GLO2238

AREA
NV
Humboldt
Baltazor

February 5, 1979

MEMORANDUM

TO: J.N. Moore & H.P. Ross

FROM: J.B. Hulen

SUBJECT: Baltazor KGRA, Nevada--Summary and an evaluation of geothermal exploration data submitted to ESL by Earth Power Production Company.

CONCLUSIONS AND RECOMMENDATIONS: Baltazor KGRA is one of seven in Nevada selected by ESL for detailed reservoir assessment under the DOE/DGE industry-coupled case study program. It is located near Denio in Humboldt County, northwestern Nevada, roughly 39 miles south of the promising Alvord KGRA in southern Oregon. Baltazor and Alvord are situated within the Battle Mountain heat-flow high. The heat source for both KGRA's, as for most others within the Battle Mountain high, is thought to be deep circulation along Basin-and-Range normal faults coupled with an abnormally high thermal gradient. Chemical geothermometers indicate maximum reservoir temperatures of 165°C for Baltazor and near 200°C for Alvord.

Earth Power Production Company's initial exploration program at Baltazor in 1977 and 1978, comprising literature compilation and review, photogeologic mapping, groundwater appraisal, a microearthquake survey, and a shallow thermal gradient drilling program, led to selection of two thermally anomalous areas for further work in 1979.

These two thermal areas--Baltazor Hot Springs and the McGee prospect--are covered by what have been described as (and what appear to be) above average thesis geologic maps (1:24,000) completed in 1971 and 1972. Although field-checking of the maps is required, the need for further lithologic mapping is probably minimal. Photolinears mapped in both thermal areas by Geothermex, Inc. for Earth Power in 1977 should be field-checked for true structural characterization.

In none of the geologic studies covering the Baltazor KGRA and vicinity is hydrothermal alteration mapped or even more than minimally discussed. Alteration almost certainly related to the presently active geothermal system(s) is present in both the Baltazor Hot Springs and McGee thermal areas. Detailed alteration maps of both areas would greatly assist our case-study evaluation.

Dipole-dipole resistivity surveys limited to the two areas of interest would be useful for delineation of the subsurface geothermal reservoir(s). If Earth Power is not contemplating such a survey, I recommend that ESL consider its undertaking.

Significant mercury mineralization is present at the McGee prospect and just northwest of Baltazor Hot Springs. Selected soil mercury surveys and/or traverses in both areas would aid our interpretation of subsurface structural trends.

Multi-element geochemical surveys would greatly assist selection of drilling targets within the two areas of interest. Hematitic limonites are apparently abundant at McGee, suggesting that in this area heavy liquid concentrate geochemistry would yield the most useful results.

Geophysical and hydrologic data and reports from Baltazor should be further reviewed by ESL experts in these fields for quality and applicability to our case-study evaluation.

LITHOLOGY AND STRUCTURE: Permian-Jurassic eugeoclinal metasedimentary and metavolcanic rocks--the oldest exposed--are intruded by Jurassic-Cretaceous granitic stocks and overlain by a thick, complex, and highly variable volcanic and sedimentary sequence of Oligocene-Pleistocene age. No Pleistocene or Recent rhyolitic rocks are present. Pre-tertiary rocks within the KGRA will have little or no primary porosity or permeability. Potential primary aquifers in the Tertiary sequence include vesicular flow tops, semi-consolidated lapilli or cinder beds, and volcanic siltstones, sandstones, and conglomerates; dense flows, shales, and siliceous sediments could function as aquicludes or caprocks.

The rocks within and around the KGRA are disrupted by northwest-trending faults of uncertain age and displacement, and by northerly-trending normal faults of Miocene-Recent age. The largest of these normal faults, with up to several thousand feet of throw, have regionally broken the rocks into subparallel horsts, grabens, and gently to moderately west-dipping cuestas. The major normal fault (or fault system) bounding the eastern edge of the Pueblo Mountains is almost certainly a major control at Baltazor Hot Springs and the McGee prospect: It may also extend into southern Oregon to provide deep channels for thermal fluid flow in the Alvord KGRA (Hose and Taylor, 1974).

Several geologic maps (1:24,000) completed by Oregon State University M.S. candidates in the period 1970-1972 cover the KGRA and vicinity (Bryant, 1970; Wendell, 1970; Burnham, 1971; Rowe, 1971; Graichen, 1972). Two of these maps (Burnham, Wendell) cover the Baltazor Hot Springs and McGee areas, and are described as "above average" by the mappers' thesis advisor. A "photogeologic" map (1:62,500) completed for Earth Power by Geothermex, Inc. (Gardner and Koenig, 1978) synthesizes and simplifies the thesis mapping described above and adds photolinears observed on 1:24,000 scale aerial photographs. Most of these linears are subparallel to major mapped faults. They should be field-checked for true structural characterization.

ALTERATION, MINERALIZATION , AND METAMORPHISM:

Mineralization and alteration in the KGRA and vicinity are of several different styles and ages.

Permian-Jurassic metasedimentary and metavolcanic rocks in the area are of greenschist grade and contain abundant chlorite, epidote, albite, and allied metamorphic minerals. Contact metamorphism of these rocks along the margins of granitic stocks has locally produced mineral assemblages characteristic of higher metamorphic grades. Intrusion of the stocks was also locally accompanied by development of gold-bearing quartz-pyrite-chalcopyrite veins and extensive pyritic stockworks, with accompanying propylitic and phyllic alteration (Bryant, 1970; Rowe, 1971; Burnham, 1971). Oxidation of the stockworks and of sulfides in the veins has produced erratic supergene argillic alteration.

Cinnabar is locally present in very small, irregular chalcedony-quartz (± kaolin) veins and breccia masses along the major range-front fault northeast of Baltazor Hot Springs (Rowe, 1971). These veins and breccias occur in Miocene-Pliocene volcanic rocks, but not in Pleistocene-Recent alluvium. They are thus probably not related to present geothermal activity, but to the older cinnabar and mercurian tetrahedrite deposits of the northern Pueblo Mountains and Steens Mountain, in southern Oregon just north Baltazor (Ross, 1942; Williams, 1953). Cinnabar also occurs within a fairly extensive bleached and altered (clay? silica?) zone at the McGee thermal anomaly (Wendell, 1970; D. Langenkamp, 1979, pers. comm.). The mineralization and alteration at Mcgee affect Pliocene sandstones and fanglomerates and may affect Pleistocene-Recent alluvium, although this must be verified in the field.

Siliceous sinter deposits of unknown size occur at or near Baltazor Hot Springs (Klein and Koenig, 1977). Geothermometric implications of the sinter are discussed under "Geothermometry".

Geologic studies completed to date in the Baltazor area deal only cursorily with alteration and mineralization, and in none of these studies is alteration mapped. A brief alteration reconnaissance and detailed alteration maps of the two thermally anomalous areas delineated by Earth Power would greatly assist our case study evaluation.

THERMAL PHENOMENA: Numerous hot and warm springs occur within the KGRA. The hottest of these is Baltazor Hot Springs, with measured temperatures fluctuating between 76°C and 98°C (Mariner and others, 1974b; Klein and Koenig, 1977). A flowing well (28 l/m) near Baltazor yielded a temperature of

90^{o}C (Mariner, 1974). Warm ground and intermittent fumaroles are reported in the McGee area (Wendell, 1971; Gardner and Koenig, 1978, D. Langenkamp, 1979, pers. comm).

GEOTHERMOMETRY: Maximum subsurface temperature indicated by silica geothermometry within the KGRA is 165^{o}C at Baltazor Hot Springs: The flowing well near Baltazor yields a corroborative silica temperature of 162^{o}C (Mariner and others, 1974b; Klein and Koenig, 1977). Na-K-Ca geothermometers at Baltazor Hot Springs and the nearby well suggest, respectively, subsurface temperatures of 148^{o}C and 152^{o}C (Mariner, 1974). The close correlation between reservoir temperatures predicted by the two techniques suggests to Klein and Koenig (1977) that mixing has not occurred and that higher subsurface temperatures cannot be reasonably expected, even though old siliceous sinter deposits at Baltazor indicate past water temperatures of at least 180^{o}C.

At the nearby Alvord KGRA in southern Oregon, chemical geothermometers indicate a maximum reservoir temperature of nearly 200^{o}C (Mariner and others, 1974a).

SHALLOW THERMAL GRADIENT DRILLING:

Earth Power completed 27 shallow (avg. abt. 300 ft.) thermal gradient holes within the KGRA in 1977 (Earth Power Production Company, 1978a). Gradients measured in the holes range from about 35^{o}C/km to 400^{o}C/km. Gradients in the peripheral portions of the KGRA average 45-50^{o}C/km--normal for the Battle Mountain heat flow high. Maximum measured temperature recorded in the drill holes is 97.1°C at 290 feet in the McGee area.

Two distinct thermal anomalies were delineated by the drilling program--one centered on Baltazor Hot Springs; the other on the Painted Hills in the McGee area. Maximum thermal gradient measured in the Baltazor Hot Springs area is roughly 290°C/km.; at Mcgee, roughly 400°C/km.

By contract with DOE/DGE, Earth Power will drill its first 1500 ft. thermal gradient hole at or near Baltazor Hot Springs in mid-1979. ✓

Sampling of cuttings from the thermal gradient holes is sporadic and haphazard. Lithologic logs are sketchy and very generalized. Neither cuttings from most of the holes nor corresponding lithologic logs will be of much value to ESL.

