical values of the curve in this region. The estimator would be more influenced by this portion of the curve than by the portion of the curve at the smaller array spacings. The estimator might then give a good estimate of the resistivity of the lower half-space but a poor estimate of the resistivity of the first layer. In general, it is desirable to weight each data point according to the noise in that data point and, also, not give it a false degree of importance because of its large or small value in comparison with the other data points.

The weighting matrix **M** commonly used is

$$\mathbf{M} = \sigma^2\mathbf{N}$$

$$= \sigma^2\begin{bmatrix} \sigma_1^2 & \rho_{12}\sigma_1\sigma_2 & \rho_{1n}\sigma_1\sigma_n \\ \rho_{12}\sigma_1\sigma_2 & \sigma_2^2 & \rho_{2n}\sigma_2\sigma_n \\ \vdots & \vdots & \vdots \\ \rho_{1n}\sigma_1\sigma_n & \rho_{2n}\sigma_2\sigma_n & \sigma_n^2 \end{bmatrix}, \qquad (6)$$

where

$$\sigma_i^2 = E(\epsilon_i^2), \quad \text{and}$$

$$\sigma_i \sigma_j \rho_{ij} = E(\epsilon_i \epsilon_j).$$

Factor ρ_{ij} is the correlation coefficient.

This matrix is the variance-covariance matrix of the data (Hamilton, 1964, p. 125). A first order approximation assumes that the error in the data at one array spacing is unrelated to the error in the data at another spacing, so that the variance-covariance matrix becomes a diagonal matrix with elements σ_i^2. To determine σ_i^2 it is necessary to know the error in the data. In many nongeophysical problems the experiment is repeated several or many times in order to determine the error present. However, in most resistivity surveys the error must be estimated. Errors in the data come from several sources: limited precision of instrumentation, effect of lateral inhomogeneities, telluric noise, and errors in measuring spacing intervals. The term σ^2 is called the problem variance and is commonly used when the relative variances σ_i^2 are known or assumed within a scale factor, σ^2 (Hamilton, 1964, p. 127). My procedure assumes that each data point has the same percentage standard deviation unless it is known or suspected that certain points are significantly noisier. It is further assumed, initially, that each point has a standard deviation equal to one percent of its measured value. The problem standard deviation σ is then adjusted to the estimated noise level of the survey. Most resistivity surveys yield data that is accurate within five per cent or less.

To incorporate the weighting within the estiestimator, each side of equation (2) is multiplied by $\mathbf{N}^{-1}$. Neglecting the error vector $\boldsymbol{\varepsilon}$, we can write

$$\mathbf{N}^{-\frac{1}{2}}\, \Delta \mathbf{G} = \mathbf{N}^{-\frac{1}{2}} \mathbf{A}\, \Delta \mathbf{P}. \tag{7}$$

The solution obtained using equation (7) is a weighted least-squares solution. The residual error is now defined as

$$\phi = (\Delta \mathbf{G} - \mathbf{A}\, \Delta \mathbf{P})' \mathbf{N}^{-1} (\Delta \mathbf{G} - \mathbf{A}\, \Delta \mathbf{P}). \tag{8}$$

The weighted least-squares estimator is given by Jenkins & Watts (1968, p. 132) as

$$\Delta \hat{\mathbf{P}} = (\mathbf{A}' \mathbf{N}^{-1} \mathbf{A})^{-1} \mathbf{A}' \mathbf{N}^{-1}\, \Delta \mathbf{G}. \tag{9}$$

The corresponding ridge regression estimator is given as

$$\Delta \hat{\mathbf{P}}^* = (\mathbf{A}' \mathbf{N}^{-1} \mathbf{A} + k\mathbf{I})^{-1} \mathbf{A}' \mathbf{N}^{-1}\, \Delta \mathbf{G}. \tag{10}$$

Thus, equation (10) is the weighted ridge regression estimator in which the data has been weighted by the inverse square root of the data variance-covariance matrix.

Scaling

Before adding the factor k, it is convenient to scale the matrix $(\mathbf{A}'\mathbf{N}^{-1}\mathbf{A})$ so that the diagonal elements have a value of 1.0. The scaled matrix $(\mathbf{A}'\mathbf{N}^{-1}\mathbf{A})^S$ and the scaled vector $(\mathbf{A}'\mathbf{N}^{-1}\Delta\mathbf{G})^S$ are defined as

$$(\mathbf{A}'\mathbf{N}^{-1}\mathbf{A})_{ij}{}^S = \frac{(\mathbf{A}'\mathbf{N}^{-1}\mathbf{A})_{ij}}{[(\mathbf{A}'\mathbf{N}^{-1}\mathbf{A})_{ii}]^{\frac{1}{2}} [(\mathbf{A}'\mathbf{N}^{-1}\mathbf{A})_{jj}]^{\frac{1}{2}}}$$

and

$$(\mathbf{A}'\mathbf{N}^{-1}\, \Delta\mathbf{G})_i{}^S = \frac{(\mathbf{A}'\mathbf{N}^{-1}\, \Delta\mathbf{G})_i}{[(\mathbf{A}'\mathbf{N}^{-1}\mathbf{A})_{ii}]^{\frac{1}{2}}}.$$

Defining a diagonal scaling matrix with elements

$$D_{ij} = 0, \qquad i \neq j$$

$$D_{ii} = [(\mathbf{A}'\mathbf{N}^{-1}\mathbf{A})_{ii}]^{\frac{1}{2}},$$

we can rewrite equation (9) as follows:

$$\Delta \hat{\mathbf{P}} = \mathbf{D}(\mathbf{D}\mathbf{A}'\mathbf{N}^{-1}\mathbf{A}\mathbf{D})^{-1} \mathbf{D}\mathbf{A}'\mathbf{N}^{-1}\, \Delta G, \tag{11}$$

and the regression estimator as

$$\Delta \hat{\mathbf{P}}^* = \mathbf{D}(\mathbf{D}\mathbf{A}'\mathbf{N}^{-1}\mathbf{A}\mathbf{D} + k\mathbf{I})^{-1} \mathbf{D}\mathbf{A}'\mathbf{N}^{-1}\, \Delta G. \tag{12}$$

Equation (12) is the estimator that is used to provide a biased best fit to Schlumberger sounding data.

It is interesting to note that the scaled matrix $(\mathbf{D}\mathbf{A}'\mathbf{N}^{-1}\mathbf{A}\mathbf{D})$ is the matrix of correlation coefficients of the derivatives in the system matrix of equation (2), (Marquardt, 1963). Correlation coefficients that are nearly equal to one indicate that the problem is highly nonorthogonal, or nearly singular. This will result in very small eigenvalues, a condition which renders the problem sensitive to errors in the data and to roundoff error in the computer; hence, it is necessary to add the factor k to the matrix $(\mathbf{D}\mathbf{A}'\mathbf{N}^{-1}\mathbf{A}\mathbf{D})$ to stabilize the estimator.

ACCURACY OF PARAMETER ESTIMATES

The emphasis in the previous sections was on the method for obtaining a solution by beginning at some initial guess significantly removed from the solution. In this section, methods for placing confidence intervals on parameter estimates and for assessing the final fit of the data will be described.

Residual variance

Prior to estimating the confidence intervals of the parameters, it is necessary to estimate the residual variance, or problem variance, in equation (6). An estimate of the residual variance is given by Hamilton (1964, p. 130) as

$$\hat{\sigma}^2 = \frac{(\Delta \mathbf{G})' \mathbf{N}^{-1} \Delta \mathbf{G}}{N - M} \qquad (13)$$

for weighted least squares. The only requirement to this point is that the values $G(\mathbf{P}, \mathbf{x}^i)$, the measured apparent resistivities, be unbiased finite variance estimates of the population means. If the measurement at a point were repeated an infinite number of times, the average value of all the measurements would be called the population mean. The fact that the number of points with a specified value increases as the value approaches the population mean indicates that the measured values have a finite variance. For purposes of simplicity it is assumed in this paper that each measurement is free of bias. This may not be strictly true in a Schlumberger array, where it may be common for the $AB/2$ spacing to be shorter than anticipated, but it is rarely longer. However, in many carefully conducted surveys this effect will probably be negligible.

The calculation of $\hat{\sigma}^2$ depends on the fit between the theoretical data, computed for the hypothesized model, and the field data. When $\hat{\sigma}^2$ is significantly greater than σ^2, the data have not been fully explained by the hypothesized model. In many cases this means that more detail in the field curve may be fitted if a more complex model is used, such as one with more layers. However, a $\hat{\sigma}^2$ greater than σ^2 may also mean that σ^2 is underestimated. Although the value of σ^2 varies between surveys, it is assumed that the error in any data point is five percent or less. If σ^2 is found to be greater than $\hat{\sigma}^2$, either the estimated variances of the observations have been overestimated (Wiggins, 1972, p. 258–259) or the curve calculated from the hypothesized model is fitting the noise in the data.

Thus, we see that the residual variance can be used as an indication of the goodness-of-fit given by the hypothesized model (Glenn et al, 1973). The residual variance is independent of the linearity or nonlinearity of the problem with respect to the model parameters.

Covariance of parameters

It is important to be able to judge the accuracies with which the parameters of the estimated model are known. It was noted earlier that it is very difficult to determine accurate estimates for the parameter standard deviations if there is a high degree of correlation between the parameters or if the problem is nonlinear in the estimated parameters. Also, there is the problem of calculating the variance of a biased estimator [equation (12)] and interpreting the variance in terms of the earth model. While it would be nice to be able to give a firm, quantitative answer to the question of parameter standard deviation, it is impossible to do so. Hence, in the following paragraphs I will present the philosophy I use to make a conservative estimate of the parameter standard deviations.

One of the first problems encountered results from the fact that the variance of the ridge regression estimator decreases with increasing k (Figure 1). Increasing the value of k is similar to disregarding the small eigenvalues and their associated eigenvectors of the system matrix $\mathbf{A}$ of equation (2). Each eigenvector is a linear combination of the original parameters of the model (resistivity and thickness), and those parameters associated with the largest eigenvalues are the best determined linear combinations. This means that if one calculates the variance of equation (12), the biased estimator, the standard deviations for the original parameters will be unusually small because the linear combinations of the parameters with large variance have been neglected. In effect, the variance of the biased estimator is a poor estimate of the true variance of the original parameters. For example, suppose a field curve is measured over a layered earth that has a thin conductive layer. Among the eigenvectors associated with the largest eigenvalues there will be one eigenvector which represents the resistivity-thickness product of the thin conductive layer because this product is well defined by the Schlumberger sounding curve. Among the eigenvectors associated with the smallest eigenvalues there will be one eigenvector which represents the ratio of thickness to resistivity of the thin conductive layer because this ratio is poorly defined by the Schlumberger sounding curve. Thus, while the product is well determined because it is associated with a large eigenvalue, the ratio is poorly determined because it is associated with a small eigenvalue. If a biased estimator, which eliminates the small eigenvalues and the associated eigenvectors, is used, then the variance estimate would be quite small because of the well-determined resistivity-thickness product. Although a solution is obtained using a biased estimator, the variance of the parameters is computed with the least-squares estimator, which is not biased.

The least-squares estimator, equation (11), includes all the eigenvalues, and, therefore, the parameter variance should be calculated from this expression. The variance-covariance matrix, $\mathrm{cov}(\mathbf{\Delta\hat{P}})$, is

$$\mathrm{cov}(\mathbf{\Delta\hat{P}}) = \mathbf{D}(\mathbf{DA'N^{-1}AD})^{-1}\mathbf{DA'N^{-1}} \cdot \mathrm{cov}\,(\mathbf{\Delta G})\mathbf{N^{-1}A'D}(\mathbf{DA'N^{-1}AD})^{-1}D.$$

The covariance matrix of $\mathbf{\Delta G}$ is given in equation (6) as $\sigma^2\mathbf{N}$. The covariance of $\mathbf{\Delta\hat{P}}$ now becomes

$$\mathrm{cov}\,(\mathbf{\Delta\hat{P}}) = \sigma^2(\mathbf{A'N^{-1}A})^{-1}. \qquad (15)$$

The value of σ^2 is estimated by equation (13). Equation (15) is a matrix whose diagonal elements are the variance terms of each element of the vector $\mathbf{\Delta\hat{P}}$ and whose off-diagonal elements are the covariance terms between the elements of $\mathbf{\Delta\hat{P}}$.

The next question is one of relating the covariance of $\mathbf{\Delta\hat{P}}$ to the covariance of the model parameters $\mathbf{P}$. Note in equation (3) that the vector $\mathbf{\Delta\hat{P}}$ contains the predicted parameters $\mathbf{P}$ and the estimated parameters $\mathbf{P}^0$. Since $\mathbf{P}^0$ is known, any large variance in $\mathbf{\Delta\hat{P}}$ corresponds to a large variance in $\mathbf{P}$ (Glenn et al, 1973). Thus, the covariance of $\mathbf{P}$ may be written as

$$\mathrm{cov}\,(\mathbf{P}) = \sigma^2(\mathbf{A'N^{-1}A})^{-1}. \qquad (16)$$

The correlation matrix is an indication of the linear dependence between the parameters. The elements of the correlation matrix are given as (Jenkins and Watts, 1968, p. 74)

$$[\mathrm{cor}\,(\mathbf{P})]_{ij} = \frac{[\mathrm{cov}\,(\mathbf{P})]_{ij}}{[\mathrm{cov}\,(\mathbf{P})]_{ii}^{\frac{1}{2}}[\mathrm{cov}\,(\mathbf{P})]_{jj}^{\frac{1}{2}}}. \qquad (17)$$

If the value of $[\mathrm{cor}\,(\mathbf{P})]_{ij}$ is near unity, then the parameters P_i and P_j are strongly correlated and nearly linearly dependent.

Solution space

The diagonal elements of the covariance matrix are the variance terms for each parameter. If the correlations are small, then the standard deviation is a good measure of the uncertainty of each parameter. If two parameters are strongly correlated, then the standard deviations given by the square roots of the diagonal terms of (16) will be larger than the actual uncertainties. This fact is illustrated in Figure 2, which is a generalized section in solution space. The two coordinate axes correspond to two parameters of the estimated earth model. The ellipse indicates a confidence region within which the residual sum of squares may be expected to lie for a certain percent of the repeated experiments. This region also defines the values of the parameters ρ_2 and t_2 which will give a residual within the contour. The origin of the axes is defined by the parameter values determined from the final solution. The tilt of the axes of the ellipse is a measure of the degree of correlation between the two parameters.

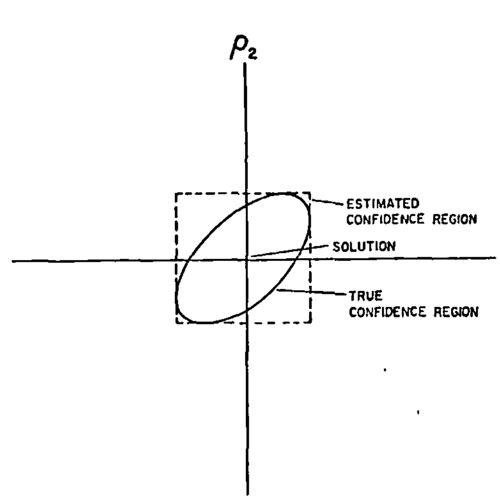

FIG. 2. Hypothetical solution space for a thin conductive layer. The contour defines a confidence region.

If the standard deviations of the diagonal terms of equation (16) are taken to be the true deviation estimates, then the ellipse of Figure 2 is enclosed by a box whose sides are defined by the standard deviations. It is easy to see that the box, which does not allow for the correlation between the parameters, represents a much larger confidence region than the ellipse; use of the box limits leads to a conservative estimate of the parameter confidence intervals. A useful practice is to present both the covariance matrix and the correlation matrix along with a "slice" of solution space. We normally take a slice defined by the parameters with large correlations; these parameters are usually the resistivity and thickness of a thin layer. Each point in the slice represents the parameters of a particular model, and at each point the least-squares error between the sounding curve defined by the model and the field curve is calculated. The values can then be contoured into confidence regions defined by (Jenkins and Watts, 1968, p. 138)

$$\phi(\mathbf{P}) \leq \phi(\hat{\mathbf{P}})\left[1 + \frac{M}{N-M} F_{M,N-M}(1-\alpha)\right],$$

where ϕ ($\mathbf{P}$) is the least-squares error that defines a particular confidence interval and $\sigma(\hat{\mathbf{P}})$ is the least-squares error at the minimum (or solution) in solution space. The quantity $F_{M,N-M}(1-\alpha)$ is the value of the F-distribution for M and $N-M$ degrees of freedom at the $1-\alpha$ confidence level. The value $\phi(\mathbf{P})$ defines a *region* in solution space in which there is a $100(1-\alpha)$ percent chance of a repeated experiment yielding a value for $\phi(\hat{\mathbf{P}})$ within this region. Shuey (1973) and Schellinger (1972) discuss the use of these contours in reference to interpretation of gravity and magnetic anomalies, respectively. The solution space enables the investigator to determine the range of models that fits the data.

In linear problems the contours in solution space are elliptical, whereas in nonlinear problems this is not necessarily true. If the contours in the solution space of a nonlinear problem are nearly elliptical, it is indicated, but not necessarily proven, that the problem behaves linearly within the region of the contours. When the contours are nearly elliptical, the linearly estimated parameter standard deviations may be reasonably accurate. However, if the contours are not elliptical, then the problem is nonlinear, and it is then very difficult to interpret the standard deviations of the parameters. Another situation that sometimes occurs is that more than two parameters, say three or four, are highly correlated. When this occurs, the covariance matrix and the two-dimensional solution spaces are at best crude approximations; however, to produce higher dimension solution spaces is expensive, and they are difficult to visualize.

EXAMPLES OF DATA INTERPRETATION

In this section five Schlumberger sounding curves and their associated models will be used to illustrate the method of ridge regression and the method for estimating the residual variance and the parameter variances. In the first two cases discussed, theoretical data were used as input and a perturbed model was used as the initial guess. The final three cases are interpretations of field data.

Theoretical examples

Three-layer earth model.—Figure 3 shows the theoretical data for the following model:

$\rho_1 = 10$ ohm-m, $\quad t_1 = 10$ m;

$\rho_2 = 390$ ohm-m, $\quad t_2 = 250$ m;

$\rho_3 = 10$ ohm-m.

The data points were calculated, and then approximately one percent random noise was added. The initial guess or starting model was:

$\rho_1 = 8$ ohm-m, $\quad t_1 = 15$ m;

$\rho_2 = 500$ ohm-m, $\quad t_2 = 150$ m;

$\rho_3 = 5$ ohm-m.

The solid curve in Figure 3 is the final fit to the data points, and, of course, it is very good because there is little noise in the data. The final estimated model is close to the original model. The problem variance estimated by equation (13) is .633, which indicates an estimated .8 percent error in the final fit. Since this value is close to the one percent random noise level, I assume that the data fits as well as possible without fitting the noise.

The standard deviations given by the square roots of the diagonal terms of the parameter pect was illustrated in Figure 2. If more accurate estimates are desired, then it is necessary to plot the appropriate slices in solution space as discussed in the previous section.

Figure 3 shows two such slices of solution space, namely, the ρ_1–t_1 slice and the ρ_2–t_2 slice. The high degree of correlation indicated by the correlation matrix A in Figure 3 is reconfirmed by the tilt of the elliptical patterns of the confidence region. Each axis indicates the percent deviation of a particular parameter from its value at the residual sum of squares minimum. The ρ_1–t_1 space indicates a positive correlation between the resistivity and thickness of the first layer in which case decreasing the resistivity and thickness of the first layer changes the sounding curve only slightly. Likewise, the ρ_2–t_2 space indicates a negative correlation between the resistivity and thickness of the second layer; therefore, if the resistivity is increased and the thickness decreased, the sounding curve changes very little. It is impossible to characterize the uncertainty of the resistivity of either layer because the estimated resistivity depends very strongly upon the thickness of the layer and vice versa. The ranges for the resistivity and thickness of the second layer define the limits of the ellipses quite well. The ranges for the resistivity and thickness of the second layer at the 99 percent confidence interval are ±21 ohm-m and ±12.6 m, respectively. The probability is at least .99 that both the resistivity and thickness lie within the intervals of the previous sentence. However, if we had some prior knowledge about either the resistivity or the thickness, then the ρ_2–t_2 space could be used to establish much tighter bounds on the unknown parameter. For example, if it is known that the resistivity is no greater than 398 ohm-m, then the ρ_2–t_2 space indicates that there is a probability of .99 that the thickness lies between 240 and 261 m.

Correlation matrix B in Figure 3 is the correlation for the same model after the model has been reparameterized in terms of the Dar Zarrouk parameters for the resistive intermediate layer. The Dar Zarrouk parameters T and S are defined as the resistivity-thickness product, or transverse resistance, and the thickness-resistivity ratio, or horizontal conductance, respectively (Kunetz, 1966, p. 58). Note that there are no longer any strong correlations among the new parameters. In the ρ_2–t_2 space of Figure 3 we have constructed the axes of the Dar Zarrouk parameters for the second layer. If the problem had been parameterized with the Dar Zarrouk functions rather than the resistivity and thickness of the second layer, the standard deviations could be given accurately by the covariance matrix. However, the Dar Zarrouk parameters are not physical properties, and most geophysicists would perfer the use of the physical parameters resistivity and thickness.

