Well Name / Company / Well Elev. (at ground level)	Core Location (Top of Core)	Core Depth or Depth Interval — Drilled Depth (DD) / True Vertical Depth (TVD)	Core Elevation or Elevation Interval	First Steam Entry in Well — Drilled Depth (DD) / True Vertical Depth (TVD) / Elevation (EL.)	Rock Type	Comments
NEGU-17 Unocal purchased by DOE/GD for $70K EL. ? 2920 ft	1250 ft N, 200 ft W of SE cor. sec. 5, T11N, R8W, (MDBM) Lake Co., Calif. (approx. loc.— scaled fr. 1:264,000 map in Guhderson, 1990)	DD 8526-8540 ft (14 ft) TVD unknown	-5237 to -5251 ft	ND but characterized as within steam reservoir by Gunderson (1990)	graywacke	½ of 4" dia. core, sawn longitudinally poor core recovery highly fragmented & milled heavily sampled
SB15-D DOE/Geothermal Division & Unocal EL. 1880 ft	340 ft N, 830 ft E of SW cor. sec. 12, T11N, R9W, (MDBM) Sonoma Co., Calif.	DD 825-1602 ft (777 ft) TVD 821-1593 ft (772 ft)	+1059 to +287 ft	DD 1369 ft TVD 1360 ft EL. 520 ft	graywacke and interbedded argillite	3" full-dia. core; 100% recovery u 5% sampled
PRATI-5 GEO/CCOC/RREC EL. 2554 ft	1210 ft N, 560 ft E of SW cor. sec. 36, T12N, R. 9W (MDBM) Sonoma Co., Calif.	DD 6495-6507 ft (12 ft) TVD 6442-6454 ft (12 ft)	-3888 to -3900 ft	DD 6935 ft TVD 6875 ft EL. -4321 ft	"	4" full-dia. core
PRATI-29 CCOC/RREC EL. 3223 ft	(approx) 2448 S, 1243 ft W of NW cor, sec. 36 T12, R8W (MDBM) Sonoma Co., Calif.	DD 8445-8455 ft (10 ft) TVD 8062-8070 ft (8 ft)	-4839 to -4847 ft	DD 8072 ft TVD 7743 ft EL. -4520 ft	graywacke	4" full-dia core— very poor core recovery
PRATI-38 GEO/CCOC/RREC EL. 1901 ft	50 ft S, 2430 ft E of NW cor., sec 2, T11N, R9W (MDBM) Sonoma Co., Calif.	DD 5554-5560 ft (6 ft) TVD 5530-5536 ft (6 ft)	-3629 to -3635 ft	DD 6110 ft TVD 6076 ft EL -4175 ft	"	4" full-dia. core

Geysers Core Samples

STORED AT ESRI AS OF 04/15/95

Well Name / Company / Well Elev. (at ground level)	Core Location (Top of Core)	Core Depth or Depth Interval — Drilled Depth (DD) / True Vertical Depth (TVD)	Core Elevation or Elevation Interval	First Steam Entry in Well — Drilled Depth (DD) / True Vertical Depth (TVD) / Elevation (EL.)	Rock Type	Comments
CA 1862-17 Aminoil/ Calpine EL 3367 ft	310 ft N, 1300 ft E of SW cor sec 21, T11N, R8W, (MDBM) Sonoma Co., Calif.	DD 6958-6961 ft (3') TVD 6909-6912 ft	-3542 to -3545 ft	DD 8000 ft TVD 7915 ft EL. -4548 ft	graywacke	4"-dia core
BARROWS 2 Aminoil/ Calpine EL. 2200 ft	1560 ft S, 270 ft W. of NE cor. sec. 35, T11N, R8W (MDBM) Lake Co., Calif.	DD 5812 to 5814.5 ft (2.5') TVD 5728 to 5730.5 ft	-3528 to -3530.5 ft	DD 4487 ft TVD 4448 ft EL. -2248 ft	"	" badly fragmented; only ~50% of core remains
MLM-3 Aminoil/ Calpine EL. 1958 ft AIDLIN 8 EL 1960	780 ft S 1800 ft E of NW cor. sec. 36 T11N, R8W (MDBM); Lake Co., Calif.	DD 4330 to 4352 ft (22') TVD 4195 to 4217 ft	-2237 to -2259 ft	DD 6043 ft TVD 5780 ft EL. -3822 ft but MAJOR LOST CIRC. ZONE, WHILE DRILLING W/ MUD, AT: DD 4900 ft TVD 4166 ft EL. -2186 ft ... SUSPECT THIS WOULD HAVE BEEN A STEAM ENTRY IF THE DRILLING FLUID HAD BEEN AIR.	"	4"-dia. core