HEAT SOURCE: The absence of young rhyolitic volcanics within the Baltazor KGRA, and its location within the Battle Mountain heat flow high, suggest that deep and rapid circulation along Basin-and-Range faults may provide the heat for the Baltazor Hot Springs and McGee thermal areas: Waters would have to circulate to no deeper than about three kilometers to account for the predicted reservoir temperatures. Sulfur isotopic studies by Cleary (1976a, 1976b) indicate that such deep circulation--and not a cooling magma--supplies thermal energy for the Alvord geothermal system, just north of Baltazor in southern Oregon.

GEOPHYSICS: To be reviewed separately by Ross Whipple. Earth Power has supplied us with 1:62,500 scale gravity and aeromagnetic maps (Earth Power Production company, 1978b, 1978c) prepared largely from U.S.G.S. Open-File

Reports (Peterson and Hoover, 1977; Long and Senterfit, 1977). Both maps may be of use in sub-alluvial structural projection and basement topographic delineation.

An open-file list of magnetotelluric station locations and data is available from the U.S.G.S. (Hoover, 1977).

A report on microearthquake activity in northwestern Nevada prepared for Earth Power by Senturion Sciences (1977) characterizes regional microseismic activity within and around the Baltazor KGRA. The report concludes that local microseismicity and numerous hot springs indicate that the northwestern Nevada should have good geothermal potential.

No dipole-dipole resistivity surveys have been completed at Baltazor. Such surveys would be very useful for delineating low-resistivity thermal reservoirs beneath Baltazor Hot Springs and the McGee prospect area.

HYDROLOGY A report prepared for Earth Power by Geothermex, Inc. (1977) assembles and interprets data from the literature (mostly from Sinclair, 1963) and new data on temperature, flow, pH, conductivity, and selected major element (with boron and fluorine) chemistry of the principal springs and wells within and near the Baltazor KGRA. From these data, Geothermex classifies groundwater types, calculates probable subsurface temperatures, and speculates on the nature of heat sources for thermally anomalous waters. Of particular interest is the high fluorine content of several springs and wells in the area, which Geothermex feels may indicate either a magmatic heat source or fluid flow through fluorine-rich granitic basement rocks: The latter is probably much more likely.

A section of the Geothermex groundwater report deals with potential water supply problems at Baltazor, pointing out that a 55-mW isobutane power plant, for example, would require far more fluid for operation than normal recharge would provide; reinjection would be necessary.

I recommend that Christian Smith review the Geothermex groundwater report for data quality, thouroughness, and reasonabiity of speculation.

GEOCHEMISTRY: In addition to the water chemistry described under "Hydrology" above, multi-element analyses for selected stream-sediment, rock and even algae samples collected mostly west of but also within the KGRA are presented in a U.S.G.S. Open-file report by Cathrall and others (1977). According to this report and to David Langenkamp of Earth Power, (pers. comm., 1979) several springs within the KGRA are quite mercury-anomalous. This, coupled with wide-spread mercury mineralization within and north of the KGRA (especially in the McGee area) indicates that selected soil mercury traverses and/or a soil mercury survey might be of use in delineating concealed fluid-controlling structures.

Multi-element geochemical surveys would greatly assist drilling target selection within Earth Power's two areas of interest. Hematitic limonites are apparently abundant in the McGee area (D. Langenkamp. pers. comm., 1979) suggesting that heavy liquid concentrate geochemistry would yield the most useful results.

Jeffrey B. Hulen

cc: R.W. Whipple

C. Smith

R.M. Capuano

R.W. Bamford

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April 2, 1979

MEMORANDUM

TO: H.P. Ross

FROM: R.W. Whipple

SUBJECT: Geophysical surveys in the Baltazor-McGee Area, Nevada

The geology of the Baltazor KGRA and surrounding areas has been reviewed by Jeff Hulen, 1979, along with a discussion of the current exploration status and of additional studies which would add to our understanding of the area's potential. This memorandum will offer a more detailed view of the geophysical surveys, with some recommendations for further work.

CONCLUSIONS AND RECOMMENDATIONS

Geophysical surveys which have been completed in the Baltazor-McGee area do not define local structure or probable reservoir positions and are not useful in the serious business of selecting drill sites. The aeromagnetic and gravity surveys provide only regional information, with the exception of a small area of fairly detailed gravity work at Baltazor Hot Spring. An audio-magnetotelluric survey has confirmed the presence of a low resistivity region surrounding Baltazor Hot Spring but does not resolve any details of structure or depth. Microearthquake monitoring has located three epicenter cluster, none of which is very close to known thermal springs. These may be areas for future study but are believed to be of secondary importance at this time. A temperature gradient survey has located two broad thermal anomalies; one at Baltazor Hot Spring and another just east of McGee Mountain. Temperature data are lacking at Bog Hot Spring and only one gradient location (not anomalous) lies near a microearthquake cluster.

A relatively small expenditure for detailed geophysical surveys is advised before initiating deep drilling in the Baltazor-McGee area. Existing gravity work at Baltazor Hot Spring suggests that the graben lying between the Pueblo Mountains and the Pine Forest Range is tilted to the northwest, with the greatest vertical fault displacement well to the northwest of the spring. To assist in the definition of faulting and to make determinations of depth to a possible reservoir in volcanic rocks or the Mesozoic basement, detailed gravity work is recommended at Baltazor. Three gravity profiles across the valley, averaging less than two miles in length, should be sufficient. Dipole-dipole resistivity profiles would also be useful here for structural information and possible reservoir identification. These same recommendations for gravity and resistivity surveys are extended to the McGee Mountain thermal anomaly if deep drilling is contemplated there. At both Baltazor and McGee Mountain 2D interpretations should be acceptable.

A useful addition to the geophysical coverage of this region of numerous thermal springs would be an aeromagnetic survey flown at one-quarter mile flight line spacings with a mean terrain clearance of 500 feet or less.

Our knowledge of the Baltazor-McGee area would, of course, be improved by adding more detail to all of the existing geophysical data but first priorities, in the writer's opinion, should be given detailed gravity and resistivity work.

AEROMAGNETIC SURVEY

The Vya sheet of the aeromagnetic survey of Nevada, 1974, covers the Baltazor-McGee area. This survey was flown at a constant barometric elevation of 9,000 feet ASL with two mile flight line spacings. Flight bearings were east and west. In the area of interest only a few general conclusions can be drawn from this regional map.

Hose and Taylor, 1974, have discussed a lineament, based on surface geology, extending from Soldier Meadow N 30° to 35° E through the Baltazor area and on into Oregon. They suggest that this lineament existed as a large fault in the Early Tertiary terrain and that tectonism occurring after the Oligocene and Miocene volcanic rocks were deposited resulted in modest renewed displacements. This lineament can be seen on the aeromagnetic map. Where it separates the Pueblo Mountains from the Pine Forest Range, right-lateral movement is suggested.

The aeromagnetic map enables us to tentatively identify some of the igneous and metamorphic rocks in the area where they are present in volumes large enough to signigicantly effect the magnetic field at the high altitude and along the widely spaced flight lines where it was measured. Many of the Tertiary volcanic rocks are notably magnetic, some with reverse polarization. The older metamorphic and intrusive rocks, both undifferentiated on the geologic map supplied by Earth Power Resources Co. (Gardner and Koenig, 1978), do not have consistant magnetic properties. Bryant, 1970, however, has differentiated these units in the northern Pine Forest Range and we can give them rough magnetic classifications based on their effect on the regional aeromagnetic map:

Metamorphic Rocks
- hornblende diorite schist - notably magnetic
- arkosic quartzite - negligibly magnetic

Intrusive Rocks
- quartz diorite I - notably magnetic
- hornblende diorite - notably magnetic
- leucogranodiorite - negligibly magnetic
- quartz diroite II - negligibly magnetic
- hornblende gabbro - exposures too small to affect the aeromagnetic results

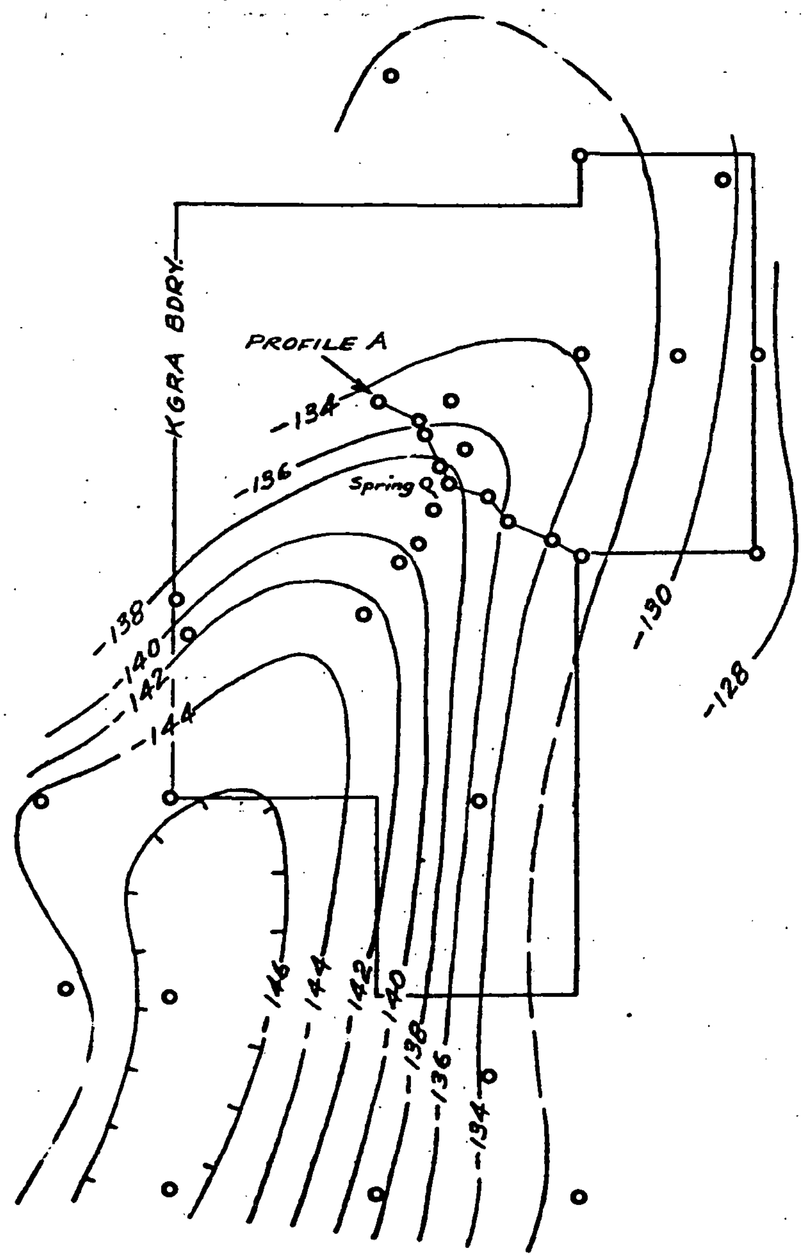
In a low-altitude, detailed survey we would expect all of the intrusive units to have some sort of magnetic signature.