Four-layer earth model.—Figure 5 shows the theoretical data points for the following four-layer model:

$$\rho_1 = 12 \text{ ohm-m}, \quad t_1 = 6 \text{ m};$$
$$\rho_2 = 840 \text{ ohm-m}, \quad t_2 = 72 \text{ m};$$
$$\rho_3 = 24 \text{ ohm-m}, \quad t_3 = 48 \text{ m};$$
$$\rho_4 = 8400 \text{ ohm-m}.$$

The third layer is quite conductive and thin and has a small effect upon the sounding curve; from the data it should be very difficult to resolve. It should also be noted that since the asymptote of the lower half-space was not obtained, it will be impossible to determine accurately the resistivity of the half-space. The inversion procedure began with a model much different from the correct model and converged to the values shown in Figure 5. The standard deviation for each parameter is also shown. The iterative process was halted at a residual variance of .383. A much smaller value could have been attained since no noise was added to the data points, but further iterations are expensive and pointless.

Figure 6 illustrates the eigenvalues and parameter eigenvectors for the model in Figure 5. In this example we note that there are three large eigenvalues and four small eigenvalues, one of which is very nearly equal to zero. Due to the several very small eigenvalues, the inverse interpretation of this model is not very sensitive to model parameter changes, but is very sensitive to noise. A large value of k (greater than .01) must be used in the ridge regression estimator to keep the process from diverging. The reason is that even a small degree of misfit between the actual and the estimated data will be multiplied by the inverse of the small eigen-

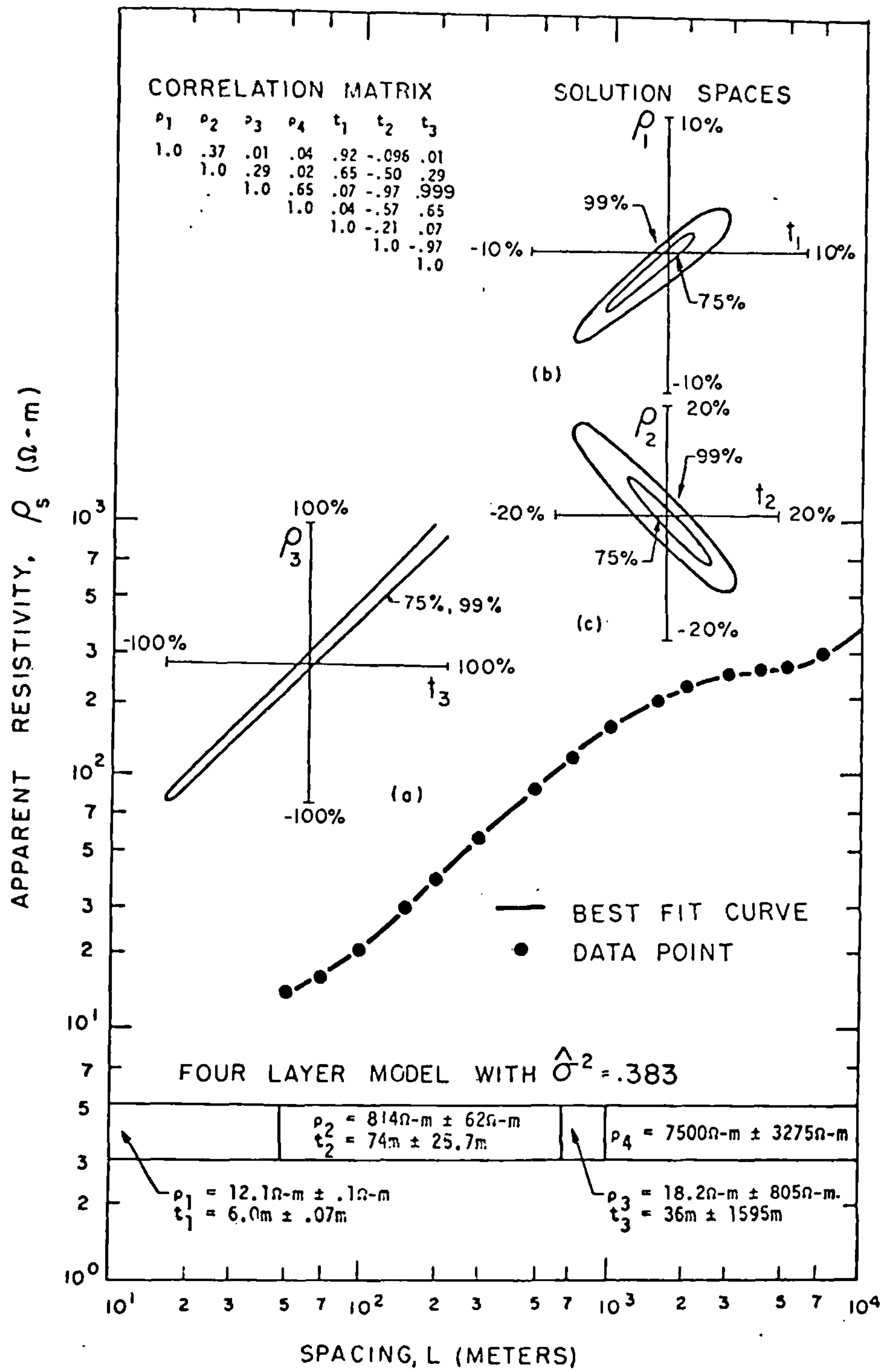

FIG. 5. Theoretical data and best fit curve for a four-layer model. The interpreted model is shown with standard deviations. Also shown are three slices of solution space and the correlation matrix.

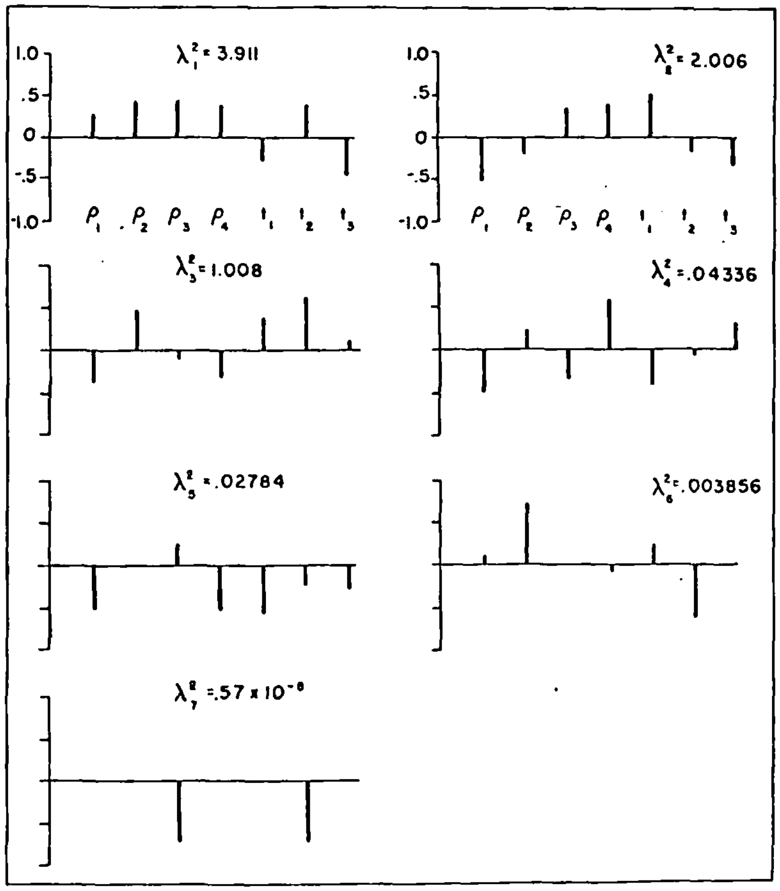

FIG. 6. Eigenvalues (λ_i^2) and parameter eigenvectors for the four-layer model in Figure 5.

values thereby yielding a larger parameter change, which leads to a divergent solution. The eigenvectors may be interpreted as was done for the three layer problem. The eigenvectors associated with the small eigenvalues indicate the expected combination of parameters to which the sounding curve is insensitive, and the eigenvectors associated with the large eigenvalues indicate those combinations of parameters to which the problem is highly sensitive. For example, the eigenvector of the smallest eigenvalue indicates that if the values for both the resistivity and thickness of the third layer are either increased or decreased there will be almost no effect on the sounding curve.

Figure 5 also contains three slices of solution space that correspond roughly to the parameter combinations indicated in the eigenvectors associated with the three smallest eigenvalues. The ρ_3–t_3 space shows the tradeoff that exists between the third layer conductivity and thickness. The correlation matrix is also shown in Figure 5. The standard deviations for the resistivity and thickness of the thin conductive layer are several thousand percent. This comes as no surprise since the correlation matrix shows that the resistivity and thickness are linearly dependent and, therefore, greatly affected by any error in the data. As expected, the resistivity of the lower half-space also has a large standard deviation, and the true resistivity of 8400 ohm-m lies within this range.

If the standard deviations are compared with the extremes of the ellipses in the solution spaces, it is clear that one variable predicts the other rather accurately. However, the extremes predicted for the elliptical regions in the ρ_3–t_3 space are much larger than the figure indicates.

One reason for this over-estimation is that the elliptical regions are not symmetric about the minimum point. The ellipse cannot go beyond the −100 percent mark for both parameters, since negative thicknesses and resistivities do not exist. Thus, the ellipse will be shorter in the third quadrant and somewhat extended in the first quadrant. While the standard deviations are very gross, the ρ_3-t_3 space shows that putting limits on one of the parameters greatly reduces the standard deviation of the remaining parameter. For example, suppose that a similar resistivity section was logged in an adjacent area, and the true resistivity for the third layer was found to lie in the range 15 to 30 ohm-m. Then the third layer resistivity of the interpreted model could be expected to fall within the same range. On the basis of the 99 percent confidence ellipse, one could then state that the thickness of this layer is very likely to lie within the range 8.3-54 m. This range is much tighter than that given by the covariance matrix.

I conclude from the two examples discussed that it is important to temper any interpretation of the standard deviations with an analysis of the correlation matrix. If it is desired to know the limits of a specific set of parameters, such as the resistivity and thickness of a given layer, it is best to obtain a view of that particular slice of solution space. I would not recommend obtaining all the possible slices because of the expense and because for some parameters the accuracy of the standard deviations of equation (16) are sufficient.

Field examples

Three field curves will be analyzed. The data were taken in different environments with different resistivity systems, noise levels, and electrode spacing rates. Drill hole information is shown for two of the soundings. The degree of correlation between the drill hole geologic section and the electrical resistivity section indicates both the accuracy of the inverse method of interpretation and the ability of resistivity sounding to delineate the geologic section.

Lake Bonneville sounding.—Figure 7 contains the data for a Schlumberger sounding taken in west-central Utah. This conductive section consists primarily of Lake Bonneville sediments, which typically have very low resistivity because of their high salt content. In an arid climate, a typical section consists of a thin, dry upper layer underlain by a thin layer of sediments with a large amount of salt due to fluctuations of the water table. Typically the saline layer would overlay a saturated or partially saturated sediment that would probably contain less salt.

The data in Figure 7 suggest that the most complicated model which might be derived with any degree of confidence is a three-layer model with a very thin surface layer. However, there does appear to be a slight inflection in the data at spacings of 5 m to 7 m. The fact that the inflection also appears in a prependicular sounding indicates that it may be caused by another layer rather than by lateral changes. When I attempted to fit a three-layer model to the data, the residual variance and, hence, the estimate of the noise level were higher than expected. A four-layer model interpretation and its computed sounding curve are shown in Figure 7. The curve fits the data quite well, and the estimated noise level based on this fit is approximately 3.5 percent of the value at each data point. Since I consider this to be the approximate accuracy of the data, I do not feel that a closer fit is justified. The slight inflection in the data between spacings of 40 m and 70 m might be due to another layer. However, since the fit to the data shown in Figure 7 is already within the estimated noise level of the field data, there is little justification for using a more complex model to attempt a closer fit to the data.

The correlation matrix in Figure 7 indicates a high degree of correlation between the resistivity and thickness of the third layer. However, since the data does not appear to contain much information about the second layer, we expected a much higher correlation between the parameters of the second layer than was obtained. Apparently the second layer is better represented in the data than was anticipated. Another interesting point is the strong correlation that exists between both parameters of the third layer and the thickness of the second layer.

Figure 7 shows the slice of solution space defined by the parameters of the third layer. As is often the case, the standard deviations determined from the covariance matrix are much larger than those predicted by the confidence contours. However, we suspect that the contours

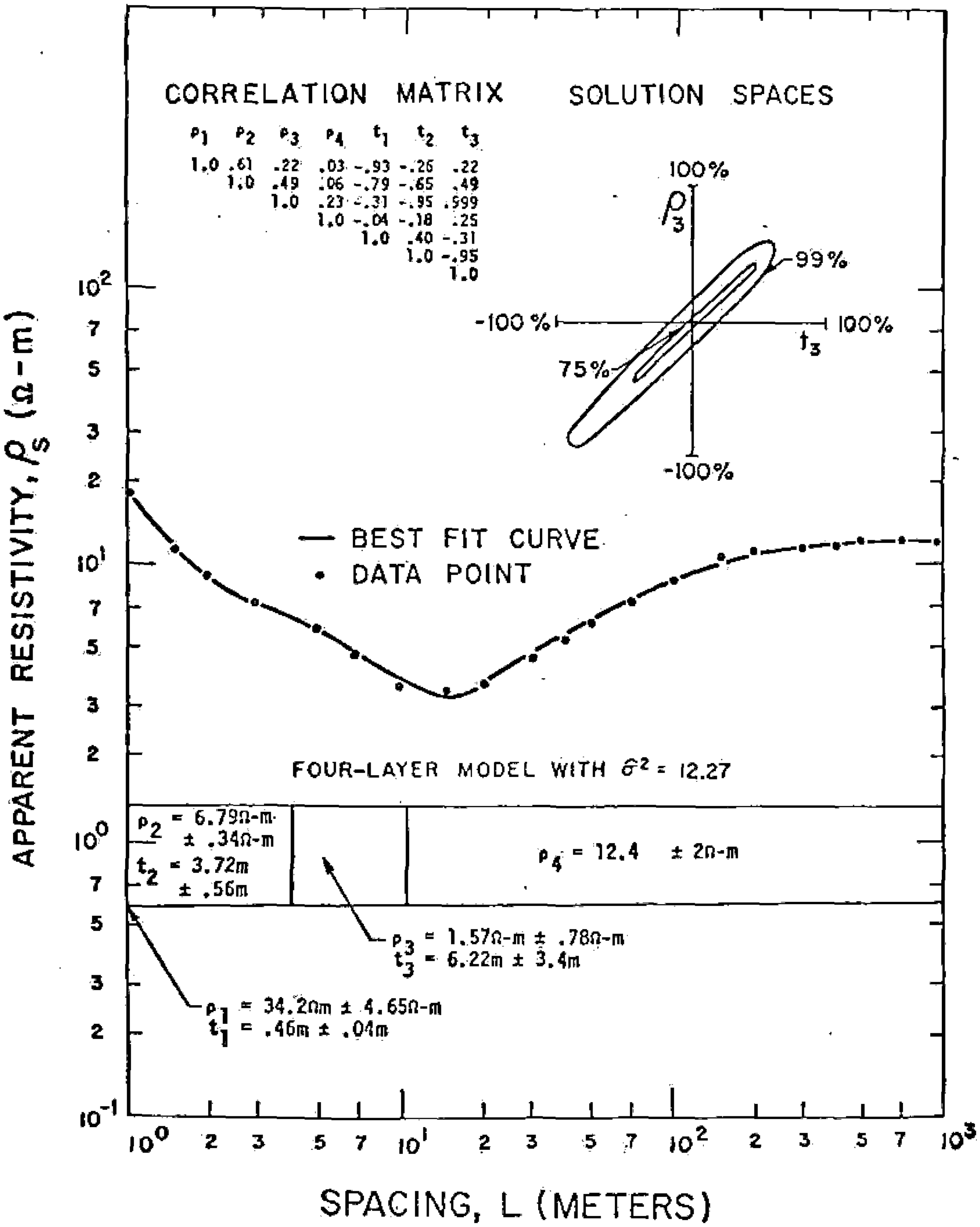

Fig. 7. Field data taken over Lake Bonneville sediments and interpreted best fit model slice of solution space.

of the ρ_3–t_3 space may underestimate the standard deviations because of the high degree of correlation between the parameters of the third layer and the thickness of the second layer. If the second-layer thickness had been changed as the third-layer parameters were also changed, the range of third-layer parameters that resulted in a good fit to the field data would be changed.

Curlew Valley sounding.—Figure 8 shows a

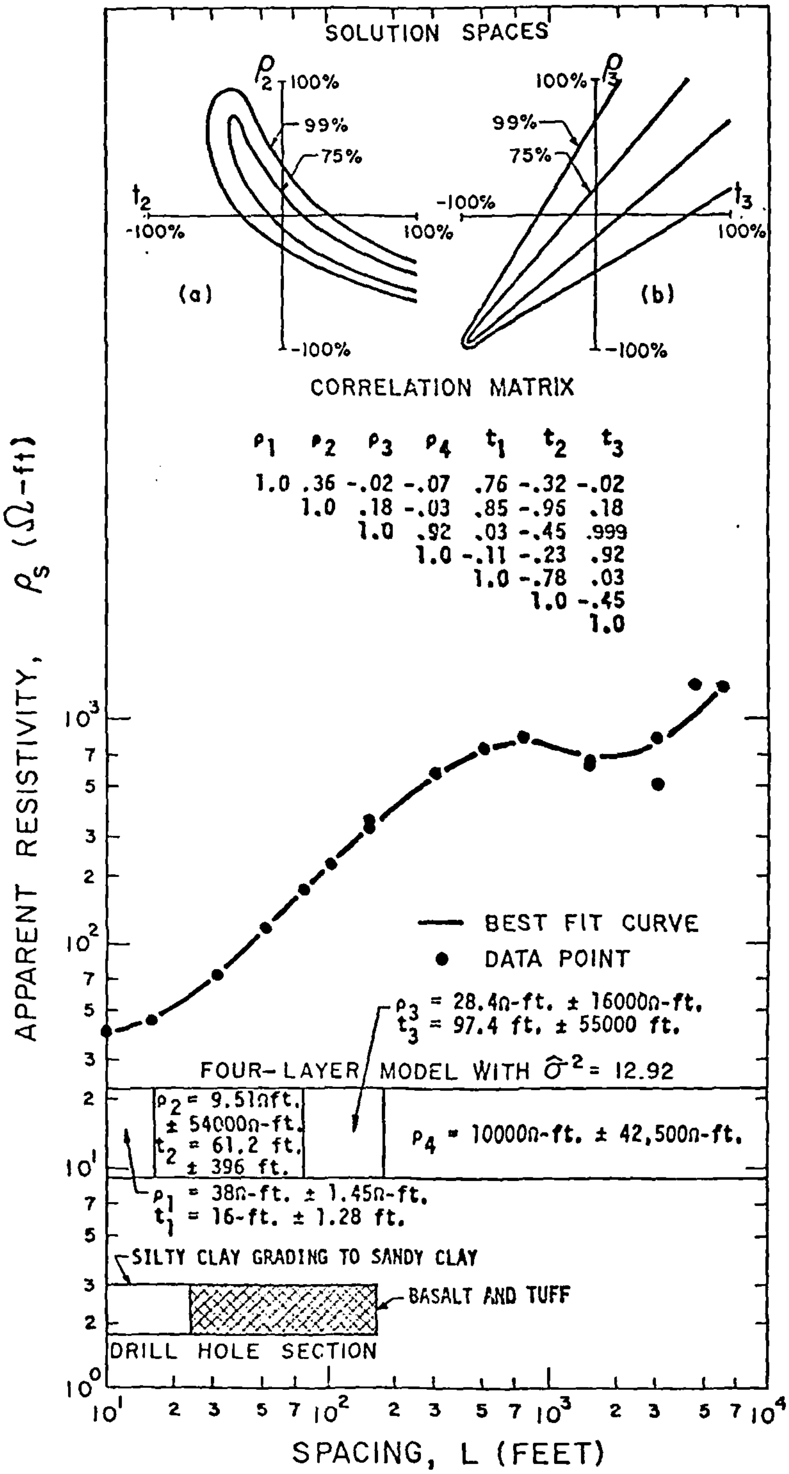

FIG. 8. Field data from Curlew Valley in northern Utah with interpreted best fit model.

sounding from a typical basin and range valley located in Utah immediately north of the Great Salt Lake. The area was the subject of an intense study of the use of electrical methods in ground water exploration (Glenn, 1973). One objective of the study was to determine the principal aquifers of Curlew Valley and their recharge areas. In general, the geology of the valley consists of an upper layer of interbedded Quaternary lake deposits and alluvial fans and a second layer of intercalated Tertiary sediments, basalts and tuffs, underlain by Paleozoic limestone or dolomite, or possibly a dense, crystalline rock with high resistivity. The surface topography of the buried basalts is quite variable and the rocks outcrop in two low hills near the center of the valley. Several confined aquifers are thought to lie within the basalt where the basalt is highly fractured.