Geysers Core Samples

STORED AT ESRI AS OF 04/15/95

Well Name / Company / Well Elev. (at ground level)	Core Location (Top of Core)	Core Depth or Depth Interval — Drilled Depth (DD) / True Vertical Depth (TVD)	Core Elevation or Elevation Interval	First Steam Entry in Well — Drilled Depth (DD) / True Vertical Depth (TVD) / Elevation (EL.)	Rock Type	Comments
PRATI STATE 12 GEO/CCOC/RREC EL. 2435 ft	1280 ft S, 820 ft E of NW cor. sec 1, T11N, R9W (MDBM) Sonoma Co., Calif.	DD 6256-6266 ft (10 ft) TVD 6121-6131 ft (10 ft)	-3686 to -3696 ft	DD 4778 ft TVD 4718 ft EL. -2283 ft	graywacke w/ minor argillite	4"-dia. core, most sawn in half longitudinally poor core recovery highly fragmented and milled heavily sampled
PRATI STATE 24 GEO/CCOC/RREC EL. 2435 ft	≈ 1250 ft S, 790 ft W of NE cor. sec 1, T11N, R9W (MDBM) Sonoma Co., Calif.	DD 3983-3993 ft (10 ft) TVD 3955-3965 ft (10 ft)	-1520 to -1530 ft	DD 6070 ft TVD 6002 ft EL. -3567 ft	graywacke and argillite	4"-dia. core
CA958-3A Aminoil/Calpine EL. 2900 ft	850 ft N, 1700 ft E of SW cor. sec 34, T.11N, R8W (MDBM) Sonoma Co., Calif.	DD 2440.5-2454 ft (13.5') TVD 2424.5-2438 ft (")	+475.5 to +462.0 ft	DD 3770 ft TVD 3711 ft EL -811 ft	schistose graywacke	4"-dia. core some pcs. sawn in half longitudinally for imaging
CA958-6 Aminoil/Calpine EL. 2200 ft.	80 ft N, 870 ft W of SE cor. Sec. 35, T11N, R8W (MDBM) Lake Co., Calif.	DD 7842-7842.5 ft (0.5') TVD 7519-7519.5 ft (")	-5319.0 to -5319.5 ft	DD 5671 ft TVD 5502 ft EL -3302 ft	biotite-hornblende-orthopyroxene granodiorite, sparsely porphyritic	4"-dia core 1 pc. remaining, ≈ 1" long
CA1862-4 Aminoil/Calpine ELEV. 3373 ft	1150 ft S 700 ft W of NE cor. sec 28, T11N, R8W (MDBM) Sonoma Co., Calif.	DD 4455-4465 ft (10') TVD 4443-4453 ft (10')	-1070 to -1080 ft	DD 4530 ft TVD 4517 ft EL. -1144 ft but MAJOR LOST CIRCULATION ZONE DD 4241-4311' → SUSPECT THIS WOULD HAVE BEEN A STEAM ENTRY HAD AIR BEEN THE DRILLING FLUID (DLN) TVD 4230-4300' EL. -857 to -927'	schistose metagraywacke or graywacke semischist	"