An isolated magnetic high occurs off the southwest flank of the Pueblo Mountains at Bog Hot Springs over alluvium and young sediments. A gravity high is also present here. These anomalies are probably caused by either Permian-Jurassic hornblende biotite schist or by one of the magnetic intrusive units at the base of the Tertiary.

No areas of alteration are apparent on the aeromagnetic map.

GRAVITY SURVEY

Earth Power Production Company has compiled a Bouguer gravity map of the Baltazor-McGee area from U.S. Geological Survey publications (Plouff, et al, 1976, and Peterson and Hoover, 1977). The density of gravity stations on this



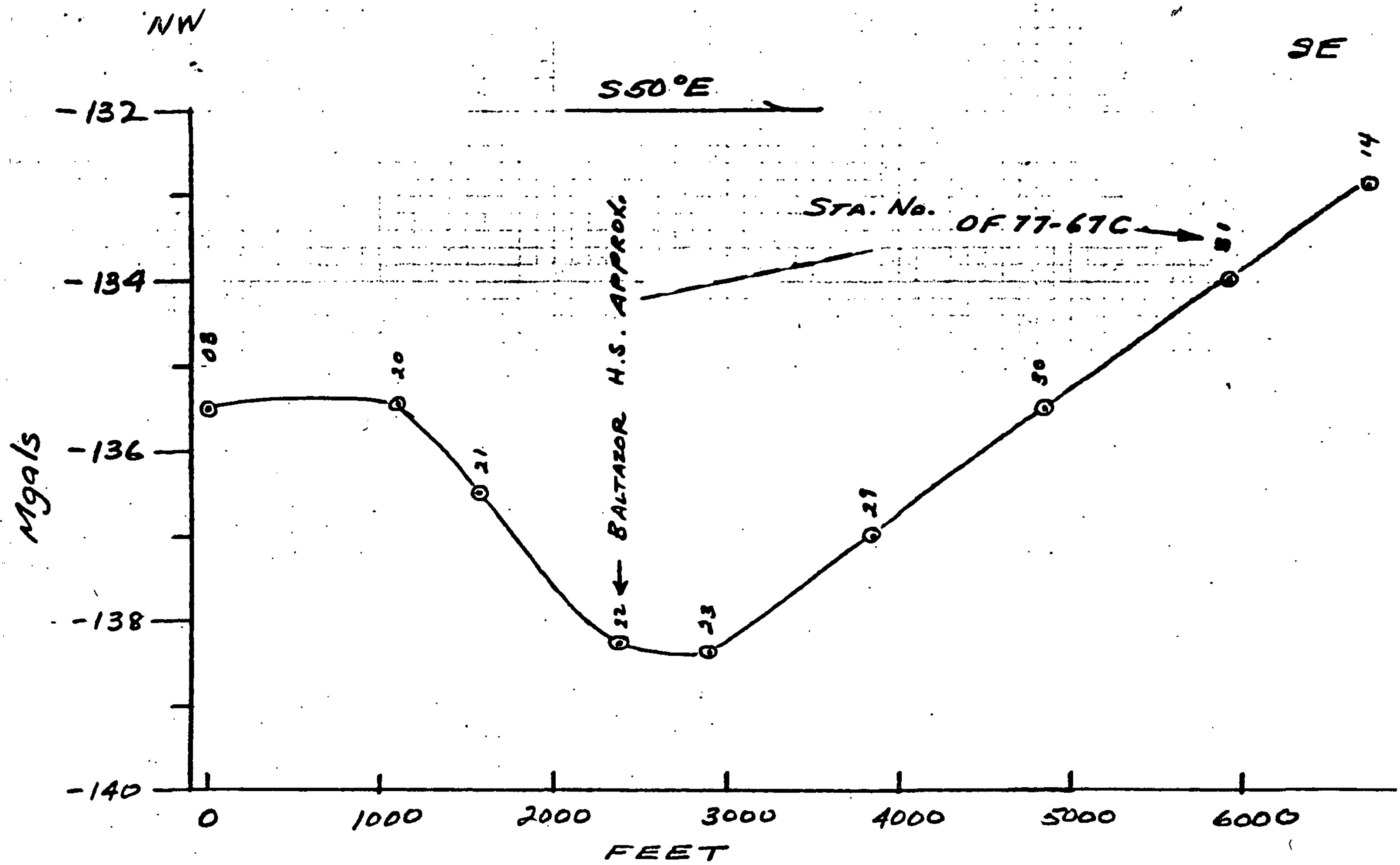
GRAVITY SURVEY OF BALTAZOR KGRA

FROM O.F. Rept. 77-67C

FIGURE 1

SCALE : 1:62,500

CONTOUR INT.: 2 mgal



GRAVITY PROFILE - BALTAZOR
PROFILE A
(Fig. 1)

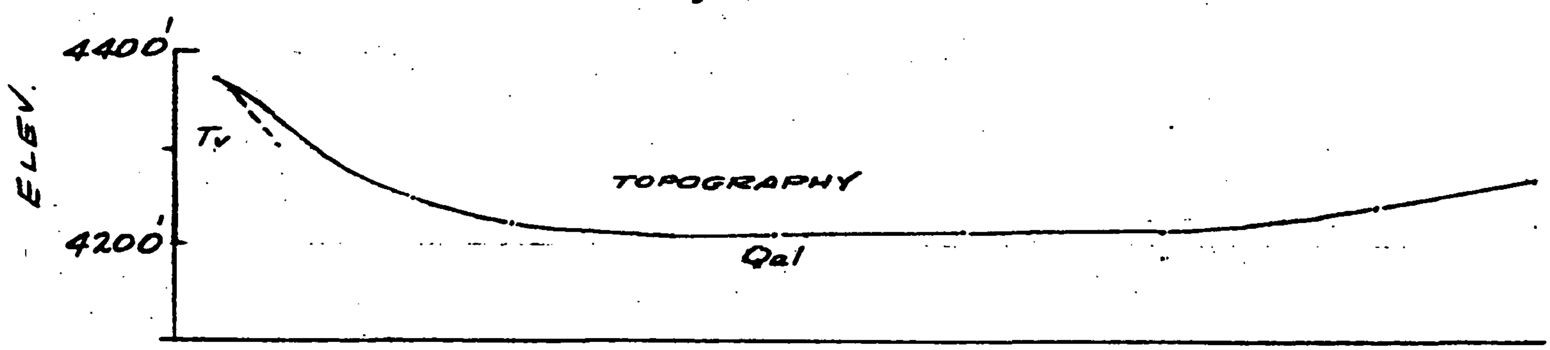


FIGURE 2

map is so low that it provides only a very general picture of the bedrock configuration. The NNE trending lineament separating the Pueblo Mountains and the Pine Forest Range can be seen and also the gravity high at Bog Hot Spring which has been mentioned. The gravity contours appear to be considerably in error even though they conform to the station values. This is especially noticeable near the north edge of the map in the Pueblo Mounains and in the southeast part of the survey in the Pine Forest Range. These areas are contoured without regard for the low density of valley alluvium.