Note that fewer data were obtained for the Curlew Valley sounding, Figure 8, than were obtained in any other sounding studied in this paper. This has resulted in a more poorly defined curve than would result from a more densely spaced survey. The sounding curve in Figure 8 is poorly defined from 1500 ft to 6100 ft. The measurements taken at the large spacings were more noisy than the other measurements. An interpreted fit, with a residual variance of 12.92, yields an estimated error in the data of 3.5 percent except for the spacings of 3000 ft and 4500 ft, where the final estimated errors were 9 and 20 percent, respectively. In view of the poor definition of the field curve at large spacings, we expected the standard deviations for the parameters of the third and fourth layers to be quite large. The standard deviations indicate that the third and fourth layers are poorly resolved, but also the standard deviations for the parameters of the second layer are very large. All the parameters except those of the first layer are crudely determined as shown in the ρ_2–t_2 solution space. The confidence contours deviate from the typical elliptical pattern expected for a problem that is linear over the region of the contours. The contours indicate that, while there is a definite negative tradeoff between resistivity and thickness, there also exists a lower bound for an acceptable thickness and another lower bound for an acceptable resistivity. At these lower bounds, several values of one parameter will yield an acceptable fit for a fixed value of the second parameter. The bounds indicated by the 99 percent confidence contour are such that the thickness must be equal to or greater than 27.5 ft and the resistivity must be equal to or greater than 3200 ohm-ft. However the ρ_2–t_2 space neglects the strong correlation between the parameters of the second layer and the thickness of the first layer. The correlation matrix indicates that if the thickness of the first layer was decreased and the thickness of the second layer was increased, the resistivity of the second layer could be made smaller than the apparent bound given by the ρ_2–t_2 space and still yield a good fit to the field data. The ρ_3–t_3 space in Figure 8 illustrates that the third layer is unresolvable. The correlation matrix indicates that the parameters of the third layer are linearly dependent and very highly correlated with the resistivity of the underlying half-space.

Also shown in Figure 8 is the limited geologic section determined from a rather shallow drill hole. The drill hole failed to reach the basement rock, so it is not possible to check the depth to basement given by the inverse interpretation. The overall characteristics of the four-layer model fit the known geologic section. It appears that the upper part of the basalt is dry and resistive, while the lower part seems to be more porous and saturated with saline water. It is doubtful that fresh water could have resulted in such a conductive third layer. Beyond this general description, I cannot reliably predict the depths to the various layers; the available data are simply too noisy and sparse. It would be helpful if the resistivity of the basalt and basement were determined by measurements on outcrops in the valley.

Brazil sounding.—Figure 9 is a sounding taken by Rijo (1973, personal communication) in an alluvium-filled river valley in northeastern Brazil. The sounding was taken in an attempt to find the depth to the metamórphic basement rock. In this area, if the basement is very close to the surface, any water in the section above the basement is likely to be of poor quality because of the organic material in near surface aquifers. However, where the basement is deeper, the water is generally of better quality. The field data and the best interpretation are shown in Figure 9 along with the estimated standard deviations. Note that the data points

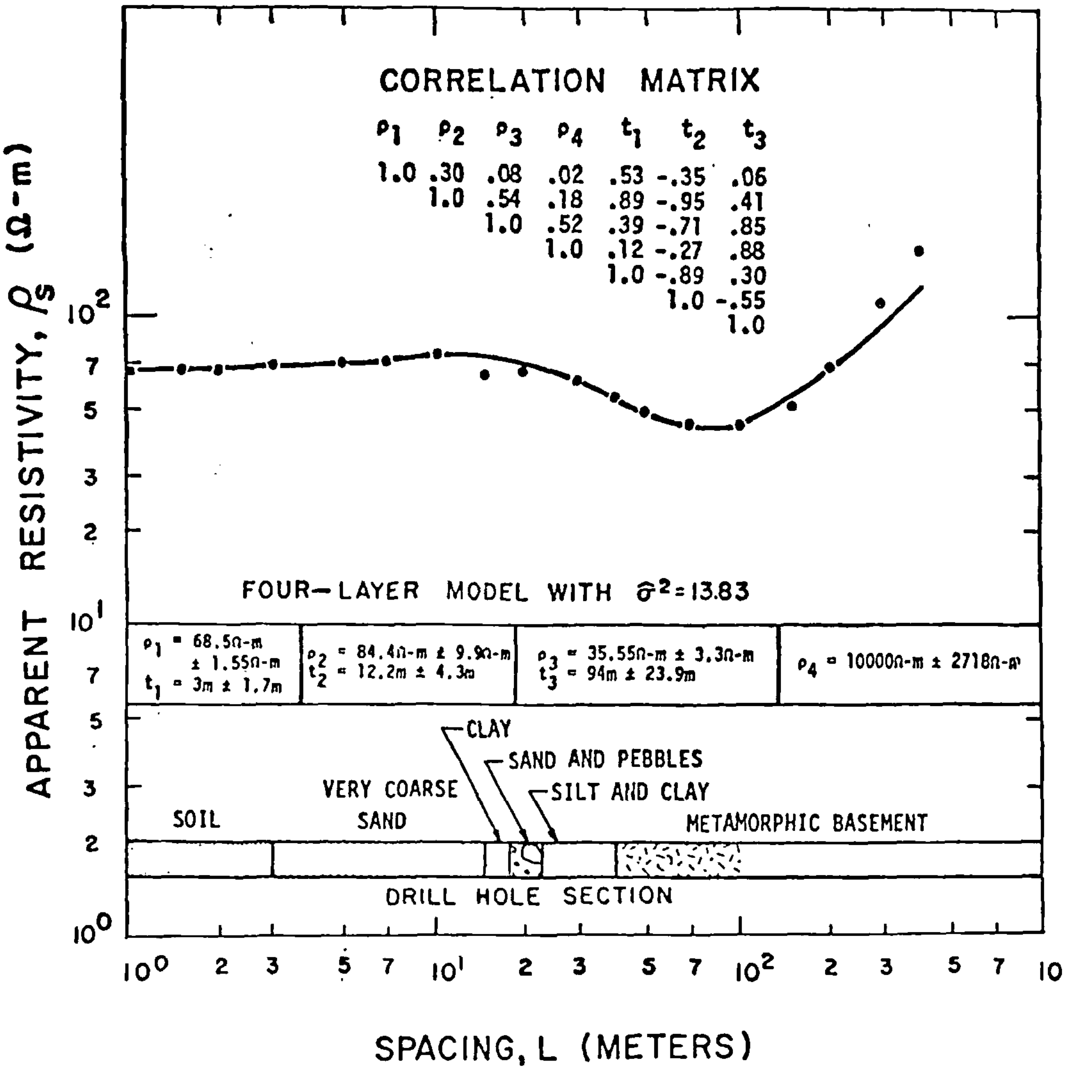

FIG. 9. Field data from Brazil with interpreted best fit model.

at the largest spacings rise at an angle that exceeds 45 degrees, indicating the presence of lateral inhomogeneities. The final fit indicates an error in the data of approximately 3.7 percent except for those points at the largest spacings, which are assumed to have a larger error level. The resistivity model corresponding to the best fit curve is also shown in the figure along with a drill hole section taken close to the center of the sounding. The correlation matrix is rather complicated and seems to indicate that there are not any two parameters that are strongly correlated exclusively one to another. For this reason, it is very difficult to define a slice of solution space with two highly correlated parameters. Therefore, the standard deviations must be interpreted with care. Note that none of the standard deviations is either extremely large or extremely small, except for the fourth layer, so they may be relatively accurate.

A comparison of the drill hole section with the resistivity model indicates that the thickness of the upper two layers are predicted accurately. However, the model thickness (and, I suspect the resistivity) of the third layer does not correspond at all well with the drill hole observation. The depth to the basement is greatly overestimated. Even if the standard deviations of Table 5 are included, the third layer is still too thick and too resistive. From other soundings in the area it is known that the conductive layer consists chiefly of a silt and clay sequence that may or may not include a thin gravel unit. The true resistivity for this layer is commonly around 10 ohm-m or less, depending on the water quality and the thickness of the gravel unit if it is present. Since the estimated curve fits the data very closely, I can assume with some confidence that the horizontal conductance given by the parameters of the estimated model for the third layer is the correct value. If we assume that the true resistivity of the third layer is closer to 10 ohm-m than to 36 ohm-m, the horizontal conductance gives a thickness of approximately 27 m, which corresponds much more closely to the drill hole information.

Another important point concerns the number of layers used to fit that data. Using the depths indicated by the drill hole section, I attempted to fit a six-layer model to the field data. I fixed the thicknesses and was able to achieve a fit slightly more accurate than the four-layer model fit. However, I believe it is best to fit the simplest model to the data provided that model yields an estimated residual variance within the noise level of the data. If we assume that the noise level is approximately 5 percent, then the four-layer model fits the data within this accuracy. Therefore, without other information, I do not feel justified in attempting to fit a more complicated model.

CONCLUSIONS

The ridge regression estimator is a powerful method for interpreting resistivity soundings over plane-layered earth structures. Using this method, it is possible to find a model that fits the data, to indicate the accuracy of the fit relative to the noise level in the data, and to predict the accuracy with which each parameter is estimated. This is certainly an improvement over most other methods because they are rarely able to indicate the range of models that will fit the data with a given degree of confidence.

It is important to note that the method is not a panacea. As shown by the Brazilian field example, more control is needed than just the resistivity data if we are to predict accurately the geoelectric section. I believe the ridge regression method makes full use of the data, but interpretation of even near perfect data requires some, if not substantial, geologic control.

The cost of interpretation for the three field curves, including the solution spaces, was approximately \$70–\$100 each. The cost would be less for one who was familiar with the geology of the three areas. In the Brazilian example several hours were required to fit the curve using the auxiliary point method. The resultant fit was not nearly as good as that provided by the inversion and there was no way to estimate the accuracy of the model or the range of models that would fit the data.

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Resistivity of Saturated Crustal Rocks to 40 km based on Laboratory Measurements

1970?

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Abstract. Recent studies in solution chemistry, together with our earlier high-pressure work, provide the information needed to construct resistivity-depth profiles for typical crustal rocks saturated with aqueous solutions. Profiles are presented for three heat flow provinces: the Sierra Nevada, the Basin and Range, and the eastern United States, to a depth of 40 km. The effects of high pressure and temperature and the variation of pore pressure from hydrostatic to lithostatic are discussed. For aqueous solutions alone, resistivity typically decreases with the conditions encountered at depth. However, this decrease is nearly counteracted by the effect of decreasing porosity of typical rocks at depth, so that below a few kilometers, resistivity of solution-saturated rocks should vary only slightly until temperatures sufficient for mineral conduction are reached. Mineral conduction should become significant at a depth of 10 to 40 km, depending on heat flow province. At no depth should resistivity of solution-saturated crustal rocks be greater than 10^6 Ω-m.

Much is known about electrical resistivity of rocks of the sort thought to make up the earth's crust, for pressures and temperatures appropriate to depths of 50 km or more [see *Keller*, 1966; *Parkhomenko*, 1967]. In most of the laboratory studies upon which these data are based, the rocks were nominally dry or, if they were water-bearing, they were at atmospheric pressure [see *Scott et al.*, 1967]. In the earth, rocks below the water table are saturated with aqueous solutions to at least 4 to 5 km, based on observations in deep wells, and possibly to even greater depths. What is the resistivity of crustal rocks if these conducting solutions are taken into account? No estimates appear to be available in which all the important factors such as temperature, salinity, and pore pressure are taken into account. The purpose of this paper is to attempt such an estimate based on laboratory studies. Two assumptions are made: that laboratory samples are truly representative of intact rock in the crust and that crustal rocks are saturated. Actual field measurements of resistivity of deeply buried rocks may themselves provide a test of these assumptions.

What factors determine resistivity of rocks in the crust? From earlier studies at room temperature [*Keller*, 1966; *Brace and Orange*, 1968*b*], porosity is the sole rock property that determines the resistivity of water-saturated rocks composed of nonconducting minerals; grain size and mineralogy have almost no effect. Resistivity also depends strongly on the detailed chemistry of the pore water. Pressure and temperature are important because they affect both porosity of the rock and conductivity of the pore solution.

Of these factors, porosity, salinity, and pressure have been studied in some detail for saturated rocks [*Brace et al.*, 1965; *Brace and Orange*, 1968*a*, *b*; *Greenberg and Brace*, 1969]. Temperature, particularly in its effect on solution resistivity, is the principal remaining factor whose effect is poorly understood. The complete experiment, in which both pressure and temperature are varied for saturated rock, does not seem to be feasible at present. Instead, we will use in this paper some new measurements of resistivity of various dilute solutions to 4 kb and 800°. Fortunately, these solutions, which were studied for quite a different purpose, happen to be of geologic interest, and the pressures and temperatures are quite appropriate for the crust. We combine these data with our earlier room-temperature and high-pressure results for rocks and thereby estimate the resistivity of a solution-saturated rock at different depths in the crust. All the factors that determine resistivity vary not only vertically in the crust but also horizontally. In this paper we narrow the choice somewhat by selecting three heat flow provinces [*Roy et al.*, 1968; *Lachenbruch*, 1970]. Resistivity-depth profiles are constructed for each province, by using the appropriate temperature-depth profiles. Each resistivity profile gives the range of resistivities that is shown by a group of typical crustal rocks and the variation with depth (which is the combined effect of pressure on the rock and of pressure and temperature on the solution). Variations in resistivity as pore pressure ranges from hydrostatic to lithostatic are discussed; the effect of mineral conduction at high temperatures is also considered.

Porosity. Porosity must be considered carefully, since it is the prime factor controlling conduction in saturated rocks at lower temperatures. Natural rocks have three kinds of porosity: fracture, crack, and pore. We adopt the term fracture porosity here for porosity that is associated with joints, faults, bedding planes, cleavage, and other features typically not included in the small samples studied in the laboratory. Laboratory samples contain cracks and pores [*Brace*, 1965; *Walsh and Brace*, 1966]; the cracks close at low pressure as, presumably, does fracture porosity. Pores are somewhat reduced by pressure but still appear to provide a network of conduction paths to very high pressure [*Brace et al.*, 1965].

To what extent is the porosity of laboratory samples identical with that of rock in place? Obviously, fracture porosity is lacking in laboratory samples; there may be differences with regard to crack and pore porosity as well [*Brace and Byerlee*, 1967]. Cracks may be introduced during sampling, particularly if the rock in place is under stress [*Nur and Simmons*, 1970]. However, it seems likely that most crack and pore porosity already exists prior to sampling, inasmuch as it probably results from changes in pressure and temperature which the rock experiences during its geologic history. For example, crack porosity of laboratory samples of granites is particularly high relative to either a pure quartz rocks or to rocks with no quartz [*Nur and Simmons*, 1970]. This relation would be expected if the porosity resulted from temperature changes; the thermal expansion of quartz is quite different from that of feldspar and other common minerals. Thus, values for crack and pore porosity of laboratory and intact rock in situ are probably not very different. The most sensitive test of this would be a detailed comparison of laboratory and in situ resistivities. Although one such comparison was attempted [*Simmons and Nur*, 1968], the results were quite inconclusive [*Orange*, 1969]. As noted above, we will have to assume here that laboratory resistivity is the same as that of rock in place as long as factors such as pressure and salinity are the same.

The effects of temperature on porosity are not well understood and need to be explored, for thermal stresses may in certain cases cause cracks and increase porosity. Probably, cracking due to temperature change is minor as long as effective pressure is high. One guide in this respect is *Birch*'s [1943] study of shear velocity at high temperature and pressure. None of the pronounced dropoff in velocity that might be expected from new cracks was observed up to 600° for pressures of 3 to 4 kb; evidently any cracking was suppressed by the pressure. We will assume that this is generally true and that porosity is unaffected by temperature change as long as pressure and temperature increase together. The changes in porosity due simply to thermal expansion are probably negligible.

Pressure. Pressure also must be carefully considered, for it plays a varied role. On the one hand, resistivity of a saturated rock depends on effective or grain-to-grain pressure, $\bar{P}$, which is total pressure less the pore pressure [*Brace and Orange*, 1968*a*]. On the other hand, resistivity of the pore fluid itself depends only on pore pressure, P_{H_2O}. We will consider two situations that may be of interest geologically: when pore pressure is lithostatic $(P_{H_2O})_{LITH}$ and when it is hydrostatic $(P_{H_2O})_{HYD}$, where the corresponding effective pressures are $(\bar{P})_{LITH}$ and $(\bar{P})_{HYD}$, respectively. Not enough is known about water in deeply buried rocks to determine whether other situations (such as zero or sub hydrostatic pore pressure) are more relevant. When pore pressure is lithostatic, it balances the weight of overlying rock; effective pressure $(\bar{P})_{LITH}$ is therefore zero. When pore pressure is hydrostatic, effective pressure $(\bar{P})_{HYD}$ is total less hydrostatic pore pressure, or $(\rho_R - \rho_W)gz$, where ρ_R and ρ_W are average densities of overlying rock and water, respectively, z is depth, and g is the acceleration of gravity. Pore pressure might be hydrostatic if all pore space were continuously connected to the surface.

Salinity. Resistivity of a solution-saturated rock depends strongly on the concentration of salts in the pore solutions. This dependence was explored [*Brace et al.*, 1965] for two pore solutions that ranged in resistivity from 50 Ω-m (tap water) to 0.25 Ω-m (NaCl solution). Data from this study and from *Brace and Orange* [1968*b*] are given in Figure 1 for a wide range of crystalline igneous and metamorphic rocks, at the same effective confining pressure of 4 kb. Surface conduction [*Madden and Marshall*, 1959] lowered the resistivity of the samples with tap water by a factor of 10 to 20, so that resistivity for the two pore solutions differed only by a factor of 10 (rather than the factor of 200 to be expected from the ratio of solution resistivities).

What is the resistivity of pore fluids likely to be present in rocks in the crust? This is, of course, not known and can only be surmised from the resistivity of waters found in igneous and metamorphic rocks near the surface. Data from numerous wells [*White et al.*, 1963; *Keller*, 1966] reveal that resistivity is almost always within the limits 0.5 to 100 Ω-m, with average values for wells of 1 to 30 Ω-m. Recent sediments, young sedimentary rocks, and some volcanic environments contain waters of lower resistivity, ranging down to 0.1 Ω-m.

If we adopt 1 to 30 Ω-m as typical of natural pore solutions, then, from Figure 1, resistivity of rocks of 0.001 to 0.01 porosity will be about 10^5 to 10^6 Ω-m at $\bar{P}$ equals 4 kb. This narrow range is a helpful result of surface conduction which, in effect, requires that a rock behave as though pore fluid resistivity were about 2 Ω-m, although in reality the fluid might be much more resistive pure water.

Heat flow provinces. Basing their study on regional similarity of heat flow and surface heat production, *Roy et al.* [1968] defined three heat flow provinces: the eastern United States, the Sierra Nevada, and a zone that includes the Basin and Range tectonic province. Within each province, crustal temperature has been estimated [*Roy et al.*, 1968] with greater than normal precision (Table 1, Figure 2). For each

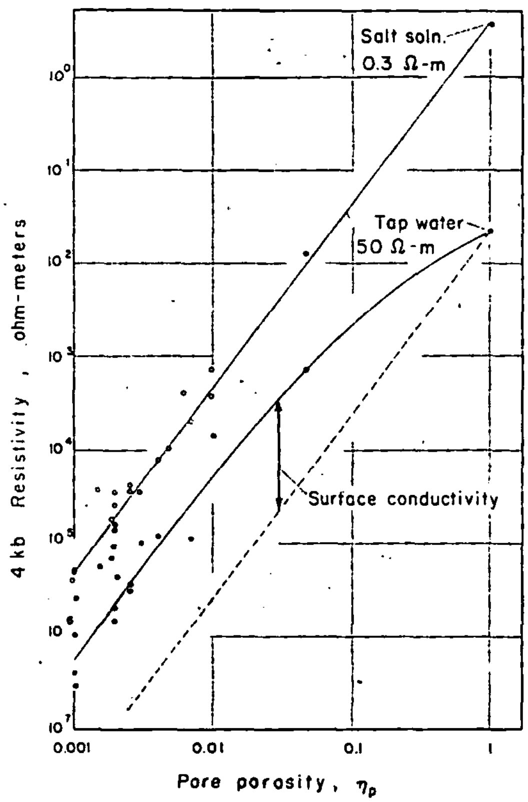

Fig. 1. Measured resistivity of igneous and metamorphic rocks at 4-kb effective pressure as a function of pore porosity [from *Brace et al.*, 1965; *Brace and Orange*, 1968*b*].

province, overburden or lithostatic pressure was determined as a function of depth based on appropriate seismic profiles. For Basin and Range and Sierra Nevada, data of *Bateman and Eaton* [1967] were used, and for eastern U. S., data of *James et al.* [1968] were used. The density-velocity relation of *Bateman and Eaton* [1967] was used. Table 1 includes lithostatic pressure P_{LITH} and effective pressure $(\bar{P})_{HYD}$ for the case when pore pressure P_{H_2O} is hydrostatic. For the other case, that P_{H_2O} equals P_{LITH}, then $(\bar{P})_{LITH}$ is zero. P_{LITH} is simply $\rho_R gz$, where rock density ρ_R is derived from the seismic profiles noted above, z is depth, and g is the acceleration of gravity.