Geysers Core Samples

STORED AT ESRI AS OF 04/15/95

Well Name / Company / Well Elev. (at ground level)	Core Location (Top of Core)	Core Depth or Depth Interval — Drilled Depth (DD) / True Vertical Depth (TVD)	Core Elevation or Elevation Interval	First Steam Entry in Well — Drilled Depth (DD) / True Vertical Depth (TVD) / Elevation (EL.)	Rock Type	Comments
CA 1862-17 Aminoil/ Calpine EL 3367 ft	310 ft N, 1300 ft E of SW cor sec 21, T 11N, R8W, (MDBM) Sonoma Co., Calif.	DD 6958 - 6961 ft TVD 6909 - 6912 ft	-3542 to -3545 ft	DD 8000 ft TVD 7915 ft EL. -4548 ft	graywacke	4" - dia core
BARROWS 2 Aminoil/ Calpine EL. 2200 ft	1560 ft S, 270 ft W. of NE cor. sec. 35 T11N, R8W (MDBM) Lake Co., Calif.	DD 5812 to 5814.5 ft TVD 5728 to 5730.5 ft	-3528 to -3530.5 ft	DD 4487 ft TVD 4448 ft EL. -2248 ft	"	" badly fragmented; only ~ 50% of core remains
MLM-3 Aminoil/ Calpine EL. 1958 ft	780 ft S 1800 ft E of NW cor. sec. 36 T11N, R8W (MDBM); Lake Co., Calif.	DD 4330 to 4352 ft TVD 4195 to 4217 ft	-2237 to -2259 ft	DD 6043 ft TVD 5780 ft EL. -3822 ft but MAJOR LOST CIRC. ZONE WHILE DRILLING W/MUD, AT: DD 4900 ft TVD 4166 ft EL. -2186 ft ... SUSPECT THIS WOULD HAVE BEEN A STEAM ENTRY IF THE DRILLING FLUID HAD BEEN AIR.	"	4" - dia. core

Geysers Core Samples

STORED AT ESRI AS OF 04/15/95

BARROWS 2

(DESCRIPTION BY MARY K. TWITCHELL)

Core Description - Barrows No. 2

An air drilled core was taken from the Barrows No. 2 well. The cored interval was from 5812 to 5814.5 feet measured depth. All but the bottom three inches were recovered. The well was flowing an estimated 50,000 pounds of steam per hour from entries at 4487, 4769, and 4774 feet measured depth. A 20 psi steam entry was encountered at 5821 feet measured depth, just 6½ feet below the cored interval. If the rock had not jammed in the core barrel, we would have cored into a steam entry.

The cored rock is a fine grained, hydrothermally altered graywacke. It broke into roughly five pieces as it was removed from the core barrel. These will be described in sequence from the top to the bottom of the cored interval.

First piece - top of core - 5812'± to 5812'6"± (1T/1B)

The piece is broken into five pieces, one large and four small. All are propylitically altered graywacke.

Graywacke description: grayish-green, fine to medium grained, poorly sorted; the most identifiable grains are milky to clear quartz clasts ranging up to 1mm in size and black, siliceous argillite lith fragments ranging to ½ mm in size. The rest of the graywacke has been pervasively altered into yellowish epidote, light green chlorite patches and minute stringers, and trace amounts of very small clayey patches. A few light reflective laths of plagioclase feldspar were noted — complete with albite twinning. Overall, the graywacke would be described as a silicic graywacke.

Fractures and Mineralization: there are a series of veinlets and fractures, some with vuggy areas

along their lengths, which cross cut the core piece. These will be described from oldest to youngest as defined from cross cutting relationships.

1. The oldest fractures are near horizontal features that trend 60° to 80° from the axial plane of the core. They are completely mineralized with quartz being the most abundant mineral accompanied by epidote and some chlorite. The fractures are discontinuous forming stringers that range up to 1½ mm in width.