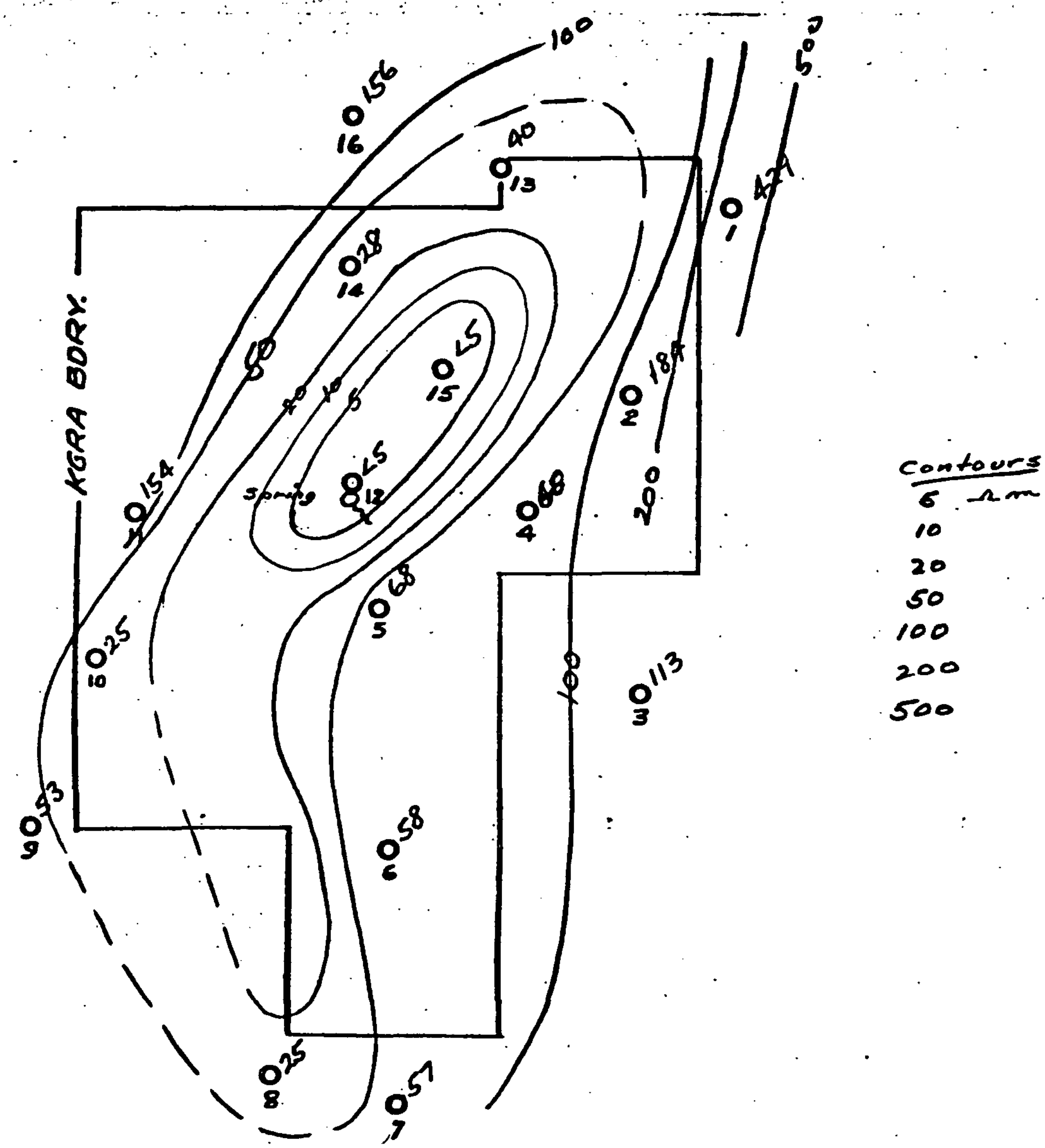
The gravitational intensity to the west of the Pine Forest Range declines across Bog Hot Valley and continues to decrease to a north-trending axis passing through McGee Mountain and Railroad Point. A topographic low in the pre-Tertiary surface along this axis is so indicated.

A gravity high, elongated east-west, lies in Bog Hot Valley just southeast of McGee Mountains. This may be due to anomalously dense Tertiary rocks or to a high in the pre-Tertiary surface. No aeromagnetic anomaly occurs here.

Principal facts for a gravity survey of Baltazor KGRA (Peterson and Hoover, 1977) contains a number of values not included on the Earth Power gravity map. Figure 1 is a contour map of the complete set of values from this survey. Figure 2 shows a gravity profile across the valley in the vicinity of Baltazor Hot Spring. It is difficult to establish a good regional gravity here, but the amplitude of the anomaly in Figure 2 appears to be about 4.4 mgal. In this case, using a density contrast of 0.4 gm/cc, the thickness of the alluvium at Baltazor Hot Spring is somewhere between 900 and 1,250 feet. The profile of Figure 2 indicates that the major vertical fault displacement occurs well to the northwest of the hot spring. For sophisticated interpretations, additional detailed gravity profiles should be run.

AUDIO-MAGNETOTELLURIC SURVEY

An audio-magnetotelluric survey of the Baltazor KGRA (Long and Senteofit, 1977) reveals a region of low resistivity at depth at Baltazor Hot Spring which



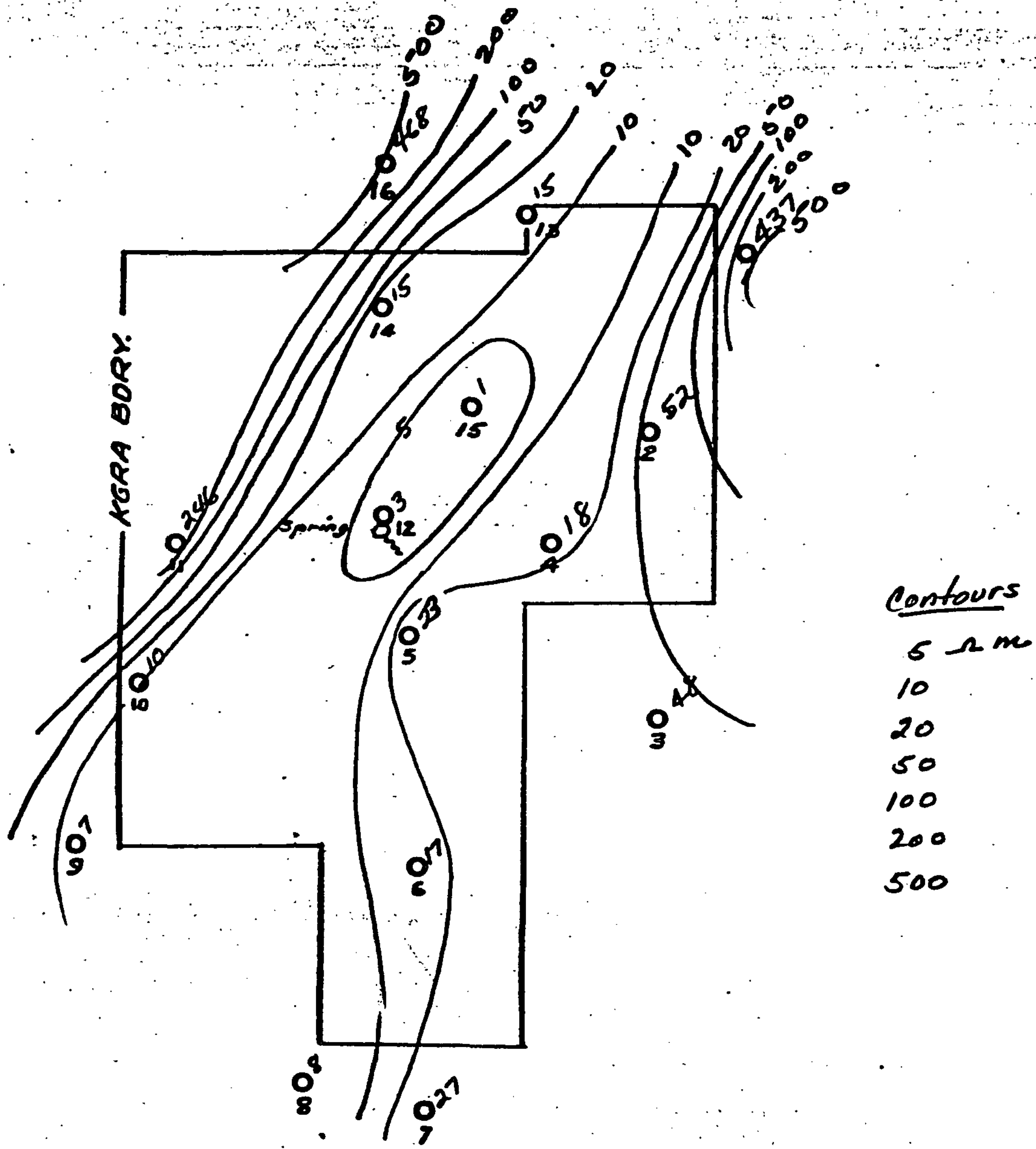
AUDIO-MAGNETOTELLURIC STATIONS AND APPARENT RESISTIVITY MAP OF

BALTAZOR KGRA

10 Hz N-S TELLURIC LINE

Scale ≅ 1:62,500

FIGURE 3



AUDIO-MAGNETOTELLURIC STATIONS AND APPARENT RESISTIVITY MAP OF

BALTAZOR KGRA

10 Hz EW TELLURIC LINE

Scale ≅ 1:62,500

FIGURE 4

parallels the mountain front. Figures 3 and 4 are maps of apparent resistivity from the AMT data at 10 Hz, from north-south and east-west orientations of the telluric line, respectively. Differences in the maps of figures 3 and 4 reflect the presence of lateral resistivity variations near the measurement sites.

MICROEARTHQUAKE SURVEY

A microearthquake survey by Senturian Sciences, Inc. (1977) located three microearthquake clusters in the Baltazor-McGee area. These were near Denio, at Craine Creek, and at Thousand Creek. None of these clusters is very near to known hot springs. The Denio cluster of epicenters lies on Permian-Jurassic metamorphic rocks on the east flank of the Pueblo Mountains. The depths of the source events average 6.4 km. One solution, by Senturain, suggests a steep fault tranding N 33^{o} E with its upthrown block on the west. The Thousand Creek events also occurred at a depth of about 6.4 km. at what might be an intersection of east-and north-trending faults. At Craine Creek, six events over a 15 day period form a rather loose cluster. The distance from the seismometer array was too great to resolve a reasonable focal mechanism here.