Mineral conduction. At high temperature, conduction even through normally insulating minerals like quartz and feldspar becomes important. Conduction varies appreciably among mineral species and even within members of a solid solution series. However, some general

TABLE 1. Pressures and Temperatures of Heat Flow Provinces
(P_{LITH} is overburden pressure and $(\bar{P})_{HYD}$ is effective pressure when pore pressure is hydrostatic.)

	East U. S.			Sierra Nevada			Basin and Range		
Z, km	T, °C	P_{LITH}, kb	$(\bar{P})_{HYD}$, kb	T, °C	P_{LITH}, kb	$(\bar{P})_{HYD}$, kb	T, °C	P_{LITH}, kb	$(\bar{P})_{HYD}$, kb
5	100	1.35	0.85	80	1.35	0.85	150	1.35	0.85
10	170	2.80	1.80	120	2.70	1.70	250	2.70	1.75
15	240	4.25	2.75	160	4.10	2.60	380	4.05	2.70
20	310	5.70	3.70	200	5.50	3.50	510	5.55	3.82
25	370	7.15	4.65	235	6.90	4.40	630	7.05	5.0
30	420	8.6	5.6	270	8.4	5.4	750	8.65	6.3
35	460	10.0	6.5	300	9.9	6.4	860	10.3	7.7
40	500	11.7	7.7	340	11.4	7.4	970	11.9	9.1

trends are clear, based on extensive laboratory studies both at room pressure and at high pressure. Two curves of conductivity versus temperature between which most reported measurements fall are shown in Figure 3. Resistivities of a wide range of dry granitic, intermediate, mafic, and ultra mafic rocks [see *Parkhomenko*, 1967; *Keller*, 1966] fall between these limits, as does the olivine (0 to 15 per cent fayalite) studied by *Hamilton* [1965] to 42 kb. Partially melted rocks, particularly in the presence of water, fall outside these limits; in this case, resistivity can be many orders of magnitude lower [*Lebedev and Khitarov*, 1964].

Detailed mineralogy of the actual rocks in the crust is not known, and even if it were known, high temperature resistivity might not be exactly predictable without knowledge of minor elements and impurities [*Hamilton*, 1965]. In what follows we assume that the two curves in Figure 3 limit the actual resistivity of subsolidus rocks in the crust. As will become clearer later, these curves which were obtained for dry materials probably also apply to water-saturated rocks at high temperature, for, above a few hundred degrees, mineral conduction dominates conduction through pore fluids.

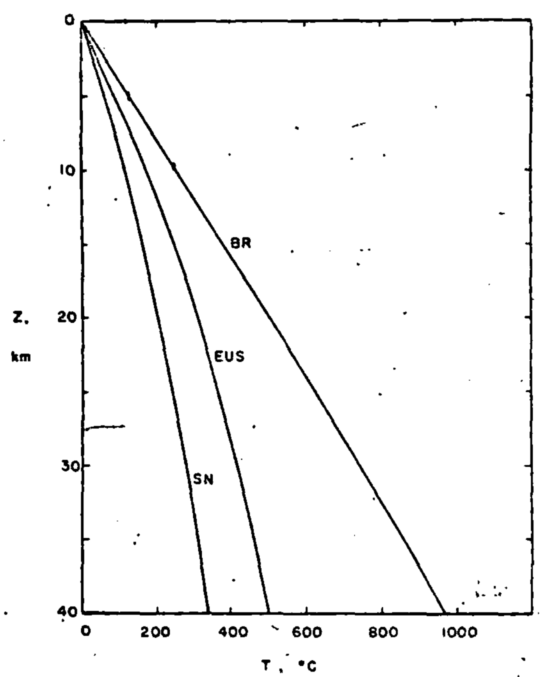

Fig. 2. Geotherms after *Roy et al.* [1968]. SN refers to Sierra Nevada, BR to Basin and Range, and EUS to eastern United States.

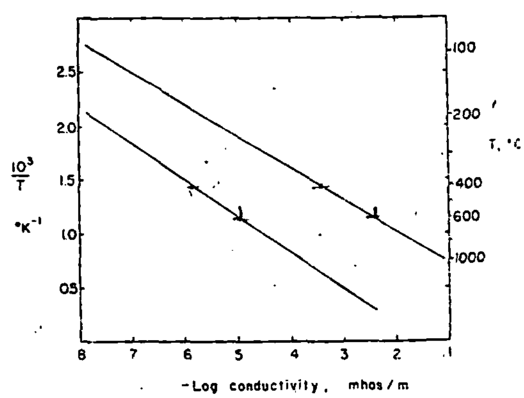

Fig. 3. Dependence of mineral conduction on temperature. The two lines give the limits between which most measurements for dry silicate rocks fall [from *Keller*, 1966; *Parkhomenko*, 1967; *Hamilton*, 1965].

CONDUCTIVITY OF SOLUTIONS AT HIGH PRESSURE AND TEMPERATURE

Before an examination of the role of solute ions, it is of interest to follow the changes in pure water that occur when it is subjected to the pressures and temperatures encountered at depth in the three heat flow provinces. Density is shown in Figure 4 for the three areas; data are based on *Kennedy and Holser* [1966]. Two curves are given for each area, termed 'HYD' when P_{H_2O} is hydrostatic and 'LITH' when P_{H_2O} is lithostatic. It is seen that density generally decreases with depth, except for Sierra Nevada, the abnormally 'cold' province. When pore pressure is lithostatic, density change nowhere exceeds 15 per cent. Even in Basin and Range, the abnormally 'hot' region, density never falls below 0.5 g/cm³.

The conductivity of a variety of dilute aqueous solutions has been measured by *Quist et al.* [1963] and *Quist and Marshall* [1966, 1968, 1969, 1970]. Typical results are shown in Figure 5 for a 0.01-molar NaCl solution as a function of pressure and temperature. Conductivity is seen to go through a pronounced maximum with temperature; the value of maximum conductivity varies little with pressure, although the maximum is shifted to higher temperature with increasing pressure. These somewhat curious changes in conductivity may be partly understood by considering the changes in the properties of water with increasing temperature. Viscosity decreases with increasing temperature, as does the dielectric constant and, to a lesser extent, density [*Quist and Marshall*, 1968]. The combination of these effects makes it initially easier for ions to move in the solution in response to an applied electric field; at higher temperature, however, motion is impeded as the effect particularly of lowered dielectric constant overtakes that of lowered viscosity.

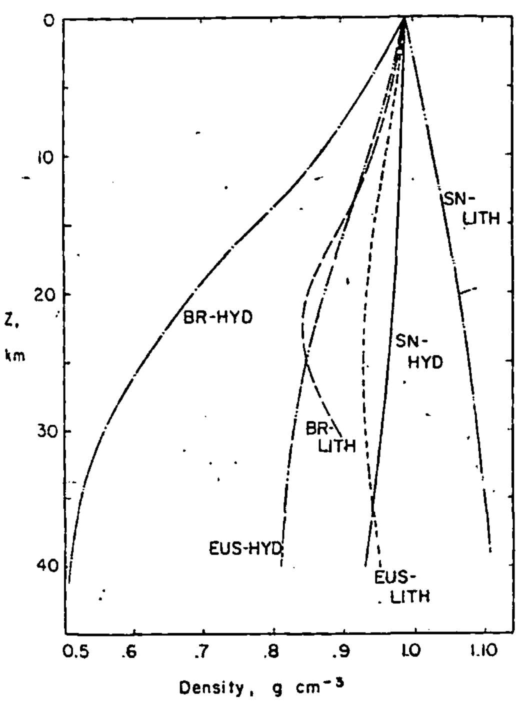

Fig. 4. Density of water as a function of depth for the three heat flow provinces, when pore pressure is hydrostatic (HYD) and lithostatic (LITH). Data are from *Kennedy and Holser* [1966]. SN refers to Sierra Nevada, BR to Basin and Range, and EUS to eastern United States.

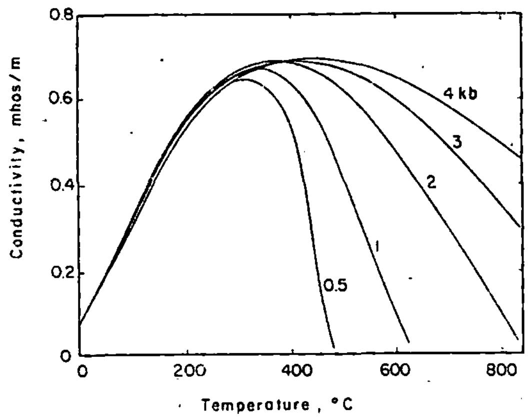

Fig. 5. Isobaric conductivity of a 0.01-m NaCl solution as a function of temperature. The number on each curve gives P_{H_2O} in kilobars [from *Quist and Marshall*, 1968].

Merely from inspection of Figure 5 it is clear that, initially at least, conductivity of a solution such as 0.01-molar NaCl would increase by a factor of about 6, irrespective of the detailed way in which pressure changes. Beyond approximately 400°, however, there is a more complicated interaction of pressure and temperature effects. For the problem at hand, we must consider the actual pressures and temperatures of the three areas of interest. This has been done; the results are shown in Figures 6 and 7. Relative conductivity was determined from the data of Quist and co-workers from figures such as

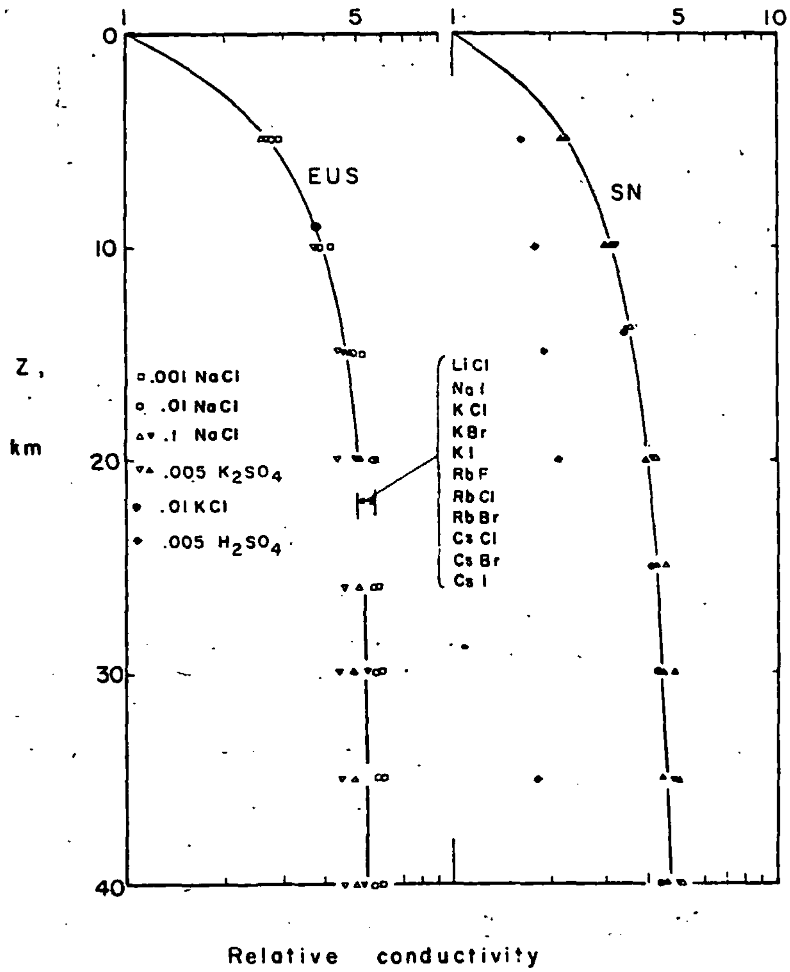

Fig. 6. Relative conductivity of various solutions for the eastern United States (EUS) and the Sierra Nevada (SN) as a function of depth. White symbols are hydrostatic pore pressure and black symbols are lithostatic pore pressure. Curves give average values.

Figure 5 for a variety of solutions using the pore pressures and temperatures listed in Table 1. The relative conductivity is obtained by dividing conductivity by the value at room pressure and temperature.

The effect of solute concentration is clearly indicated by results for the eastern United States (Figure 6). Data are shown for 0.001-, 0.01-, and 0.1-molar NaCl solutions. For this range of concentration, for which resistivity ranges from about 1 to 100 Ω-m at standard conditions, variation with depth is seen to be nearly the same. Variation with depth is also very similar for Sierra Nevada (Figure 6) and for the Basin and Range (Figure 7) when pore pressure is lithostatic. For the hydrostatic Basin and Range, variation in conductivity is markedly different; first it increases and then rapidly decreases with depth.

Variation of solute ion, for the species so far investigated by Quist and co-workers, also seems to have little effect on the variation of conductivity with depth. With the exception of H_2SO_4, all the different solutions group rather closely, as shown in Figure 6.

Curiously enough, differences between hydrostatic and lithostatic pore pressure are also minor, except for the Basin and Range. Apparently, conductivity for the three geotherms rather quickly reaches a value close to the maximum such as shown in Figure 5. As seen from this figure, the value of the maximum is not too sensitive to pressure as long as temperature is increasing slowly. For the Basin and Range hydrostatic case, temperature increases so rapidly that conductivity falls away from the maximum with increasing depth; see Figure 7.

APPLICATION TO CRUSTAL ROCKS

Porosity changes with depth. Not only fluid conductivity but also porosity of typical crusta rocks changes with depth. As noted above, only the effects of increasing pressure are believed to be significant. As depth increases, both lithostatic and pore pressures typically change; as long as the difference in these pressures, $\bar{P}$, increases with depth, then porosity decreases as well. Of the many possibilities, two cases are considered: when P_{H_2O} is lithostatic and when it is hydrostatic. For the first case, $\bar{P}$ equals zero and porosity remains unchanged with depth. For the second case, $\bar{P}$ increases and porosity decreases continuously with depth.

We next consider how $\bar{P}$ affects pore, crack, and fracture porosity and, therefore, conduction through pores, cracks, and fractures. We will attempt to define average behavior so that in later sections we can discuss characteristics of an average crustal profile.

Porosity of a wide variety of rocks decreases

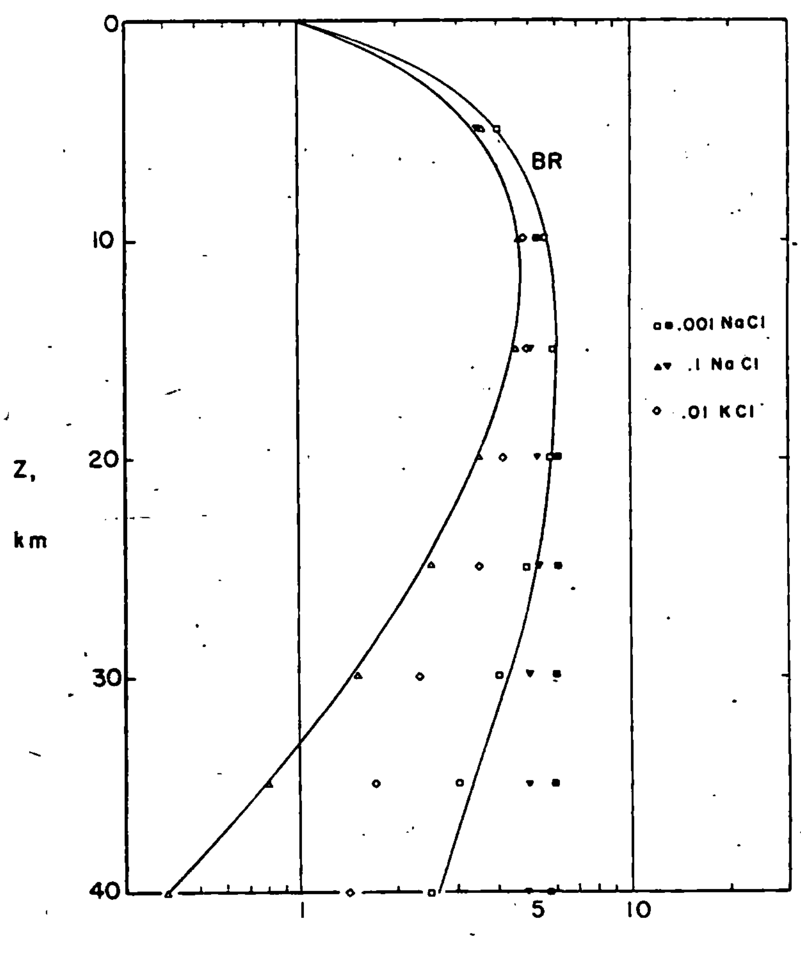

Fig. 7. Conductivity changes of various solutions for the Basin and Range (BR) as a function of depth. Black symbols are hydrostatic and white symbols are lithostatic pore pressure. Curves bound hydrostatic values.

with $\bar{P}$ in very nearly the same way between 2 and 10 kb [*Brace and Orange*, 1968*b*]. At these effective pressures, most cracks and, in the earth, most fractures would be closed, so that the porosity affected here is pore porosity. To a good approximation in this pressure region, conductivity change due to decreasing pore porosity is given [*Brace and Orange*, 1968*b*] by

$$1/\sigma \; d\sigma/d\bar{P} = -0.10 \text{ kb}^{-1} \qquad (1)$$

where σ is conductivity. In other words, conductivity decreases by a factor of 10 per 10 kilobars increase in $\bar{P}$.

Conductivity changes due to elimination of crack porosity under pressure vary rather widely among different rocks. Decrease of conductivity in the first 1 to 2 kb of a factor of 5 to 10 is typical [*Brace et al.*, 1965; *Brace and Orange*, 1968*b*].

The response of fracture porosity to increasing pressure is not amenable to study in the laboratory, but it can be estimated on the basis of certain field observations. *Snow* [1968] used measured flow rates at ten-foot intervals in drill holes at some 35 dam sites in granite, gneiss, and meta volcanics to calculate fracture porosity as a function of depth. Porosity ranged from 5×10^{-4} at 10 m or so below the surface to 5×10^{-6} at about 100 m. This porosity is appreciably lower than typical pore and crack porosity; for example, pore porosity is typically 10^{-2} to 10^{-3}, and crack porosity is approximately 1 to 2×10^{-3}. However, conduction through fracture porosity may still be important. Fractures, in the sense used here, are probably more nearly straight and therefore have lower tortuosity than cracks. Earlier measurements indicate that conduction through fractures may therefore vary more nearly as (porosity)^1 than as (porosity)^2 as observed for cracks and pores [*Brace et al.*, 1965; *Brace and Orange*, 1968*a*]. Conduction through fractures will therefore be a factor of 5 to 10 greater than crack conduction. To judge from Snow's observations, fractures are nearly closed at around 100 m, equivalent to $\bar{P}$ of about 20 bars.

Contributions from fracture, crack, and pore conduction for saturated rocks can now be combined schematically. In a plot of log conductivity versus effective pressure $\bar{P}$, this

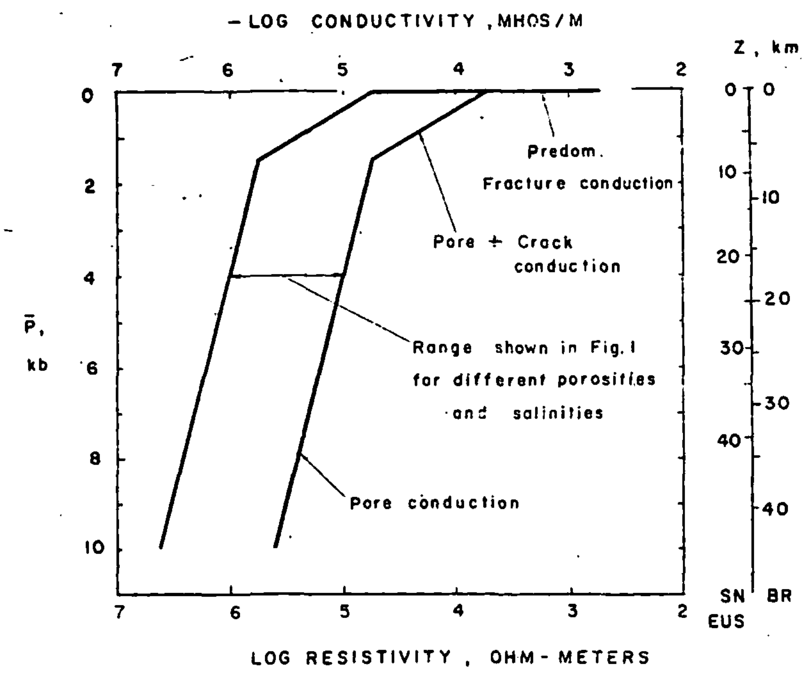

Fig. 8. Generalized effect of pressure $\bar{P}$ on conductivity of rocks saturated with aqueous solutions which remain at room temperature and pressure. Depth Z for the three heat flow provinces is shown, based on Table 1.