2. The oldest near vertical features are fractures that are less than ½ mm in width and filled with black, predominantly subhedral clusters of tourmaline. These black tourmaline veinlets, as they will now be called, are planar to wavy, discontinuous to interfingering, and trend 30° to 40° from the axial plane of the core. Clear and milky quartz accompanies the tourmaline — at times minute, green, euhedral tourmaline laths appear either suspended in the quartz or protruding from the margin into the quartz. This is best displayed in the largest of the smaller pieces at the top of the core where a tourmaline veinlet expands to 2 mm in width and is filled with milky quartz in the interior with tourmaline protruding into the quartz from the margins and also suspended in it. Vugs are present sporadically along some of the tourmaline veinlets.

3. The tourmaline veinlets are cross cut by small, discontinuous quartz veinlets. These range up to 1 mm in width, but are usually ± ¼ mm

in width. The quartz veinlets often interfinger forming a zone that trends ± 10° from the axial plane of the core. Tourmaline is either absent or almost so where the quartz veinlets cross the tourmaline veinlets. This diffuse occurrence of tourmaline indicates, I believe, resorbtion of the borosilicate by the fluid that left behind the silica. In particular, a mineralized vug occurs at the intersection of the quartz veinlets zone and a tourmaline veinlet. Only a small amount of tourmaline remains scattered around the vug from what once was a continuous tourmaline veinlet. The vug itself is almost entirely filled by milky and clear quartz, tiny laths of faint brownish green prehnite (?), and very faint pink axinite (?). Some of the quartz veinlets also contain prehnite (?). Patches of quartz and chlorite and/or actinolite are present at some intersections of the quartz veinlets with the older quartz stringers. Vugs are present along some of the quartz veinlets.

4. The youngest fracture which cross cuts the previous three is not mineralized. The core piece broke along this fracture plane. The fracture trends ± 15° from the axial plane of the core. Fine hairlike fractures were also noted.

Note: black tourmaline clusters are scattered here and there throughout the core piece - they are not restricted to the tourmaline veinlets alone. The rock is porous - numerous small vugs soak up a film of water when placed on the fresh surface as well as the smoothed cored surface of the rock. Some of the feldspar has been altered to a yellowish-white clay.

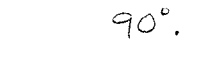
Second piece - 5812'5"± to 5812'10"± (2T/2B)

The core piece is a pervasively altered graywacke as described for the first piece. Quartz and argillite clasts are identifiable along with some gray chert clasts and altered feldspar. Tourmaline is still present in the rock. The matrix for the above clasts is now epidote, chlorite, and traces of clay.

Fractures and Mineralization: The moderate to high angle veinlets and fractures are prominent in this core piece. One of the fractures has a high degree of "vugginess" with small crystals exposed where the fracture crosses the core surface. Most of the others are veinlets. These will be described in more detail, from oldest to youngest, as defined from cross cutting relationships.

1. Tourmaline veinlets that trend 40° to 50° from the axial plane of the core seem to be the oldest features in this core piece. Not all the veinlets are included in this group; some are younger (see below). The description for these tourmaline veinlets is the same as that given for core piece 1T/1B (see #2 under fractures and mineralization). Where intersected by younger fractures, the tourmaline starts to disappear (is leached out) so that the veinlets get lighter in color and then disappear.
2. A fracture zone, 1mm to 5mm wide, composed of hairlike quartz veinlets cuts the oldest tourmaline veinlets. This zone trends at 50° to the axial plane of the core. It is most prominent on one side of the core piece; on the reverse side it is masked by younger tourmaline veinlets.
3. Very thin quartz veinlets that trend either vertically or within 20° of the axial plane of the core cross cut the older tourmaline veinlets and

the fracture zone. There are not many of these present. Total width is usually less than 1 mm.

4. Newer tourmaline veinlets that trend at 30° to 50° to the axial plane of the core cross cut all the former features. Under the binocular microscope, there appears to be no difference in composition or structural occurrence between the newer and older tourmaline veinlets. These veinlets form a network whose pattern is planar in some areas and jigsaw puzzle-like in other areas where there are a lot of interconnecting veinlets. Some prehnite (?) may be associated with the quartz in these veinlets.
5. The largest fracture in this core piece, and one of the youngest, is open along three quarters of its length as exposed at the core surface. It trends at 40° to the axial plane of the core, and cross cuts the planes of the tourmaline veinlets at almost 90°. 