Vp/Vs ratios from Denio and Thousand Creek cluster data suggest that near surface material has a Poisson's ratio of less than 0.22, which indicates that it is either deficient in liquid water saturation or that voids could be filled with steam. Senturion states that these figures compare with ones they have measured at the Geysers.

TEMPERATURE GRADIENT SURVEY

Earth Power Production Company has measured temperatures at the bottoms of 27 shallow (300 ft. av.) boreholes. Two thermal anomalies were found; one at Baltazor Hot Spring and another near the Painted Hills Mine on the east side of McGee Mountain. It seems probable that another anomaly might have been found had the survey been extended to cover Bog Hot Spring. A gradient hole close to a Basin and Range fault and the Denio microearthquake cluster produced a thermal gradient of $57^{o}C/km$. This is not anomalous for the area. There are no gradient holes near the Thousand Creek and Craine Creek clusters.

R.W. Whipple

cc:

J.N. Moore
J.B. Hulen

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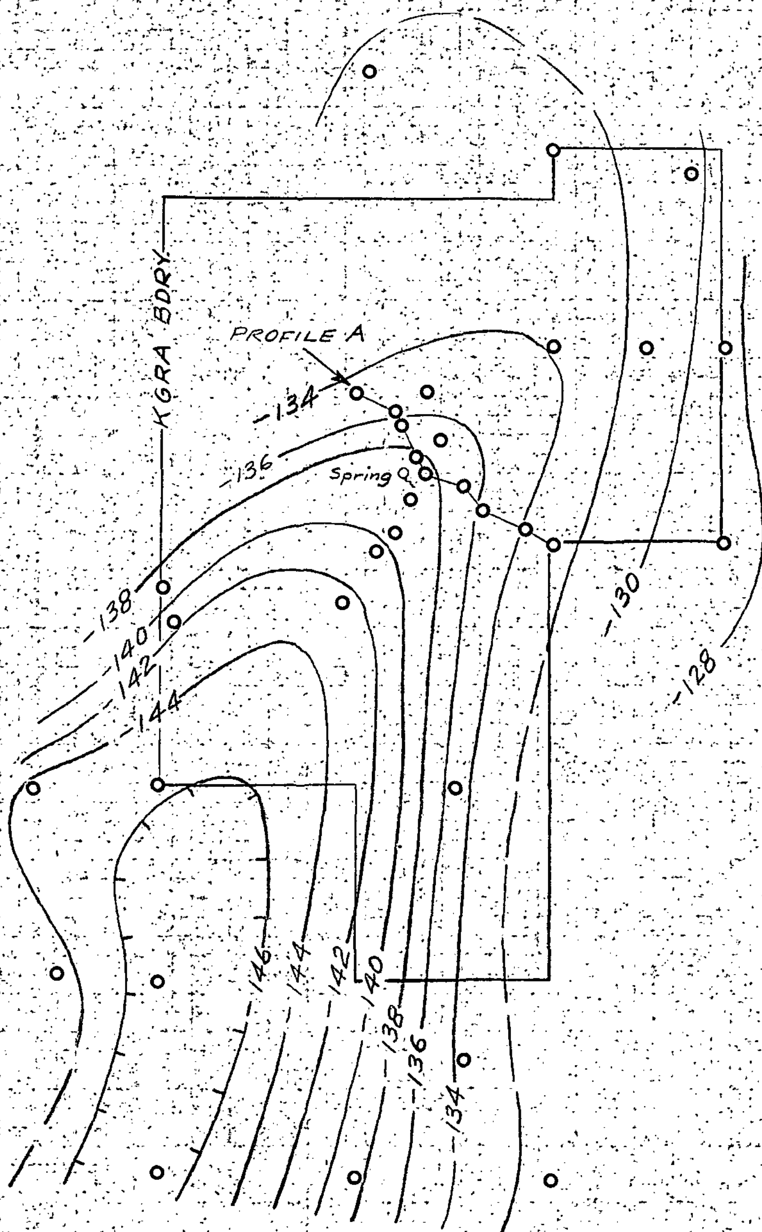


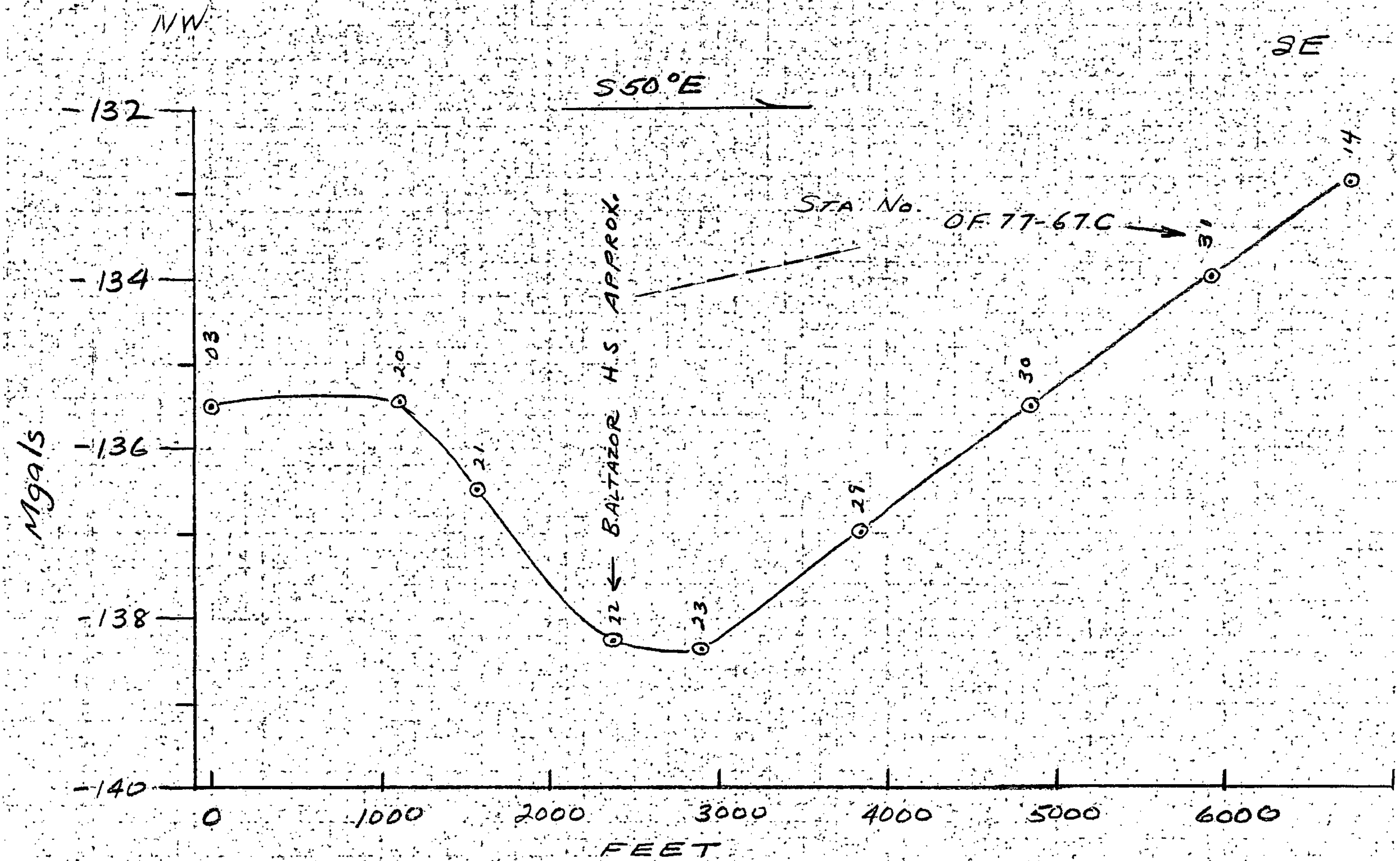
GRAVITY SURVEY OF BALTAZOR KGRA

FROM O.F. Rept. 77-67C

FIGURE 1

SCALE : 1:62,500

CONTOUR INT.: 2 Mgal



GRAVITY PROFILE - BALTAZOR
PROFILE A
(Fig. 1)