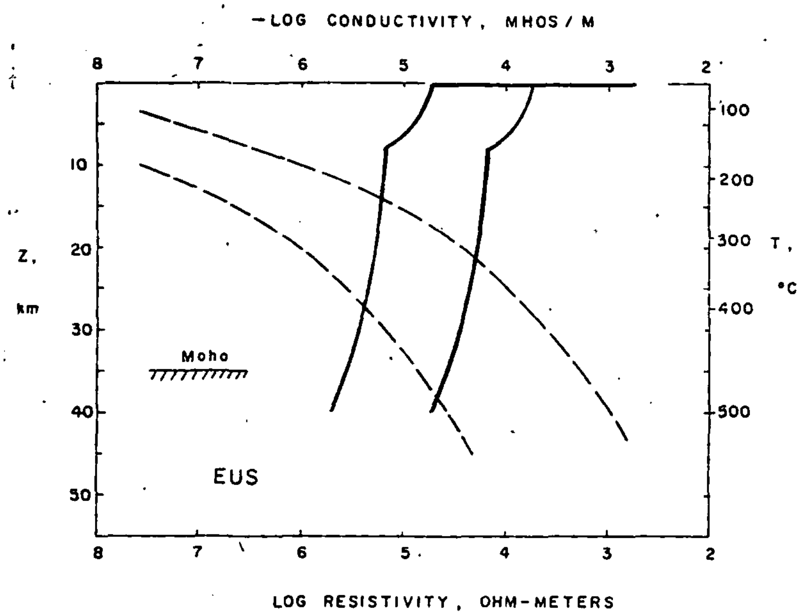

Fig. 9. Resistivity versus depth for the eastern United States (EUS) for hydrostatic pore pressure. Dry mineral conduction falls between the dotted line bounds; conduction through pore solutions falls between the continuous line bounds.

characterization (Figure 8) consists of three line segments. Close to zero pressure, conduction through fractures dominates. From zero to 1.5 kb, pore and crack conduction combined change by a factor of 10. Above 1.5 kb, pore conduction according to (1) is assumed to be dominant. The two lines in Figure 8 reflect variation in resistivity due to a porosity variation of 0.001 to 0.01, as summarized in Figure 1, for a pressure of 4 kb. Thus, the two lines bound values to be expected for typical saturated crustal rocks of these porosities.

Combined effects. The curves in Figure 8 bound the conductivity of average crust with the rock at high pressure and temperature and the pore solutions at room pressure and temperature. The effects of elevated pressure and temperature on the pore solutions can now be added. The lines drawn through the data in Figures 6 and 7 were taken to be the typical response of solutions to the pressure and temperature at depth in the three provinces. These effects were combined by multiplying rock conductivity at a particular depth (from Figure 8) by the relative conductivity of pore fluid appropriate to that depth (from Figures 6 and 7). In this way, the pairs of continuous curves shown in Figures 9, 10, and 11 were generated. For the Basin and Range, the data in Figure 7 vary, depending on salinity and pore pressure; the curves shown in that figure bound the hydrostatic case. The lower bound from Figure 7 was used for the lower bound in Figure 11, et cetera.

The continuous curves in Figure 9 to 11 show conductivity versus depth for the hydrostatic case. If pore pressure becomes equal to lithostatic pressure below some depth, then effective pressure $\bar{P}$ remains zero below that depth. Further changes in conductivity below that depth would be simply those appropriate to the pore solutions.

The broken lines in Figures 9 to 11 bound the conductivity of dry rocks; they are based on the data summarized in Figure 3. These broken lines are seen to intersect the continuous lines; they represent conduction through pore solutions, at depths which vary considerably with the particular province, from a high of around 10 km for the Basin and Range to as deep as 40 km for the Sierra Nevada. For comparison, the approximate location of the base of the crust is indicated on the left-hand side of each figure. A few kilometers above the depth of intersection, conduction through pore solutions should dominate, whereas a few kilometers below, mineral conduction should be the more significant.

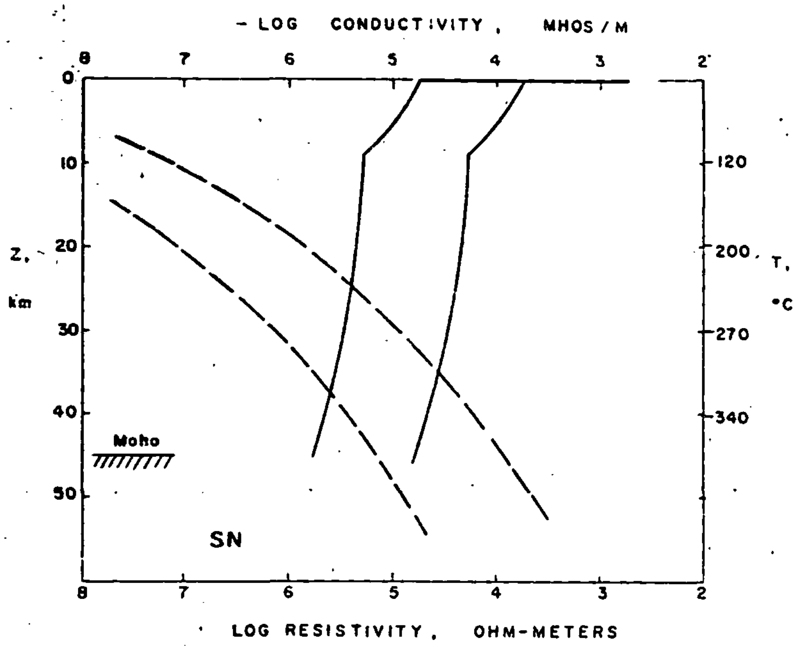

Fig. 10. Same as Figure 9, for the Sierra Nevada.

DISCUSSION

Before discussion of the three profiles above, we restate the assumptions on which they are based:

1. Crustal rocks are typical igneous or metamorphic varieties.
2. Laboratory samples have the same crack and pore porosity as rock in situ when both are at the same effective pressure.
3. Crustal rocks are saturated with dilute aqueous solutions similar to those found in surface igneous and metamorphic rocks.
4. Natural dilute aqueous solutions respond to elevated pressure and temperature in the same way as the solutions studied by Quist and coworkers.
5. Surface conduction (Figure 1) is independent of pressure and temperature.
6. Temperature remains below the solidus.

The resistivity profiles for the three regions are combined in Figure 12; for each heat flow province, a curve midway between the bounds in Figure 9, 10, or 11 has been drawn. Interesting similarities and differences in the curves are apparent.

The upper parts of all three profiles are nearly identical. Resistivity rises rapidly to a maximum of nearly the same value (10^6 Ω-m), which is reached at nearly the same depth (10 km). The abrupt corners in the profiles are, of course, fictitious. In contrast, the lower parts of the three profiles differ markedly. Rapid decrease in resistivity occurs at a depth that ranges from 15 km for the Basin and Range to 40 km for the Sierra Nevada. This variation reflects the marked differences in geothermal gradient for the different provinces.

Maximum resistivity, even if we allow for the variation suggested by the sets of bounds in Figures 9, 10, and 11, is less than 10^6 Ω-m. This resistivity is too low for efficient transmission of electromagnetic radiation [*Levin*, 1968].

Field measurements of crustal resistivity in continental areas appear to give values of the same order, as suggested by the profiles above. Crystalline rocks near the surface range in resistivity from 10^2 to 10^3 Ω-m [*Keller et al.*, 1966]. For highly resistive rocks at depth in for example, the New England and New York area, resistivities as high as 10^4 to 10^5 Ω-m are reported [*Anderson and Keller*, 1966]. These values are similar to scattered measurements made in Europe [*Keller et al.*, 1966].

Based on the evidence presented here, a typical resistivity profile is nearly independent of mineralogy and, therefore, of rock type, and nearly independent of pore water pressure, as

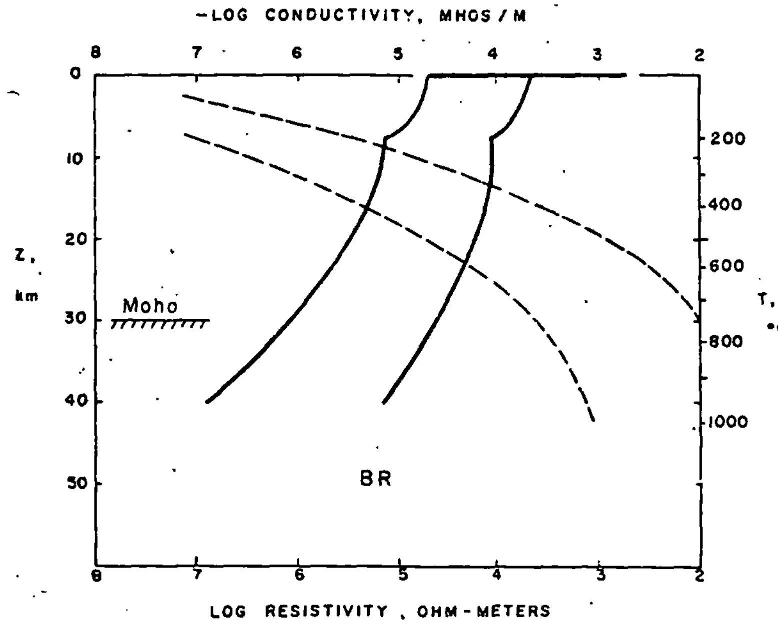

Fig. 11. Same as Figure 9, for the Basin and Range.

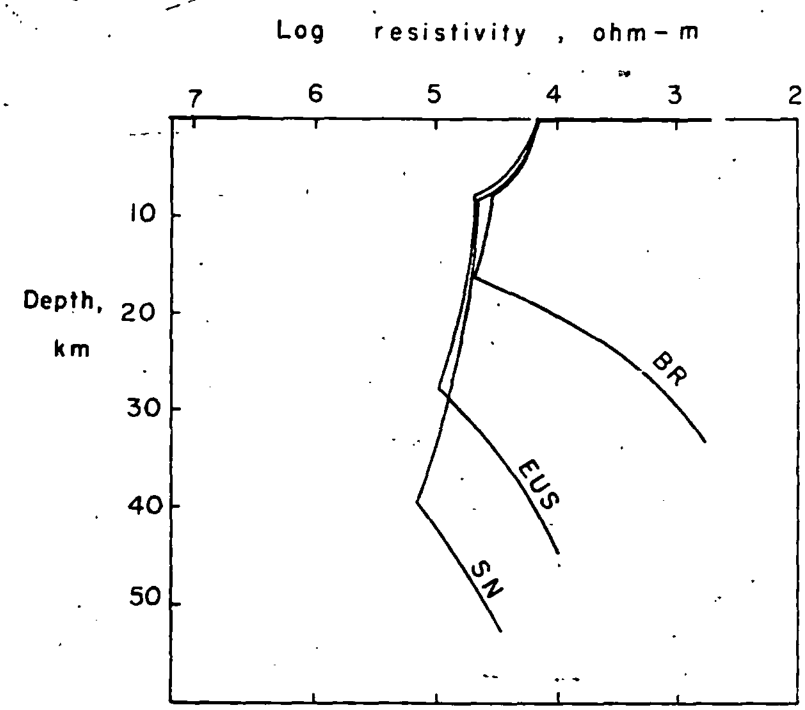

Fig. 12. Comparison of resistivity-depth profiles for the three heat flow provinces.

long as this pressure is at least hydrostatic. Thus, we should expect little correlation between profile of velocity (which depends strongly on mineralogy) and resistivity (which depends primarily on porosity). Similarly, regions of high pore pressure will not be revealed by resistivity measurements.

Of the assumptions listed above, 2 and 3 are most critical and if invalid, could cause major departures of the natural profiles from those derived above. Unfortunately, both have the same general effect and are probably indistinguishable by field measurement. If either pore porosity does not exist in natural rocks or if the rocks are water-free, then resistivity in the 10- to 40-km region of the profiles could be much higher than the maximum suggested above. Neither possibility can be ruled out on the basis of present laboratory or field studies. Either deep drilling or additional deep resistivity soundings are needed to settle this question.

Acknowledgments. I am particularly indebted to Isadore Amdur, who brought the new studies of Quist and co-workers to my attention. T. R. Madden was a constant source of ideas and criticism, and discussion of various aspects of the problem with C. Cox and D. Blackwell was particularly helpful.

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DISCUSSION

Ward: I want to repeat my warning about e sampling problem. When we look at rocks at surface we see the more competent ones ex-sed. Those hidden beneath swamps and mus-g are the more common, and these often in-ude the pyritic and graphitic rocks. They do ot show up in surface mapping, but we see em in aerial electromagnetic surveys. I think u are giving us a crust biased toward the ore competent rocks.

Brace: Yes, I have only considered the rela-vely resistive rocks, because the objective of is conference was to see if a highly resistive ayer is likely in the crust. If it is unlikely, ased on laboratory measurements on typical, sistive silicate rocks, then I think we can rule t out. For this reason, I have not looked at aphitic rocks, although in certain regions they ay well be common and may dominate the tuation electrically.

Alldredge: You showed resistivities up to 10^8 Ω-m, but no field investigation has yielded numbers higher than 40,000. Is this because your laboratory assumptions are way out of line?

Brace: Yes, this could well indicate that certain of our assumptions are not correct, although my greatest resistivity (5×10^5 Ω-m) does not seem to be way out of line with field measurements reported by Anderson and Keller (10^4–10^5 Ω-m).

H. W. Smith: I don't think you have a way in the world of measuring resistivities of the order 10^7 in the field. You cannot measure more than 5000 Ω-m in a borehole by any known technique because of the drilling mud. We must think very carefully about this if we actually drill a hole.

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May 31 - June 3

chanoid dune deposition. Facies C is characterized by tabular-planar cross-beds, 3 to 4 m thick, interlayered with flat laminated fluvial arenites. It probably formed by migration of solitary transverse dunes across emergent parts of the braidplain. Paleocurrents in all facies are unimodal and parallel to the paleoslope, but commonly show a strong mode perpendicular to the paleoslope. The lack of duricrusts, silcretes, and ephemeral lake deposits suggests a semi-arid to humid paleoclimate.

The eolianites are distinguished from fluvial sediments by: (1) tabular-planar and trough cross-beds bounded by low-angle to horizontal planar surfaces, the cross-beds being composed internally of wedge-shaped intrasets that dip in the direction of the megaset foresets; (2) ripple cross-lamination perpendicular to the megaset foreset dip; and (3) large-scale cross-beds. An eolian origin is substantiated by association with braided river facies, dissimilarity of cross stratification compared to established fluvial facies models, and the tectonic setting.

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Reflection Seismic Surveys for Basin and Range Geothermal Areas—An Assessment

Several state-of-the-art reflection seismic surveys have been completed in high-temperature geothermal areas of the northern Basin and Range province. The survey data have been made public through the Department of Energy/Division of Geothermal Energy Industry Coupled and Exploration Technology programs. Data were studied for the Stillwater, Dixie Valley, Beowawe, San Emidio, and Soda Lake resource areas.

Reflection quality, and hence usefulness of the reflection method, can be highly variable in the complex basin and range environment. Certainly survey design and proper processing are required to enhance the quality of the data. The most severe geologic condition appears to be the presence of surface, or near surface, layered volcanic rocks. These result in strong early reflections, substantial ringing and poor energy penetration to depth, as at Beowawe. In areas of thick alluvial cover, or Tertiary gravels and lake bed sedimentation (San Emidio, Soda Lake, Stillwater), data quality is often sufficient to map basin border faults and major displacements on volcanic or bedrock surfaces beneath 2,000 to 4,000 ft (609 to 1,219 m) of cover. Faulting is indicated primarily by the systematic termination of coherent reflections. Diffraction patterns are sometimes recognized but commonly obscured by the complex faulting and lithologic variations. The identification of a given reflector across major structures and accurate time-to-depth conversion are difficult interpretational problems. Excellent data quality at Stillwater and Dixie Valley should contribute to the development of these resources.

ROSS, HOWARD P., DENNIS L. NIELSON, WILLIAM E. GLENN, et al, Univ. Utah, Salt Lake City, UT

Roosevelt Hot Springs, Utah Geothermal Resource —Integrated Case Study

The Roosevelt Hot Springs geothermal resource is located along the western margin of the Mineral Mountains, approximately 19 km northeast of Milford, in southwestern Utah. To date, seven producing wells have been drilled by Phillips Petroleum Co. and Thermal Power Co. Construction will soon begin on the first stage of a 120-megawatt power plant.

Detailed geologic mapping and the study of well logs and drill cuttings indicate that the geothermal reservoir is a fracture-controlled, liquid-dominated system. The host rocks of the reservoir are Precambrian metamorphic rocks and various Tertiary intrusives. The reservoir is mainly localized between the range front and an alluvial covered horst block, along which fluids have migrated to the surface forming an elongate north-trending dome of siliceous sinter. The reservoir is an area of high heat flow (over 1,000 mW/sq mi) and low near-surface electrical resistivity (less than 10 ohm-m). Aeromagnetic, gravity, and reflection seismic data help define the geologic structure within and around the alluvium covered reservoir. Trace element geochemistry shows that arsenic, lithium, and mercury are enriched along fluid pathways of the geothermal system. Mercury concentrations greater than 20 ppb occur only at temperatures less than 225°C and reflect the present thermal configuration of the field.

The system was efficiently explored using detailed geologic mapping in combination with thermal gradient studies and dipole-dipole resistivity.

ROWELL, H. CHANDLER, Exxon Co., U.S.A., Houston, TX

Biostratigraphy of Monterey Formation, Palos Verde Hills, Southern California

Three members comprise the Monterey Formation in the Palos Verdes Hills: the Altamira Shale, The Valmonte Diatomite, and the Malaga Mudstone. Following the diatom zonation of Barron (in press), the middle to upper Altamira Shale ranges from Subzone b of the *Denticulopsis lauta* Zone through Subzone b of the *Denticulopsis hustedtii-D. lauta* Zone (14.5 to 12 m.y.B.P.), the Valmonte Diatomite ranges from Subzone b of the *D. hustedtii-D. lauta* Zone into the lower *Thalassiosira antiqua* Zone (13 to 8 m.y.B.P.), and the Malaga Mudstone ranges from the lower *T. antiqua* Zone into the lower *Thalassiosira oestrupii* Zone (8 to 4 m.y.B.P.), transgressing the Miocene-Pliocene boundary (5 m.y.B.P.). The overlap of up to one million years along the Altamira-Valmonte contact is not surprising since this contact is characterized by a diagenetic change of Opal-A to Opal-CT at most sites.

The age distribution of outcrops reflects northwest-southeast-trending anticlinorium structure of the Palos Verdes Hills, but local sections are discontinuous and deformed due to slumping, folding, and faulting during Pliocene uplift of the hills. This is best seen at Malaga Cove where folds, faults, and slumps are visible along the sea cliffs, and a short hiatus marks the Valmonte-Malaga contact.

The siliceous biostratigraphy of the Palos Verdes Hills correlates to that of the Monterey Formation at Newport Bay. However, the correlation of the siliceous zonation to the benthic foraminiferal stages (assigned by Woodring et al, and Warren) differs for the two areas.

RUBIN, DAVID M., and RALPH E. HUNTER, U.S. Geol. Survey, Menlo Park, CA

Dune Size in Paleodeserts of Colorado Plateau

Where dunes migrate during deposition, they move upward (climb) with respect to the generalized depositional surface. Sediment deposited on each lee slope and not eroded during passage of a following trough is left behind as a cross-stratified

1977

FINITE DIFFERENCE AND WAVENUMBER MIGRATION

by

P. Hood

This is a preprint of a paper to be presented at the 39th Meeting of the European Association of Exploration Geophysicists, in Zagreb. It is intended only for the information of listeners to the presentation.

FINITE DIFFERENCE AND WAVENUMBER MIGRATION

by

P. Hood*

ABSTRACT

Finite difference migration has been developed and popularised by Professor J.F. Claerbout of Stanford University and is now widely used in seismic processing. For most sections finite difference migration gives comparable results to conventional Kirchoff migration and, where events are not dipping too much, a cleaner appearance is often apparent. However, there are two practical limitations of the method, and these occur in regions of very steep dip and where there is large variation of the velocity in the lateral direction.

It is possible to develop successively more accurate equations to deal with the steep dip problem, but above third order these schemes become prohibitively expensive to implement. The finite difference method itself introduces errors and so imposes further limitations on the angle of dip. For the effective treatment of steeply dipping beds there appears to be no method available in the time domain which does not suffer from dispersion inaccuracies. However, by developing wavenumber migration, an exact one-way wave equation can be used, and this eliminates any error except that caused by finite sampling.

The other difficulty with wave migration is the correct migration in regions with lateral velocity variation. There are two approaches possible: one uses an exact theory, whereas the other uses approximate theory based on the deviation from a depth stratified model. Both methods are discussed with their advantages and limitations. Finally, some examples are shown of wave migration applied to synthetic and real data.

* Seismograph Service (England) Limited

FINITE DIFFERENCE AND WAVENUMBER MIGRATION

Introduction

There are a number of different options available for the migration of seismic data, three of these methods are shown schematically in Fig. 1. The first method is the Kirchoff integral formulation of the wave equation, which gives rise to the "diffraction stack" process. This has been available for a number of years and offers quite a satisfactory method of migration. Essentially it uses summation along "NMO curves" of either $(\partial P/\partial t)^{\frac{1}{2}}$ or P, where P is the pressure recorded at the hydrophones. Using $(\partial P/\partial t)^{\frac{1}{2}}$ corrections for phase are automatically applied, whilst using P it is necessary to make a separate correction after summation[1-4]. Similarly amplitude corrections can be made to account for the varying numbers of traces in the summation process.

The finite difference solution to the wave equation is the second method listed and will be the main subject of this paper. A limited discussion of the third technique which for brevity may be termed "wavenumber migration", will also be included. In "wavenumber migration" the migration is carried out entirely in the frequency domain.

The use of finite difference techniques to migrate seismic data is so widely practised in the oil exploration industry that the subject requires little introduction. There are, however, two cases where finite difference wave migration can give poor results, namely in areas of steep dip or in regions where correct compensation for lateral velocity variation has not been applied. Although some think the best solution with a limited angle wave equation is probably to be obtained using slant stacked data[5], a surprising degree of success can nevertheless be achieved with conventional CDP stacked data. In this paper, therefore, attention is focussed on migration of CDP stacked data and on the two questions of migration in regions with lateral velocity variation and steep dip beds.

The subject of lateral velocity variation can fortunately be treated in isolation since, once a particular approach has been selected, it may be applied to a shallow or steep dip wave equation. The treatment of steep dip events, on the other hand, depends on the accuracy of the parabolic approximation to the wave equation used and on its numerical approximation. Both the parabolic wave equation and its finite difference solution introduce errors. In deriving a steep dip algorithm, errors from the two sources must be considered, and, as far as possible, made to cancel.

Unfortunately the very nature of the finite difference approximation means that errors can never be entirely eliminated, and for this reason migration in wavenumber space is now being considered. There appear to be a number of encouraging features with wavenumber migration and some preliminary results using this technique are discussed.

One-way wave equations

The starting point for wave migration is normally the scalar wave equation. In a co-ordinate system in which the shot and receiver are coincident (i.e. a CDP stack approximately), the velocity must be halved[6], so that in these co-ordinates the wave equation is:

$$\frac{\partial^2 P}{\partial x^2} + \frac{\partial^2 P}{\partial z^2} = \frac{4}{c^2}\frac{\partial^2 P}{\partial t^2} \tag{1}$$

where P(x,z,t) = pressure recorded at the hydrophones
(x,z,t) = (horizontal, vertical, time) co-ordinate
c(x,z) = sound wave speed.

Following Claerbout(7) the one-way wave equation which governs the propagation of waves along the direction of the z axis is (in the frequency domain):

$$\frac{\partial P}{\partial z} = i\left(\frac{4\omega^2}{c^2} + \frac{\partial^2}{\partial x^2}\right)^{\frac{1}{2}} P \tag{2}$$

where ω = angular frequency.

The key to the success of various parabolic approximations to equation (2) lies in the accuracy to which the square root term S is approximated. Claerbout derives a set of approximations of various orders in Ref. 7. In Fig. 2 the second and third order approximations to the square root operation are shown. These are called the 15° and 45° approximations respectively. As can be seen the 45° approximation is a better approximation than the 15° approximation at all angles. Also shown is a different third order approximation which has been developed at Seismograph Service Limited. Here the emphasis is on achieving a closer fit at steeper angles, and, from about 40° dip and steeper, this approximation is better than the 45° approximation (with the effects of the numerical approximation included).

It is feasible to use fourth order or higher approximations to S, but there are a number of computational drawbacks arising from the fact that the resulting finite difference equations no longer have a straightforward tridiagonal form. This causes a progressive increase in the computational costs. Furthermore, errors introduced by the finite difference method can be more serious than those caused by the parabolic wave equation, so that, unless the finite difference method is abandoned in favour of other techniques, there seems to be little prospect of high order approximations achieving any noticeable improvement.

In Fig. 3 we show a synthetic section (generated using ray tracing techniques) of a model with beds dipping between 0–50° in 10° steps. The geophone interval is 200 ft and the velocity 10,000 ft s^{-1} with a sampling interval of 4 ms. The pulse is a zero phase wavelet centred at 15 Hz. Figs. 4a-c represent the migrated results using the 15°, 45°, and our current approximation respectively with a depth interval of 40 ms used in the migration. The beds should all be aligned after migration and it is apparent that none of the methods work perfectly. All suffer from dispersion effects caused by the wave equation error and finite difference approximation. However, it must be noted that the gains on the plots are unrealistically large, and these dispersion effects, although produced near steep beds on real data, are not usually quite so apparent.

Returning now to equation (2), a 15° equation is derived for later reference. Let $\bar{c}$ be a constant velocity then:

$$\frac{\partial P}{\partial z} = i\,\frac{2\omega}{\bar{c}}\left[1 - 1 + \left(\frac{\bar{c}}{c}\right)^2 + \left(\frac{\bar{c}}{2\omega}\right)^2\frac{\partial^2}{\partial x^2}\right]^{\frac{1}{2}} P$$

$$\doteq i\,\frac{\omega}{\bar{c}}\left[1 + \left(\frac{\bar{c}}{c}\right)^2 + \left(\frac{\bar{c}}{2\omega}\right)^2\frac{\partial^2}{\partial x^2}\right] P \tag{3}$$

This may be placed in a retarded time frame by setting $P = P' \exp(i \frac{2\omega z}{\bar{c}})$, thus:

$$\frac{\partial P'}{\partial z} = i \frac{\omega}{\bar{c}} \left[\left(\frac{\bar{c}}{c}\right)^2 - 1 + \left(\frac{\bar{c}}{2\omega}\right)^2 \frac{\partial^2}{\partial x^2} \right] P' \quad (4)$$

Restoring (4) to the time domain and dropping the primes we obtain:

$$\frac{\partial^2 P}{\partial t \, \partial z} = \frac{\partial^2 P}{\partial t^2} \left(\frac{\bar{c}}{c^2} - \frac{1}{\bar{c}}\right) - \frac{\bar{c}}{4} \frac{\partial^2 P}{\partial x^2} \quad (5)$$

A special case of this arises if lateral velocity variations are insignificant, in which case, neglecting transmission effects, the following equation can be derived:

$$\frac{\partial^2 P}{\partial z \, \partial t} = - \frac{c(z)}{4} \frac{\partial^2 P}{\partial x^2} \quad (6)$$

Finite difference approximation

The application of the finite difference method to parabolic wave equations is fairly standard and has, for example, been discussed by Claerbout and Johnson[8]. However, one or two parameters are of interest and so a brief discussion of the equations will be given in this section. Let $P_{j,k,n}$ be the value of P at the mesh point $P(t_j, x_k, z_n)$. The following difference operators may be defined:

$$D_x P_{j,k,n} = (P_{j,k+1,n} - P_{j,k,n}) \frac{1}{\Delta x} \qquad \left(\approx \frac{\partial P}{\partial x}\right)$$

$$D_{xx} P_{j,k,n} = (P_{j,k+1,n} - 2 P_{j,k,n} + P_{j,k-1,n}) \frac{1}{\Delta x^2} \qquad \left(\approx \frac{\partial^2 P}{\partial x^2}\right)$$

and let:

$$A_1 P_{j,k,n} = \tfrac{1}{2} \left[(1-\theta) P_{j,k,n} + \theta P_{j,k,n+1} + (1-\theta) P_{j+1,k,n} + \theta P_{j+1,k,n+1} \right]$$

$$A_2 P_{j,k,n} = \alpha P_{j,k+1,n} + (1-2\alpha) P_{j,k,n} + \alpha P_{j,k-1,n}$$

Equation (6) may be expressed in difference notation as:

$$\left(A_2 D_z D_t + \frac{c(z)}{4} D_{xx} A_1\right) P_{j,k,n} = 0 \quad (7)$$

For stability of equation (7) $0 \leq \alpha \leq \frac{1}{4}$ and $0.5 \leq \theta \leq 1$. Values of α in the range $\frac{1}{12} \leq \alpha \leq \frac{1}{6}$ appear to be widely accepted.

The parameter θ is interesting in that its value determines whether or not the difference scheme is implicit or explicit. The migration results obtained in Fig. 4 were for θ=0.52 in all three examples. By increasing θ towards unity waves at large angles to the axis are successively attenuated with the high frequencies being first affected. In Fig. 5a-c and 45° approximation is used with values θ=1, θ=0.75, θ=0.6 respectively. It is clear that at θ=0.6 we have practically eliminated the dispersion from the dipping planes yet still retained all beds up to 40° dip. Therefore it might be considered attractive to use an off-centred difference scheme as a kind of dip filter to remove the precursors from steeply dipping planes. Unfortunately on real data the results are disappointing, giving diffuse and blurred sections. Fig. 6a shows part of a stacked line before migration and Fig. 6b-c after migration using θ=0.6 and 0.5 respectively.

Having selected α and θ what are the possible choices of sampling step size which can be chosen to permit steeply dipping events to migrate accurately? The sampling interval in the x direction is fixed by the geophone interval and re-sampling to a coarser Δx will generally degrade the results totally(3). Similarly Δt, the time increment, would normally correspond to the actual recording sampling interval, but resampling to a coarser Δt can sometimes give tolerable results. In the z direction the choice of step size is less critical and varies widely in company practice, the accuracy is usually higher with a small Δz. Step size in this direction is conventionally expressed not as Δz, but $\Delta\tau$, the two-way travel time corresponding to the depth step. In all cases an analysis of the errors arising for a particular frequency, velocity, dip and migration equation can be used to assess the optimum difference scheme and increments necessary for acceptable results.

Lateral velocity variation

We have identified three main methods of including the effects of lateral velocity variation. Doubtless the list is incomplete and each company will have its own particular preference for inclusion of these effects.

The first and most obvious method is to solve equation (5) directly by a finite difference procedure. The stability of the solution depends on the range of velocity departure from the frame velocity $\bar{c}$ and on the recording parameters. For normal values there appear to be certain stability difficulties. An alternative solution suggested by various authors is to treat the effects of lateral velocity variation in two parts. The first part of equation (5) deals with diffraction and wave propagation effects, the other with a time shift associated with the velocity fluctuations. This method is unconditionally stable.

The second method of treating lateral velocity variations is based on the deviation from a depth stratified model (equation (6)). It is founded upon the idea that the wave migration method is simply a method for projecting the seismogram downwards. The section is migrated when all events have returned to their point of origin. In one sense then, it is immaterial what migration velocity is chosen in each depth step, provided that the migration is continued to a depth sufficient to encompass all sources. For example, supposing a reflecting interface is located at a depth of 9000 ft. We could arrive at this depth either by migrating over 1 second with a velocity of 9000 ft s^{-1} or over 2 seconds using a migration velocity of 4500 ft s^{-1}. This may be demonstrated more rigorously by considering what migration does to each Fourier component of the wavefield. Propagation through a depth z in a medium with velocity c is achieved by multiplication of each component by $\exp\{i\,\frac{2\omega}{c}z[(1-(\frac{ck}{2\omega})^2)^{\frac{1}{2}}-1]\}$ using a retarded time frame(9). If instead the migration uses a velocity c_1 then the component is multiplied by $\exp\{i\,\frac{2\omega}{c_1}z_1[(1-(\frac{c_1 k}{2\omega})^2)^{\frac{1}{2}}-1]\}$ and is projected through a distance z_1. In order to achieve the same migration results with the velocity c_1, the phase in both expressions must be equal. Thus dropping third order terms in the expansion of the square root and equating coefficients gives:

$$z_1 = z\,\frac{c}{c_1}$$

So, to second order accuracy, the results using the incorrect velocity in any depth interval may be corrected by adjusting the depth of migration in the ratio of the true/migration velocities.

The third method is analogous in many ways to the second method but involves a conversion to a "depth" section. Thus instead of using the usual time shifted co-ordinate system[8]:

$$t' = t + \frac{z}{c}$$

a depth co-ordinate d is used defined by:

$$d = \frac{c_a\, t}{2} + z$$

where $c_a\, t = \int_0^t c_{int}\, dt$

c_a is commonly referred to as the average velocity and c_{int} as the interval velocity. Provided that the interval velocity varies slowly as a function of x and z several simplifications can be made to the equations and migration through depth layers proceeds in the normal manner.

Of all the methods outlined only the first method makes no assumption about the velocity variation, but it is difficult to apply since the migration technique requires data in multiplexed format. The second method assumes that third order effects are negligible which is consistent with a 15° approximation, whilst the third method assumes definite bounds on velocity changes and introduces further inaccuracy due to resampling. However, since velocity control is normally only approximate, then probably any of the inexact methods could be used without introduction of serious error, and the choice will largely depend on individual company practice.

In Fig. 7 is shown a depth model of two point scatterers located in regions with interval velocities of 5000 ft s^{-1} and 10000 ft s^{-1} respectively. Fig. 8a shows the time section with superimposed background noise of two types - random and partially organised. In Fig. 8b a migrated section using the second method is shown. Both point scatterers are now fairly clear, with the diffractions largely collapsed, and with the noise spread out over the wavefronts.

Wavenumber migration

The idea that migration may be carried out entirely in the frequency domain is not new. Maginness[9] presented a scheme for reconstruction of wavefields at successive planes parallel to z=0 using surface recorded information. The procedure he discussed may be applied in the following manner to seismic data:

1. From P(x,t;0) form the Fourier transform

$$\hat{P}(k,\omega;0) = \iint P(x,t;0)\ \exp\left[i(kx-\omega t)\right]\ dx\ dt$$

2. Modify the phase of each Fourier component by multiplication by the term

$$\exp\left[i\Delta z\sqrt{\frac{4\omega^2}{c^2} - k^2}\right]$$

3. Form the inverse Fourier transform and obtain $P(x,t;\Delta z)$, the seismogram at a depth Δz.

The migration procedure in the wavenumber domain thus follows exactly the same procedure as finite difference migration in that the seismogram is projected downwards a distance Δz at each stage. To avoid circular convolution it is necessary to multiply components by an additional shifting term $\exp(-\ i2\omega\Delta z/c)$ in process 2.

As presented above, this procedure is inefficient for migration purposes in that only one particular time is of interest at any given depth z - the one at which the upgoing waves were generated. A modification is thus desirable in which the projection downwards yields only the results at the required depths and times. Research on this method is incomplete but preliminary results for the migration of the synthetic in Fig. 3 are shown in Fig. 9a. In Fig. 9b the same synthetic is migrated using Kirchoff summation. It is clear that wavenumber migration suffers from none of the frequency dispersion of the finite difference method, nor the noise generated by the Kirchoff summation method. Migration of the lowest bed is incomplete since some time section data for this bed appeared at times later than the 4 seconds used for this migration. Although only limited experience has been gained using wavenumber migration, these early results are encouraging.

Migration of real data

Having devoted considerable time to synthetics some examples of migration with real data are now discussed. The first example is a section from the Yorkshire coastal area and includes a salt piercement dome which is typical of the area (Fig. 10a). The stack is a 48 fold stack and has been corrected for instrument phase distortion. The migrated results are shown in Fig. 10b using finite difference migration with a depth interval $\Delta\tau$ of 40 ms. Migration clearly improves the right-hand edge of the section where the overlapping beds are returned to their correct locations, although in this particular case the 2-dimensional assumption is not sufficient.

The next example is also North Sea data and shows a buried focus at about 4 seconds on a 30 fold stack (Fig. 11a). Fig. 11b shows the migrated section again using finite difference migration, demonstrating the simplification in interpretation which can be achieved through migration.

Conclusions

The migration of seismic data may be achieved in either the time or wavenumber domain. Results using the finite difference method can be very good up to 45° dip or steeper provided that a suitable choice of one-way wave equation and difference approximation is made. However dispersion errors from various sources can spoil results near steeply dipping beds. For precise migration at all dips, wavenumber migration offers possibly the ultimate in migration accuracy and represents a very promising new development.

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KIRCHOFF INTEGRAL (DIFFRACTION STACK)	SUMMATION ALONG NMO CURVES OF $(\frac{\partial P}{\partial t})^{1/2}$ OR P.
FINITE DIFFERENCE SOLUTION	MODIFICATION OF THE SCALAR WAVE EQUATION & SOLUTION BY THE FINITE DIFFERENCE METHOD.
WAVENUMBER MIGRATION	TRANSFORM TO (K,W) PLANE & USE EXACT ONE WAY WAVE EQUATION. INVERSE TRANSFORM.