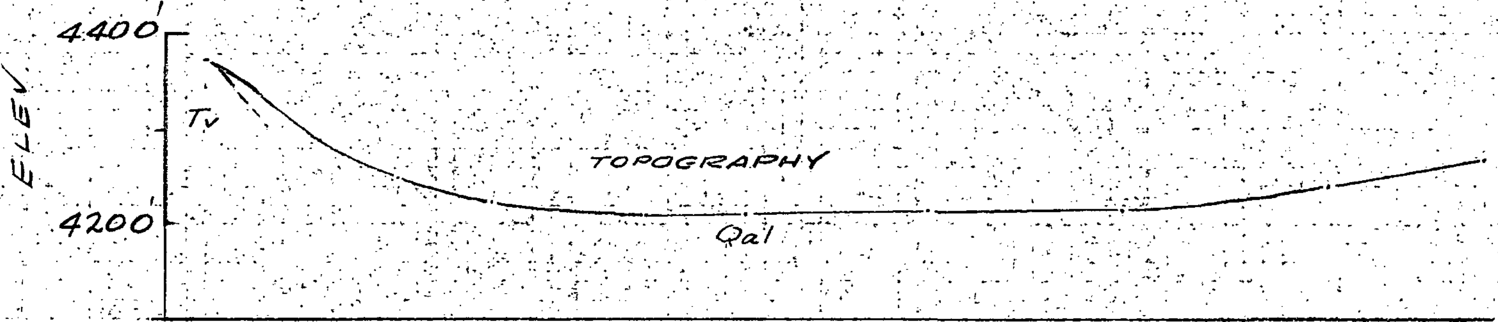
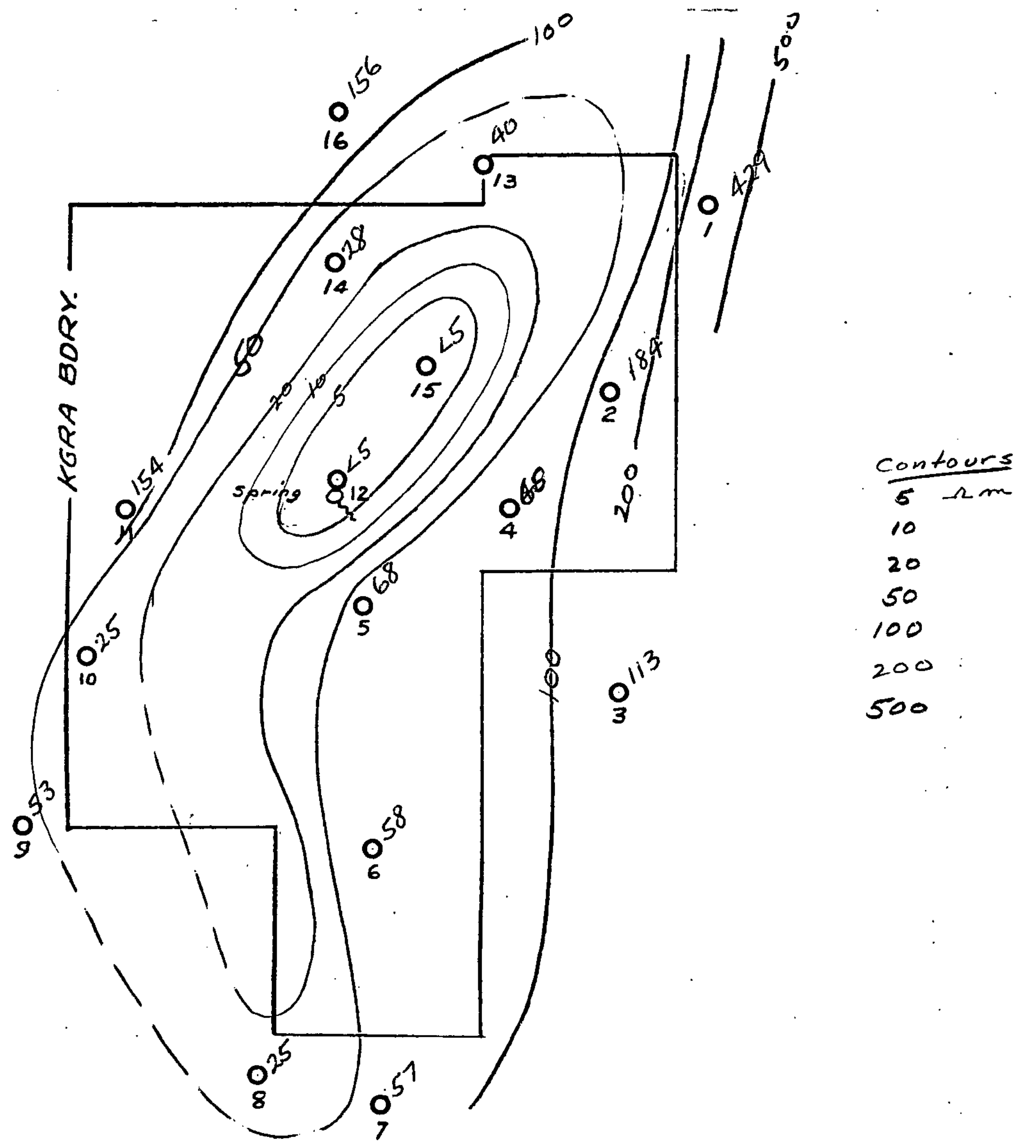