FIG. I. THREE POSSIBLE MIGRATION METHODS

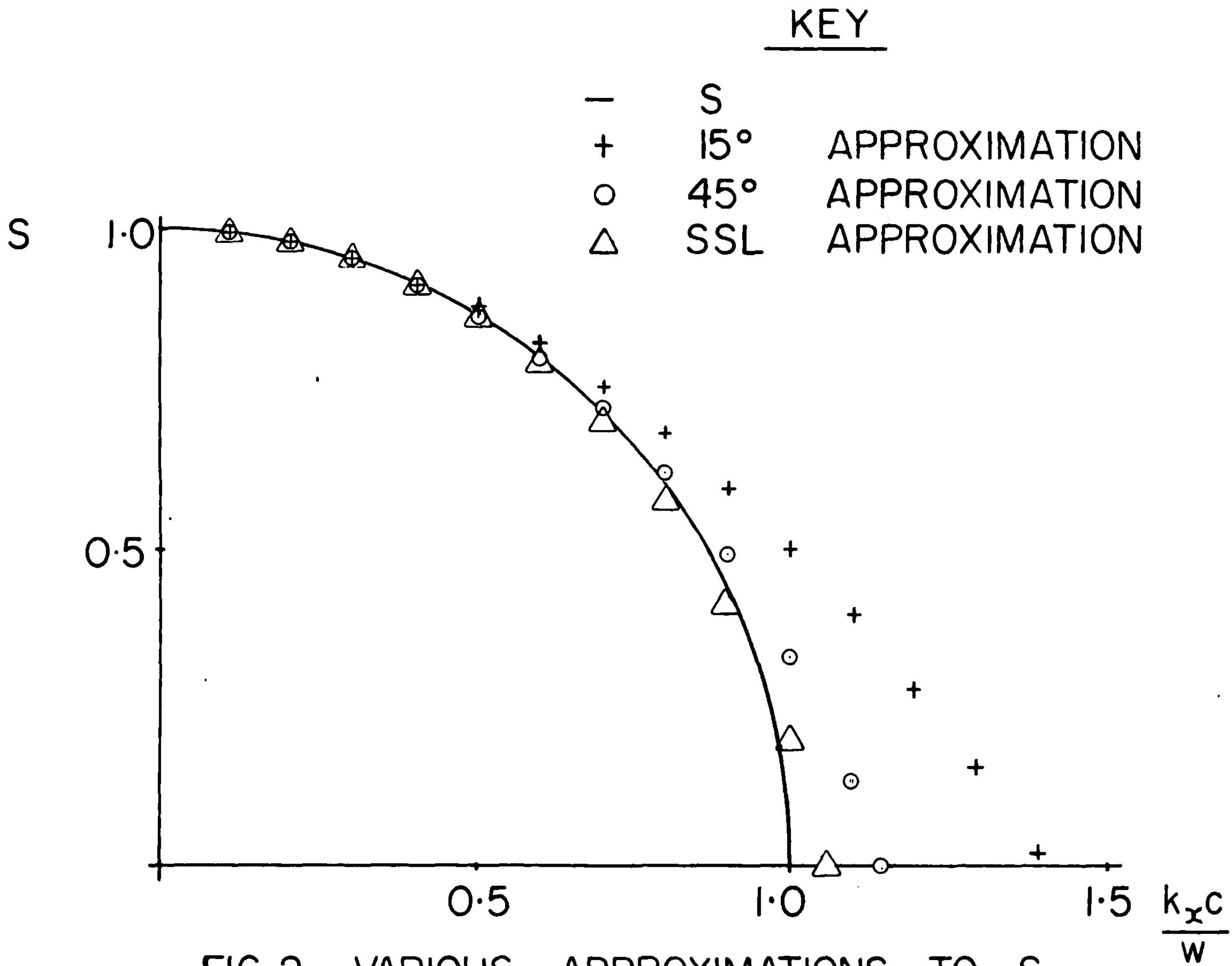

FIG. 2. VARIOUS APPROXIMATIONS TO S

$v = 10{,}000 \text{ ft sec}^{-1}$
$\Delta x = 100 \text{ ft}$

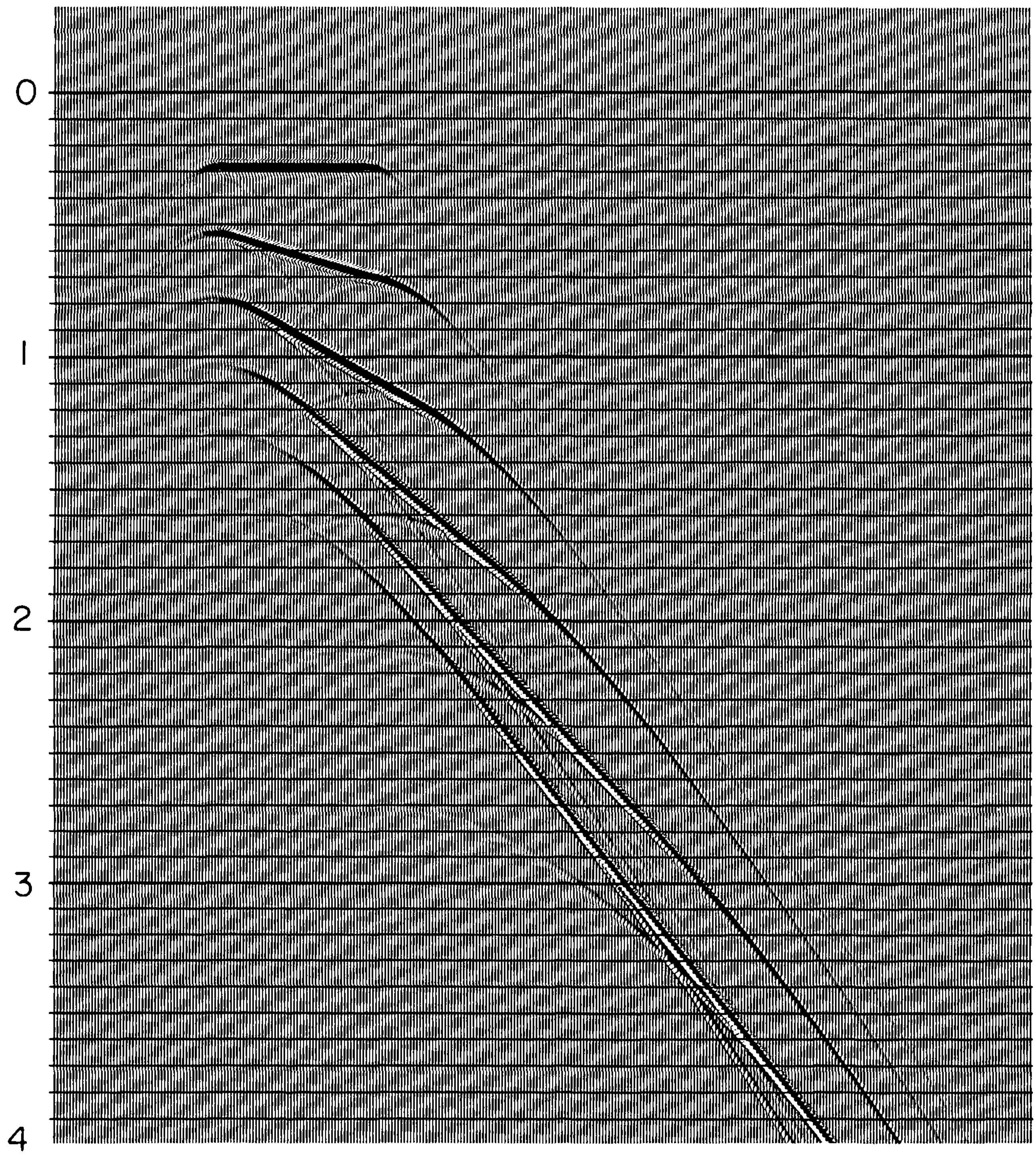

FIG. 3. DIPPING PLANES 0–50°

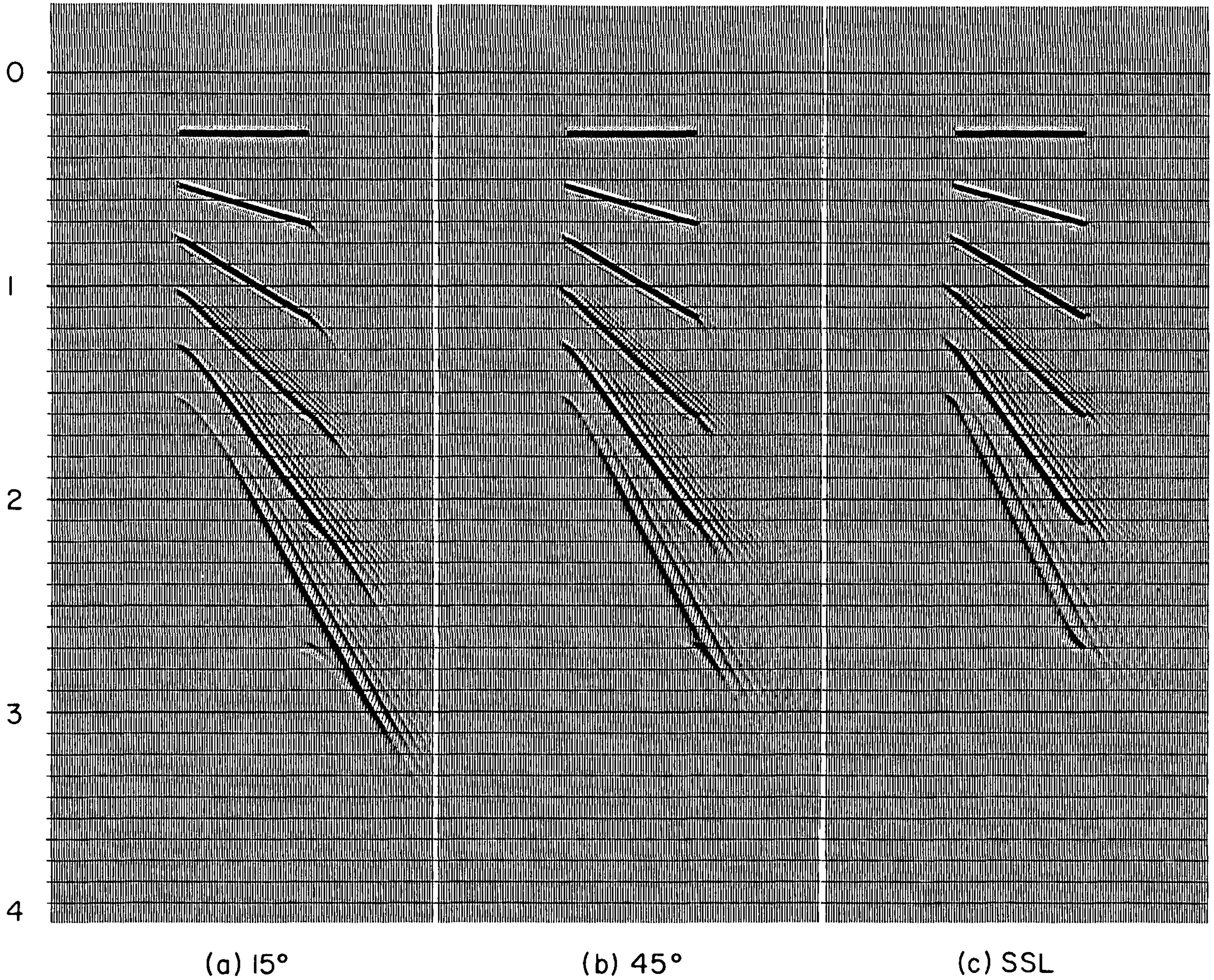

FIG. 4. MIGRATION WITH VARIOUS PARABOLIC APPROXIMATIONS

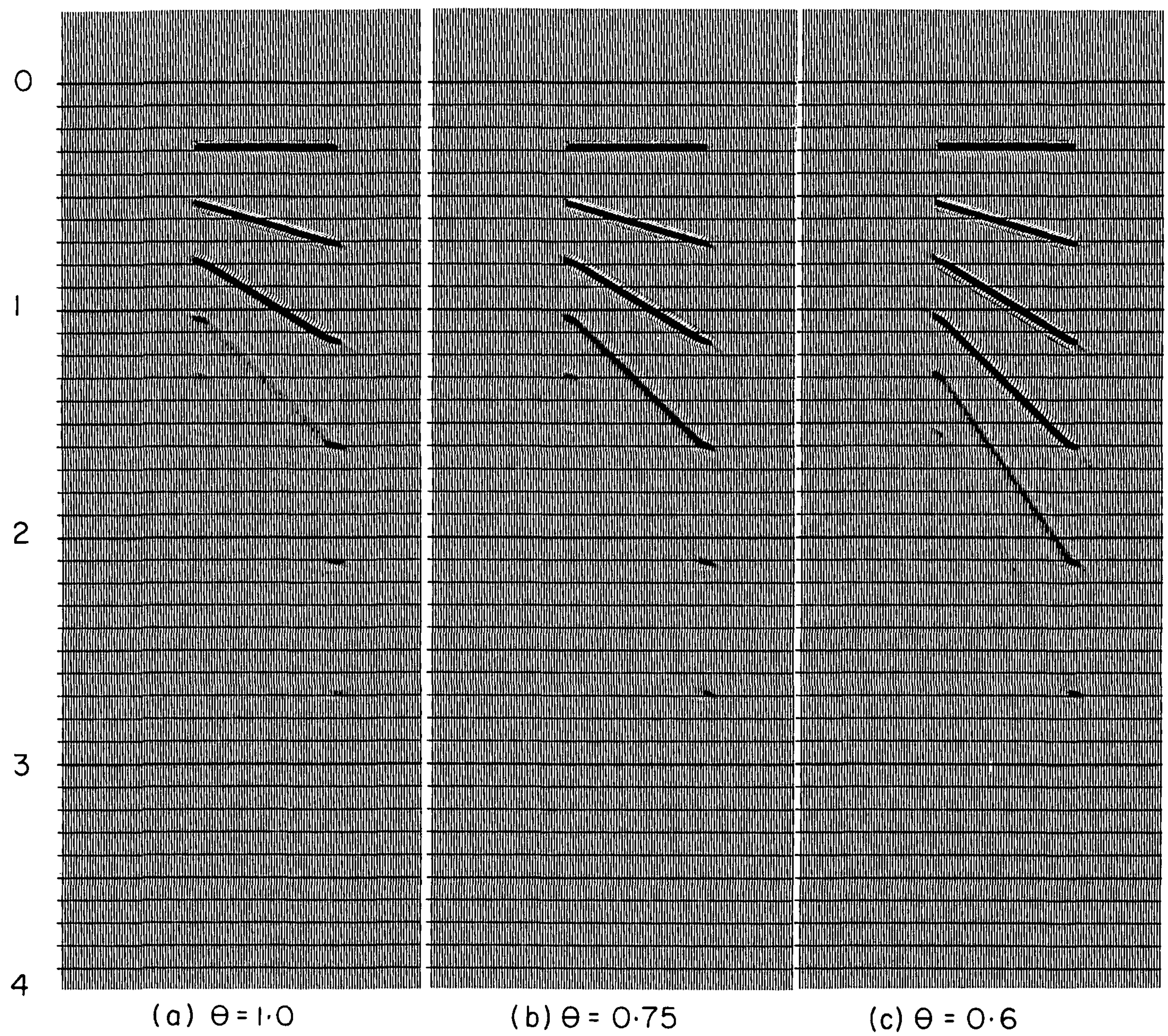

FIG. 5. VARIOUS Θ VALUES (SYNTHETIC DATA)

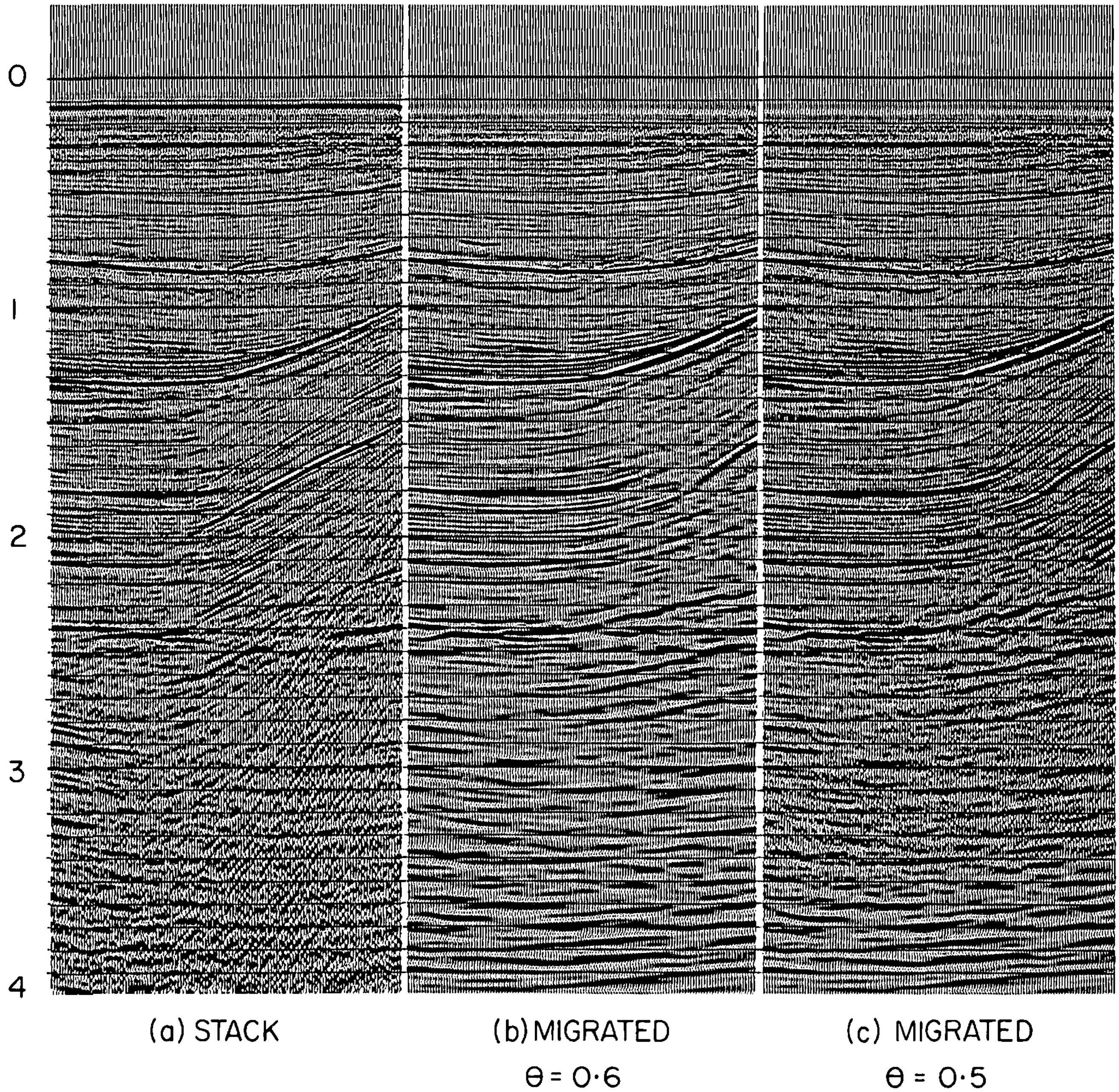

FIG. 6. VARIOUS θ VALUES (NORTH SEA DATA)

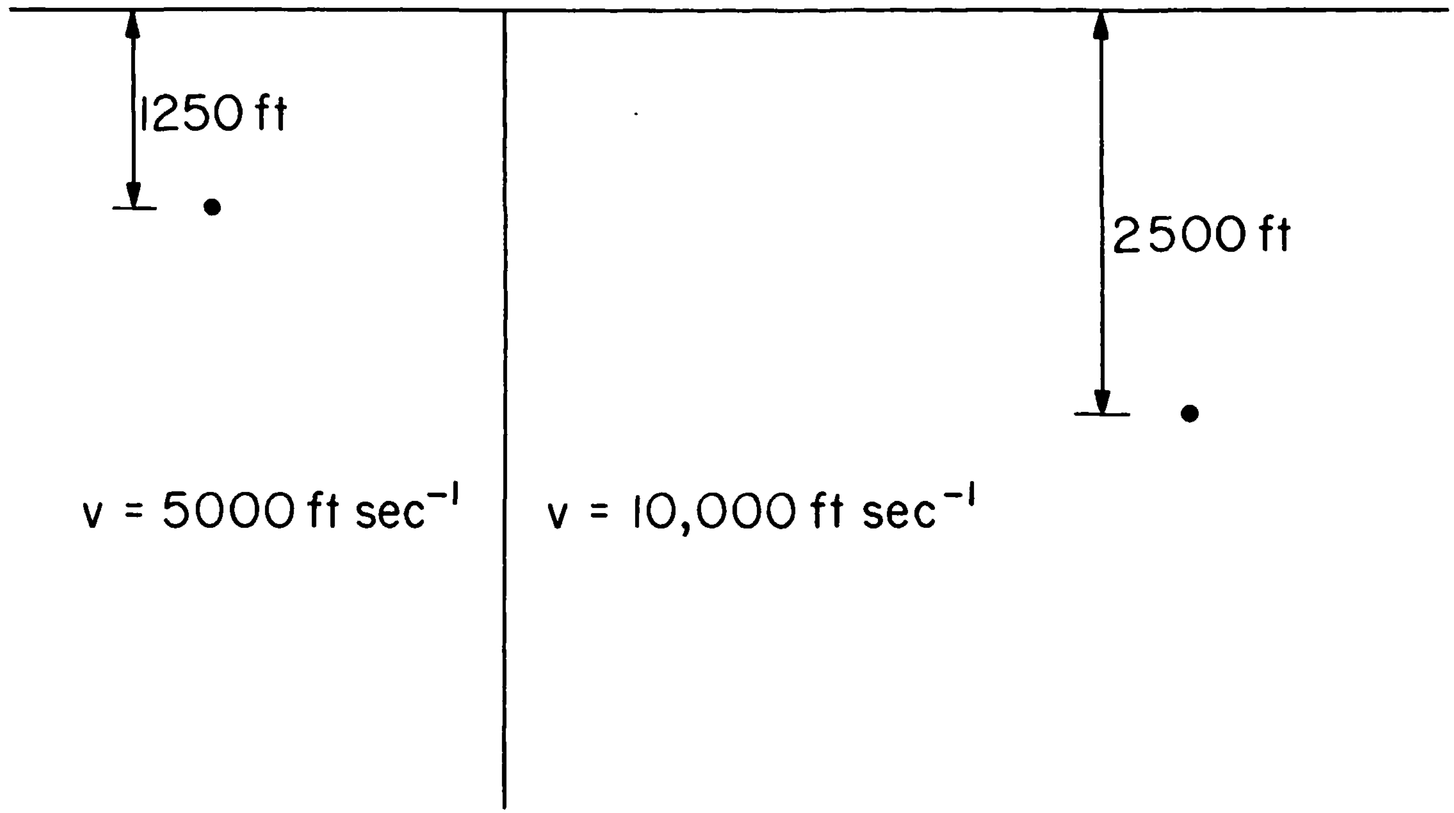

FIG. 7. DEPTH MODEL LATERAL VELOCITY SYNTHETIC

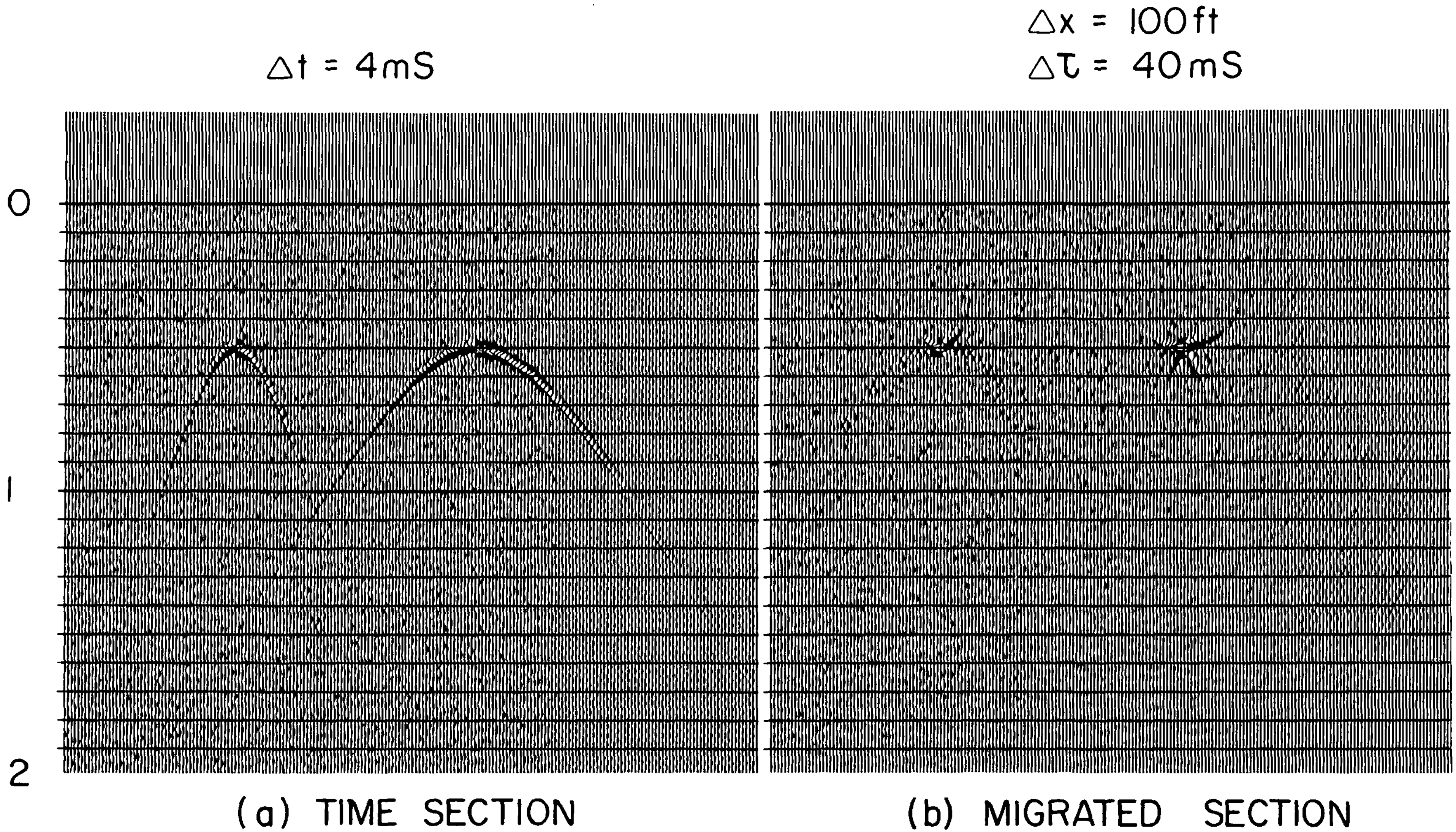

FIG. 8. LATERAL VELOCITY SYNTHETIC

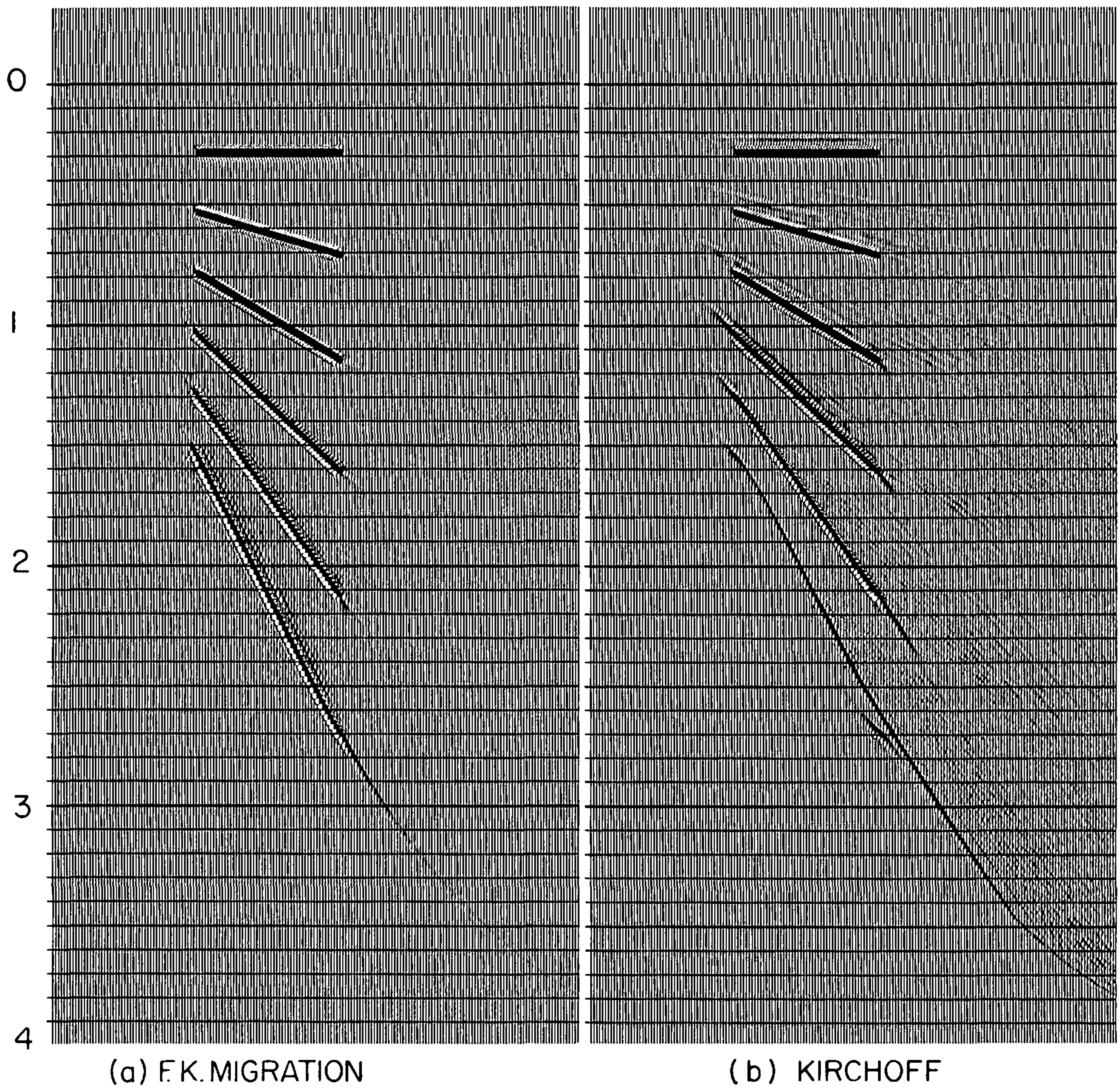

FIG. 9. MIGRATION OF SYNTHETIC

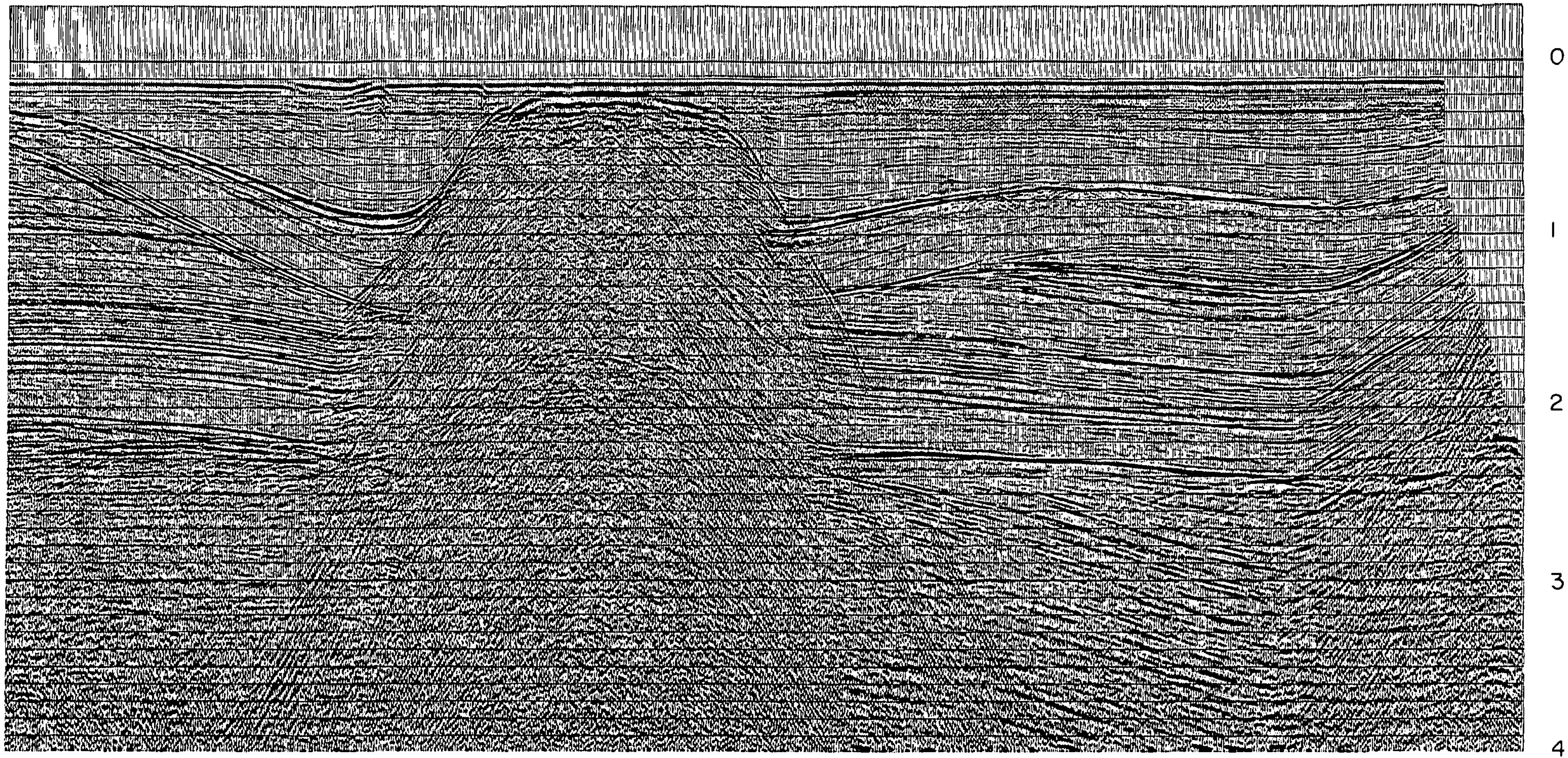

FIG. 10 (a) 48 - FOLD STACK. NORTH SEA AREA

Δx = 84 ft
$\Delta \tau$ = 40 mS

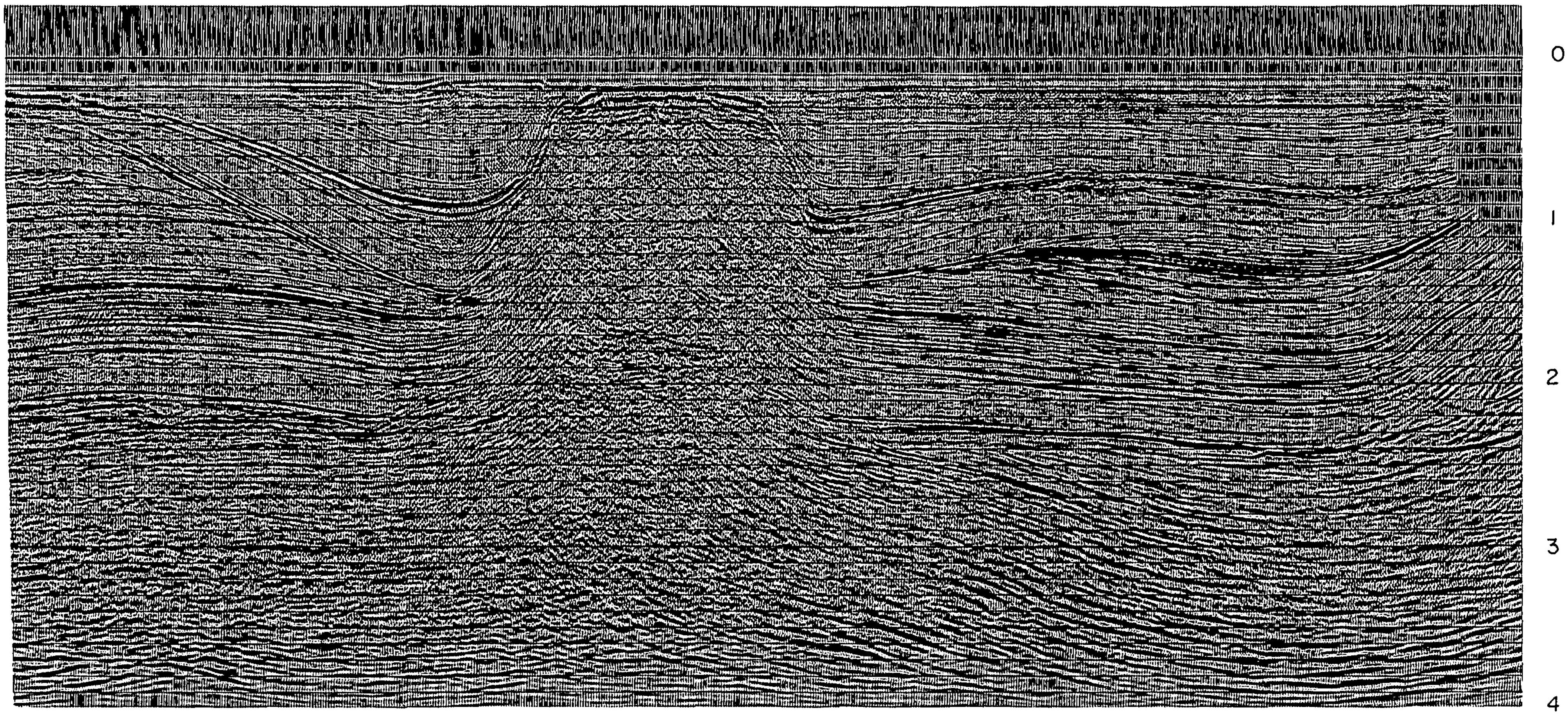

FIG. 10 (b) WAVE EQUATION MIGRATED STACK

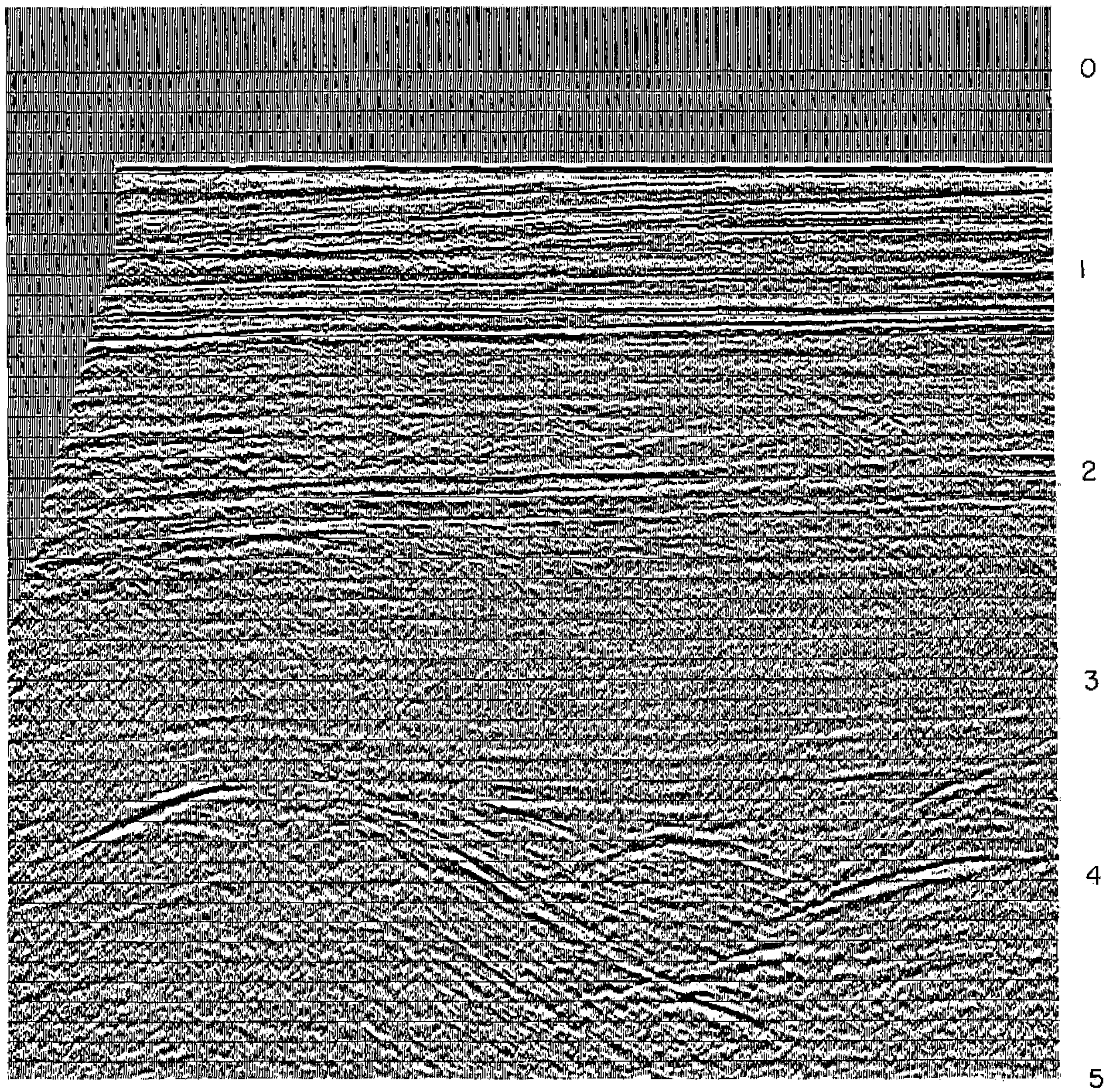

FIG. 11 (a) BURIED FOCUS. 30-FOLD STACK NORTH SEA.

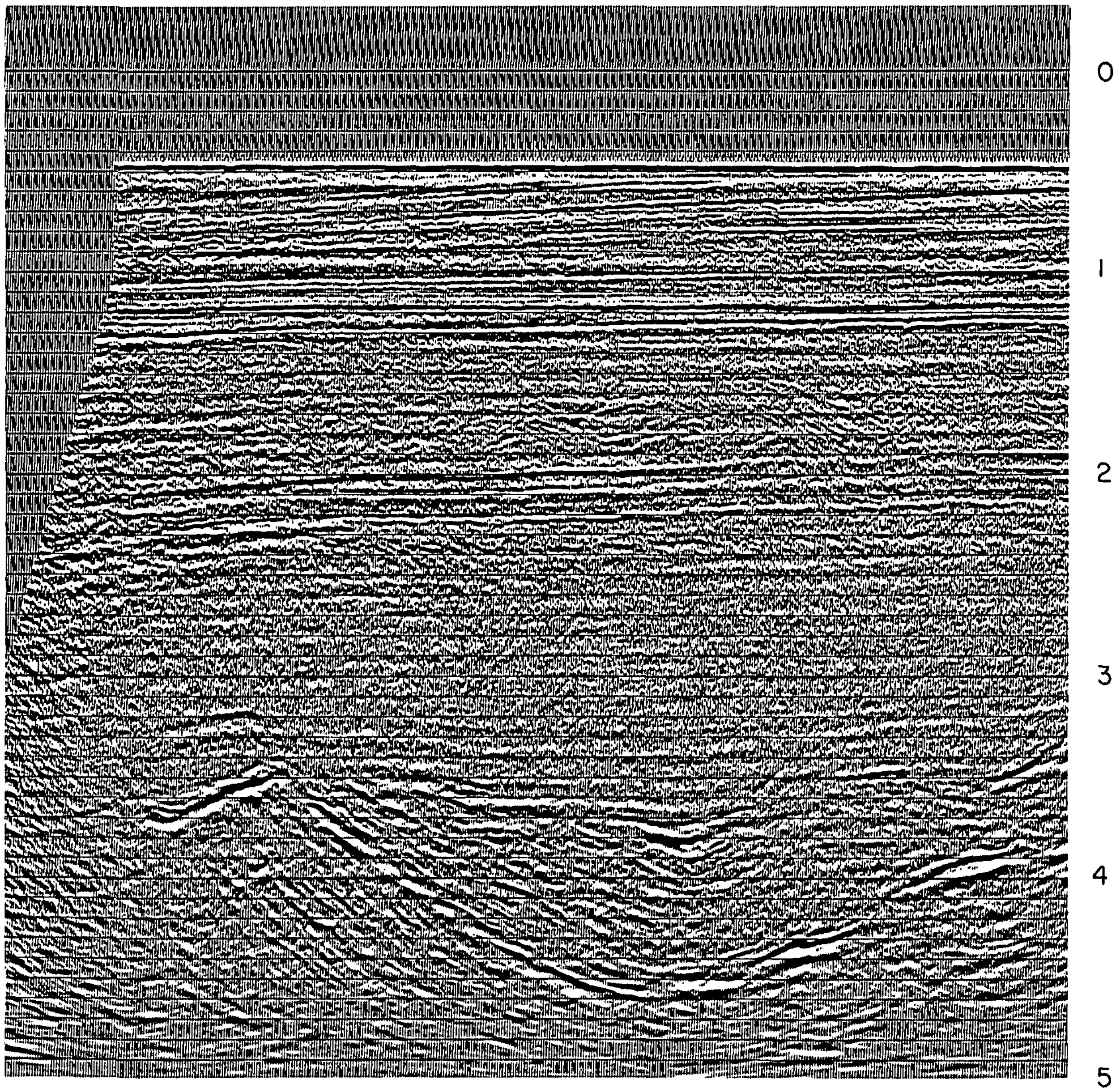

FIG. 11 (b) WAVE EQUATION MIGRATED SECTION