FIGURE 2



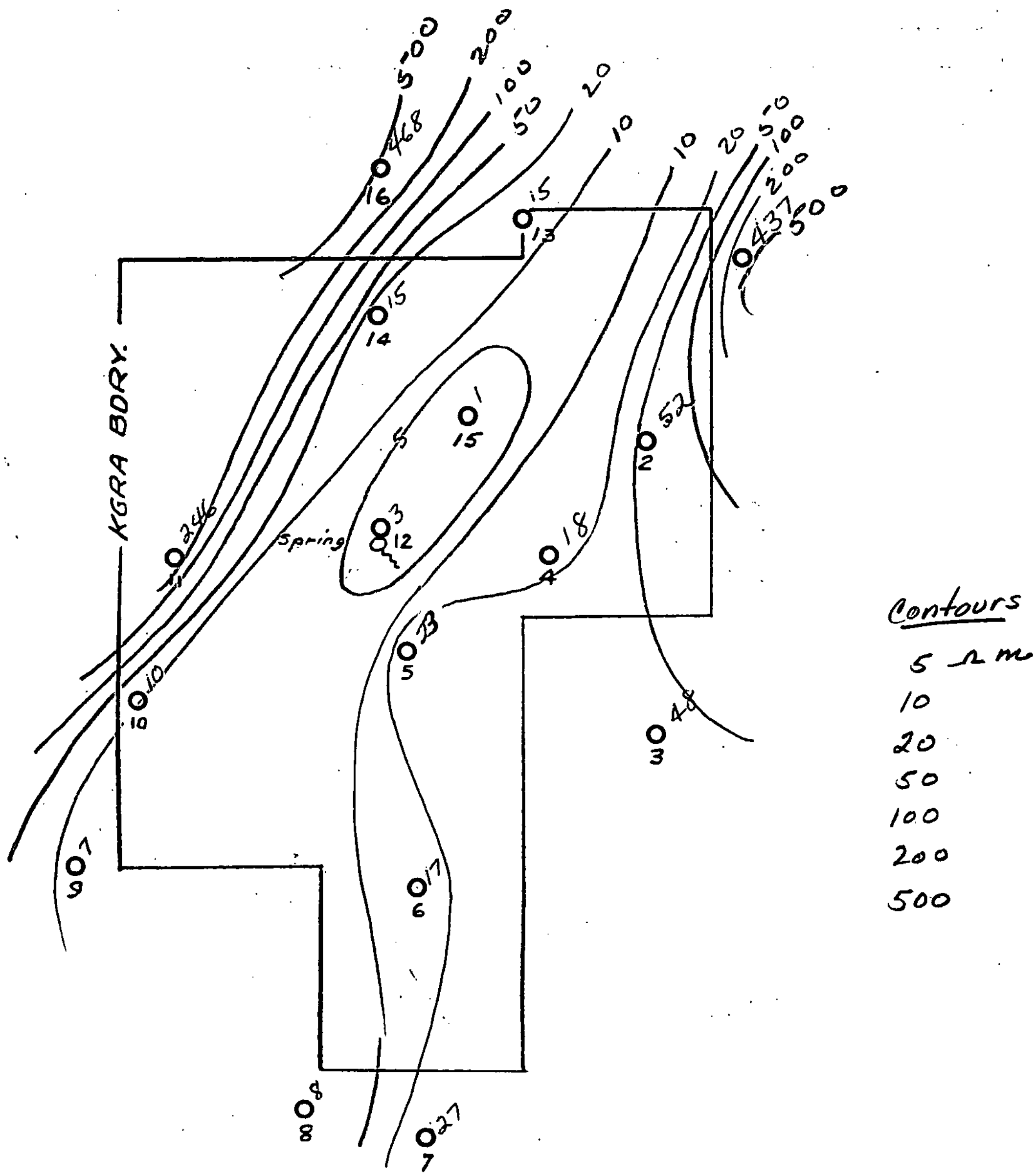
AUDIO-MAGNETOTELLURIC STATIONS AND APPARENT RESISTIVITY MAP OF

BALTAZOR KGRA

10 Hz N-S TELLURIC LINE

Scale ≅ 1:62,500

FIGURE 3



AUDIO-MAGNETOTELLURIC STATIONS AND APPARENT RESISTIVITY MAP OF

BALTAZOR KGRA

10 Hz EW TELLURIC LINE

Scale ≅ 1:62,500

FIGURE 4

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min thermal-reservoir temp + the statis-
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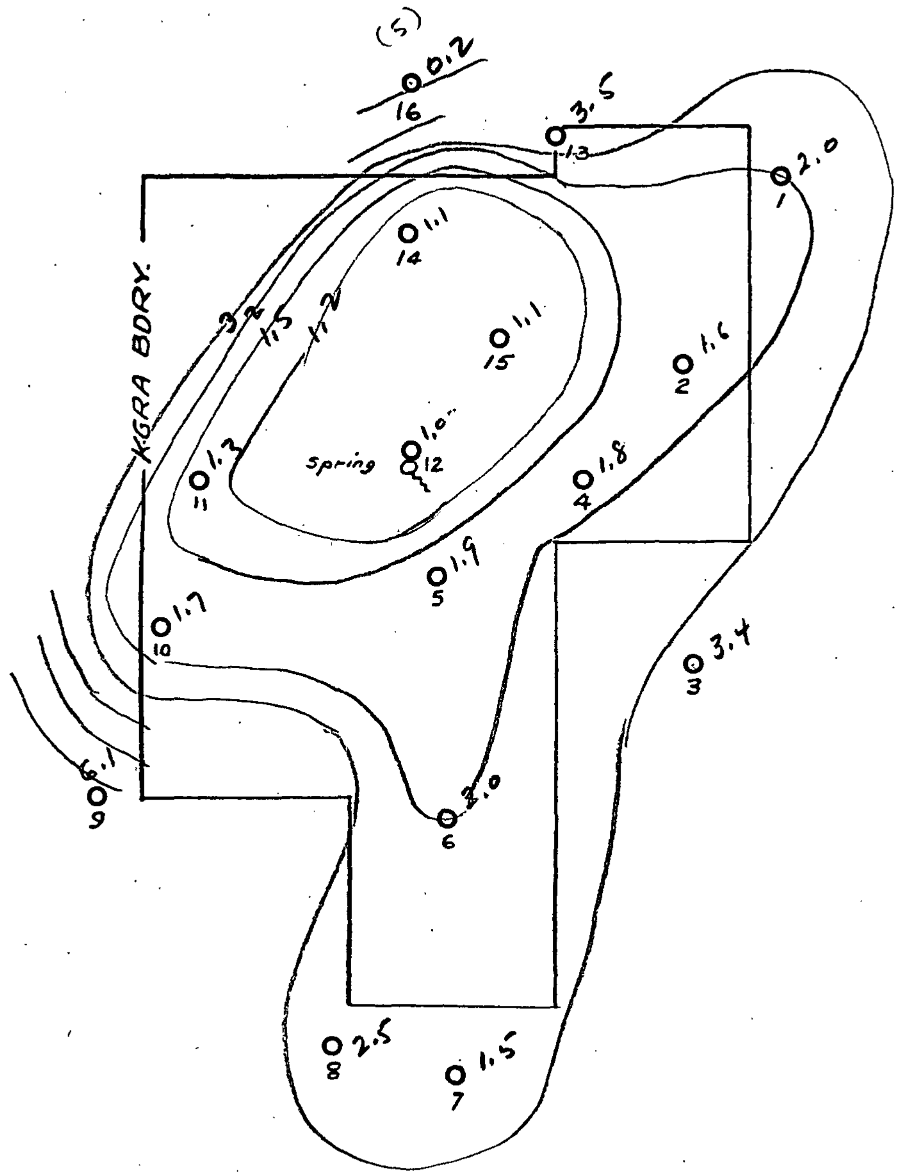
Sheet 2 - Distribution + lithologic char
acter of 34-17 my sedy + ign. rk of Nev,
showing centers of volcanism
Sheet 3 - a/a 17-6 my
Sheet 4 - a/a <6 my
Includes abstract (IL as map 41)

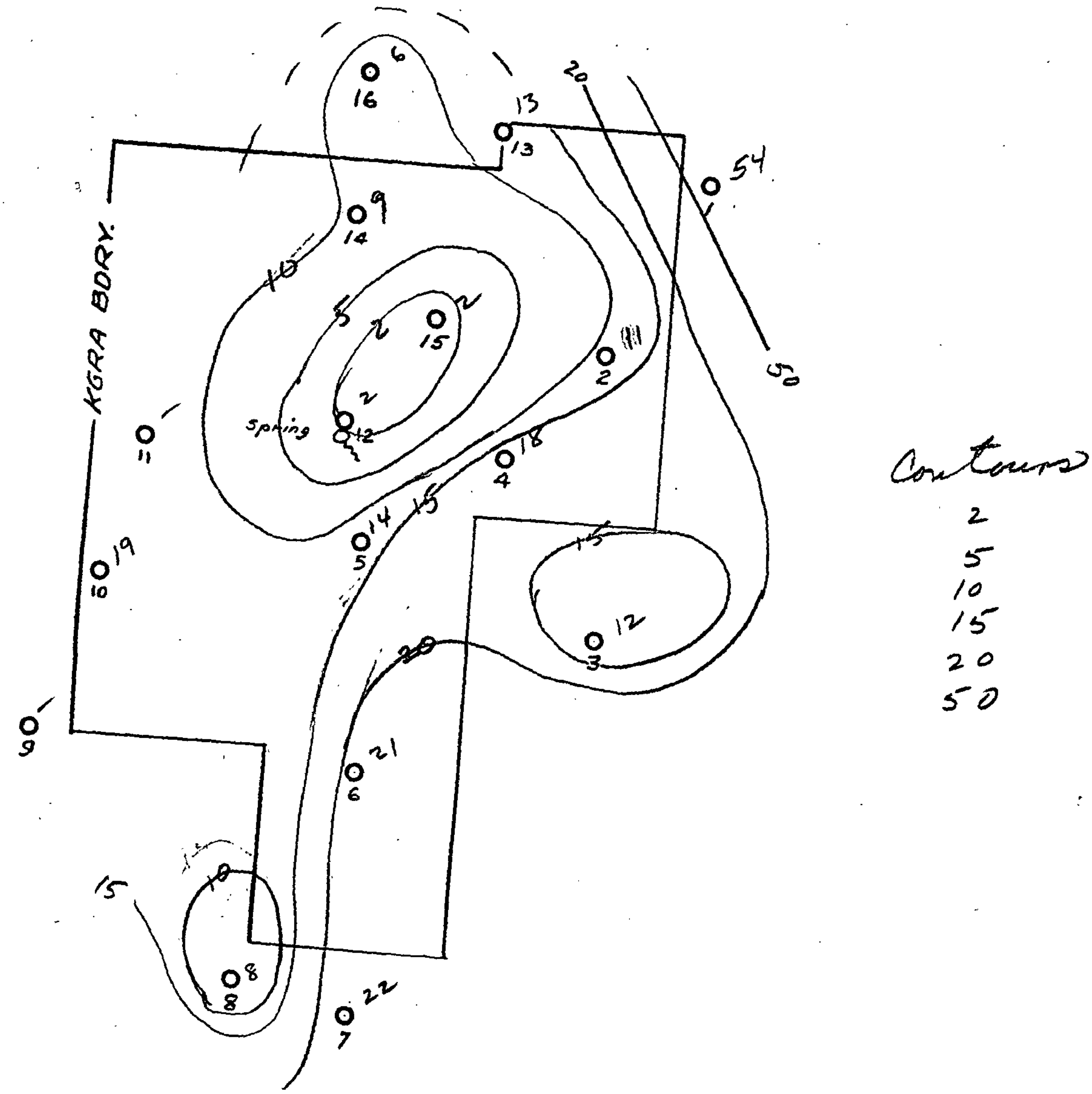


AUDIO-MAGNETOTELLURIC STATIONS
AND APPARENT RESISTIVITY MAP OF

BALTAZOR KGRA

27 Hz   TELLURIC LINE $\frac{N\text{-}S}{E\text{-}W}$ RATIO

Scale ≅ 1:62,500

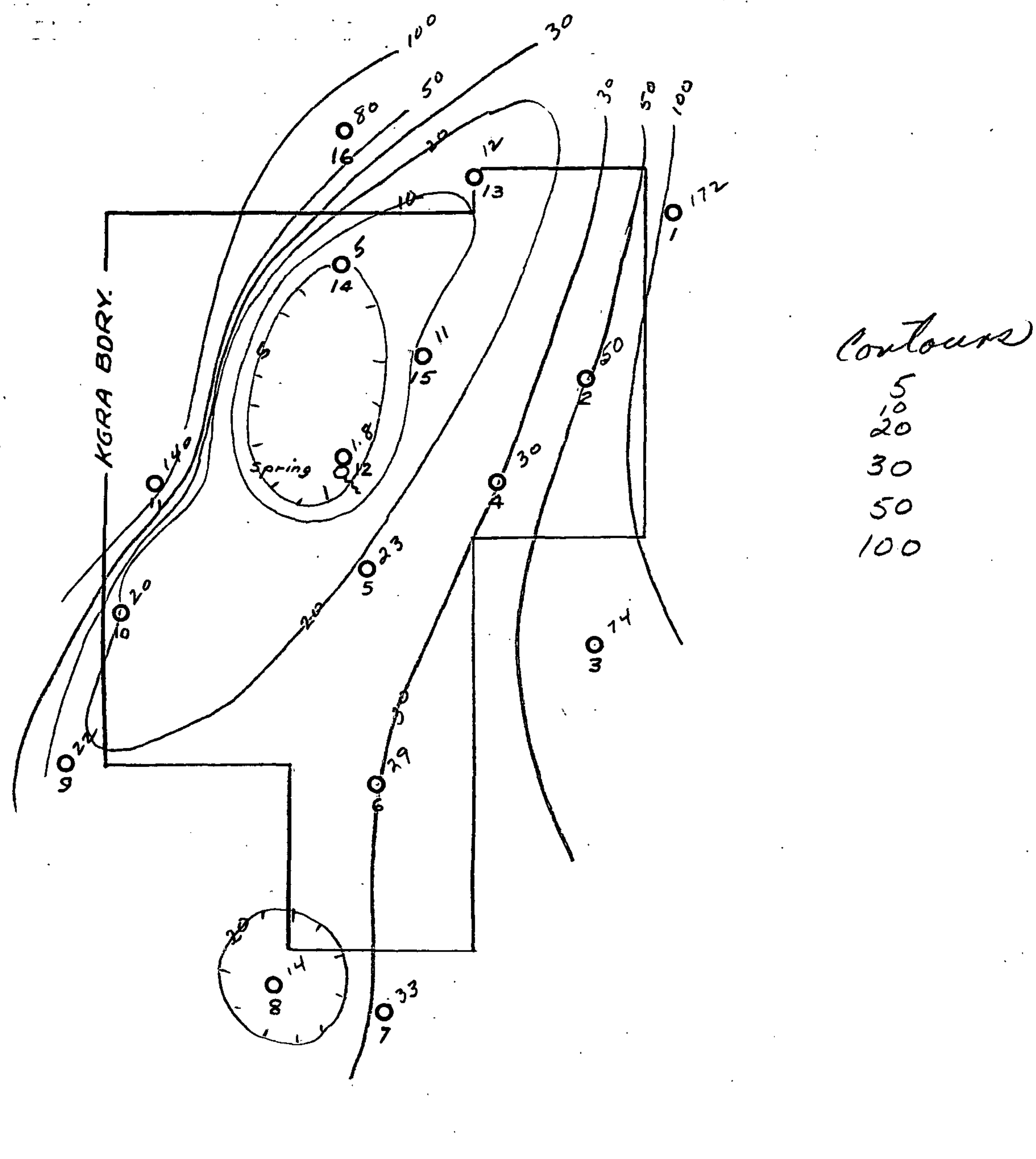


AUDIO-MAGNETOTELLURIC STATIONS
AND APPARENT RESISTIVITY MAP OF

BALTAZOR KGRA

285 Hz AV, TELLURIC LINE

Scale ≅ 1:62,500



AUDIO-MAGNETOTELLURIC STATIONS
AND APPARENT RESISTIVITY MAP OF

BALTAZOR KGRA

27 Hz AV. TELLURIC LINE

Scale ≅ 1:62,500

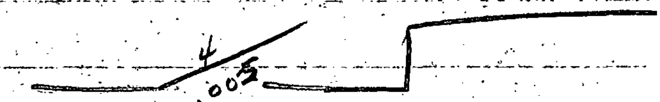
Baltazor AMT - Ratio $\frac{Pa_{NS}}{Pa_{EW}}$

	FREQUENCY										
	7.5	10	14	27	76	285	685	1.2K	3.3K	6.7K	10.2K
1	1.34	.98	.69	2.0	1.4	1.5					
2	3.2	3.5	2.8	1.6	.95	.57					
✓ 3	2.9	2.3	2.5	3.4	3.4	1.2					
✓ 4	—	2.5	2.5	1.8	1.1	.74					
5	3.6	3.0	2.0	1.9	2.8	.74					
6	2.7	3.4	2.0	2.0	2.0	.97					
7	2.0	2.1	1.7	1.5	1.0	.61					
8	—	3.0	2.0	2.5	1.0	.42					
9	3.7	7.8	3.2	6.1	5.9	—					
10	2.0	2.4	1.5	1.7	1.8	.83					
11	1.0	.63	1.2	1.3	—	—					
12	.32	—	1.8	1.02	.60	.38					
13	2.9	2.5	1.4	3.5	1.4	.53					
✓ 14	.86	1.8	.71	1.1	1.1	.39					
✓ 15	1.9	—	6.0	1.1	.57	.67					
16	.27	.333	.09	.20	.12	.27					

4mgl BALTAZOR

BOUGUER $0.01276\sigma_a$ mgl/ft step function

$\Delta g_{max} = 4$ mgal

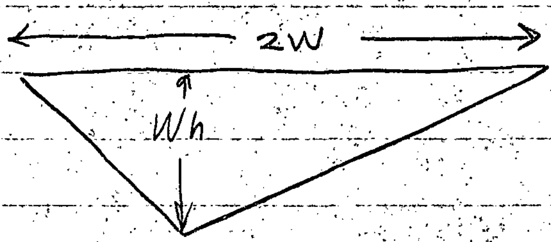


minimum depth = 800 ft

maximum depth

GRANT + WEST p 290

$$\frac{\Delta g_{max}}{4G\Delta\sigma W}$$



2W = 6900'

W = 3450

$\Delta g_{max} = 4$ mgal

2W = 2.1 km W = 1.05

$\Delta\sigma = 0.4$ gm/cm²

$$\frac{4\times10^{-3}}{4\times66.7\times10^{-9}(.4)\,1.05\times10^{5}} = \frac{4\times10^{-3}}{112\times10^{-4}} = .35$$

h = .32

Wh = 1104 = maximum depth

Actually ~~128.0~~ ?0 mgl looks like a better regional value

Δg_{max} = 4.4 mgal

minimum 880'

maximum G+W

1276 ft max

.393 h = .37

Wh = 1276

between 900 and 1250 ft

profile perfect the major fault[?] is to the west of Baltazor[?]

McGEE MOUNTAIN NEGATIVE

ELEV CORR = FREE AIR - BOUGUER

$$k_E = 0.09406 - 0.01276\,\sigma_B \qquad gu/ft = \frac{0.1\ mgal}{ft}$$

BALTAZOR

STA. AT BOGGS HOT WELL (B)

BOUGUER GRAV. −176.88 mgal

ELEV 4314 ft

STA	mgl (MAP)	APPROX. h ELEV ft.	Δh ft	Δ mgal ΔkΔh		ALTERNATE STA. VALUE*
1	−181.58	6020	1706	5.88		−175.70
2	−181.59	6120	1870 / 1806	6.45 / 6.23		175.14 / −175.36
3	−179.48	6020	1706	5.88		−173.60
4	−177.32	5720	1406	4.85		−172.47
5	−174.24	5290	976	3.37		−170.87
6	−174.80	5180	866	2.99		−171.81
7	−1[illegible]3.87	5240	926	3.17		−180.68

$$\text{MAP } k = .09406 - .01276(2.67) = 0.05999\ mgal/ft \quad (.3407)$$

$$\text{ALTERNATE } k = .09406 - .01276(2.40) = 0.06344\ mgal/ft \quad (.3062)$$

$$\Delta k = .06344 - .05999 = 0.00345\ mgl/ft.$$

* USING BOUGUER DENSITY OF 2.40 gm/cc ABOVE 4314' ASL

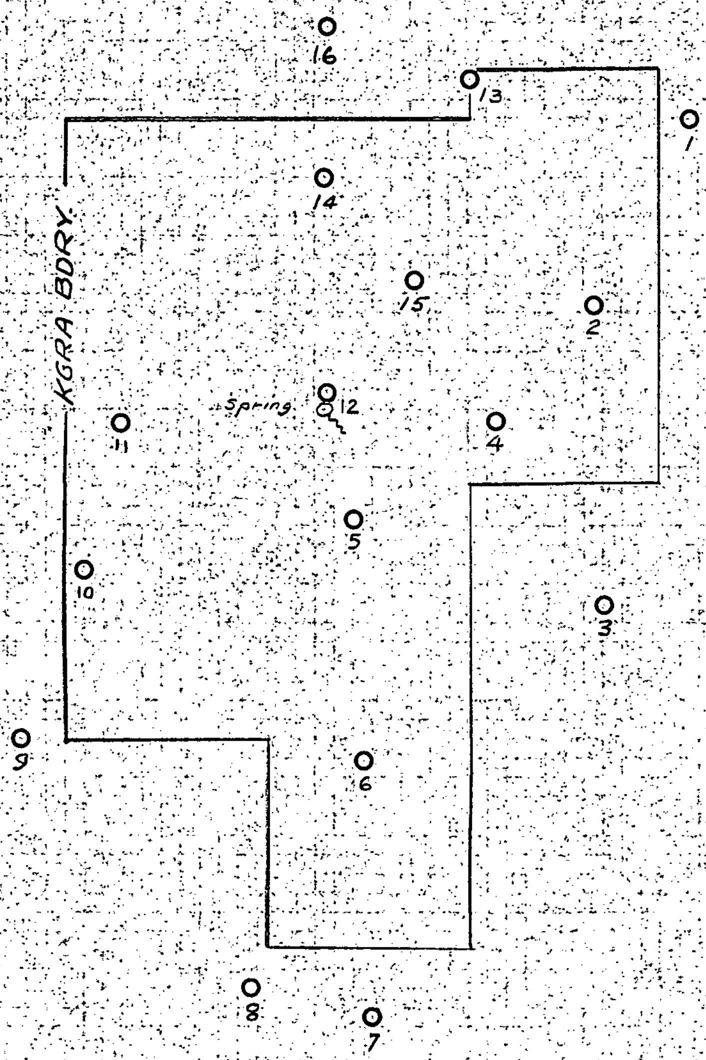
SEE TERRAIN k OF 77-67-C ✓

Unlikely that Terrain corrections based on σ = 1.4 would change contours.

actually [illegible] impossible

REQUIREMENTS
GRAVITY BALTAZOR

✓ PLOUFF OF 76-601
✓ PETERSON OF 77-67-C
USGS GEOPH COVERAGE NEV-ORE
DENSITY MEASUREMENTS
HEALEY 1973 GRAV KINGMAN SHEET CDMG
MABEY 1960 " W MOJAVE USGS PP 316 D, 73 p
USGS BIBLIO
CLEARY THESIS
Assumed densities
Miocene Vol 2.6 – 2.8) DOBRIN
VALLEY FILL 1.9 – 2.3)
Used contrasts of .4 and .6
(0.5 gm/cc would support telluric results)
CHAPMAN 1975 CLEAR LAKE GRAV
CDMG Special Rept 116
KEN COOK Grav of Roosevelt
THIRUVATHUKAL REGION GRAV ORE
GSA BULL V 81 p 725-738
CHECK CALDERA IN N NEV
THOMPSON 1958 GRAV OF VIRGINIA CITY MT ROSE
GSA Bull V 69, 1269-1281
Check subsurface silicification possibility
CHECK USGS PUB
GRAV MAP MCDERMOTT CALDERA



AUDIO-MAGNETOTELLURIC STATIONS
AND APPARENT RESISTIVITY MAP OF

BALTAZOR KGRA

-Hz TELLURIC LINE

Scale ≅ 1:62,500