From the most open, vuggy part of this fracture (estimate < 1mm to < 2mm), the fracture closes down to an almost unseeable hairlike fracture along the broken base of the core piece. Quartz appears to be the mineral along the walls of the fracture where it opens up euhedral crystals of adularia (?) and minor euhedral crystals of prehnite (?) are exposed in the vuggiest portions. (Estimate that the crystals range up to ½ mm in size.) A very thin fracture "parallels" the open fracture for a distance before disappearing

into the tourmaline veinlets.

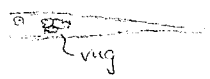
Third piece - 5812'10"± to 5813'3"± (3T/3B)

This piece has the most distinct, planar fractures of the pieces described so far. At the top of the piece is the network of tourmaline veinlets described under #4 for the second core piece. These veinlets are exposed on the broken surfaces (bottom of the second core piece and top of the third) and show up quite well when the surfaces are wetted. The "open fracture" described under #5 for the second core piece extends into this third piece. The "open fracture" is cross cut by vuggy, quartz filled fractures that make these the youngest features yet seen. These will be described below.

Fractures and Mineralization: Many of the features in this piece are much the same as already described. Reference will be made to previous descriptions.

1. Older tourmaline veinlets that are "bleached" are present (see description #1 for core piece 2T/2B).
2. A fracture zone composed of hairlike quartz veins (much like description #2 for core piece 2T/2B) trends at 50° to the axial plane of the core. This feature is somewhat obliterated by younger crosscutting features. Its width ranges up to 3mm.
3. Only one thin quartz veinlet as that described in #3 for core piece 2T/2B was noted. A larger vein, 1mm to 1½ mm, first trending at 15° to the axial plane of this core piece and then veering to 40° to 50° to the axial plane in core piece 2T/2B is open along some of its length with true vug structures here and there. This vein contains mainly quartz with minor amounts of

prehnite (?) and very small, localized amounts of epidote. There are two vugs that may or may not be associated with the "vuggy" quartz fractures (just described and in description #5 for the 2T/2E core piece). The one vug disrupts (is younger than) the hairlike quartz veinlet. The vug is at the center of a disc-like form measuring approximately 3cm across and 3½ mm thick. The left side of this disc is not well defined. ?



The disc-like form is visible because the margins are green due to chlorite and possible actinolite. The interior has quartz and prehnite (?) filling the narrower portions; the vug occupies the thickest portion with subhedral crystals protruding into the space. (The crystals are contaminated with drilling gunk which makes identification difficult.) The other vug occurs slightly off center of the quartz vein described at the beginning. There is no defined chloritized margin. Epidote seems to be slightly more abundant in the area of the vug. The vug itself measures 3mm by 1½ mm.

4. Newer tourmaline veinlets are present at the top of this core piece (a continuation from the 2T/2E core piece). Other near vertical tourmaline veinlets are present in this core piece which were not conspicuous in the previous core pieces.
5. The fracture described in #5 for core piece 2T/2E extends into this piece. It is cross cut by a younger mineralized fracture (described next) and essentially obliterated.

6. The youngest feature is a mineralized fracture 1mm thick trending at approximately 30° to the axial plane of the core. Quartz is the only recognizable mineral. Small vugs are present along its length.
7. Part of the bottom of the core piece is broken along a fracture whose trend is 40° to the axial plane of the core. Much of the surface of the fracture is covered by subhedral to euhedral crystals of adularia (?) and ankerite (?). The surfaces are coated with drilling gunk which does not readily wash off making identification difficult. The cross cutting relationship of this fracture to the others is difficult to ascertain because of it being at the edge of the core piece.

Fourth piece - 5313'3" ± to 5313'7" ± (4T/4B)

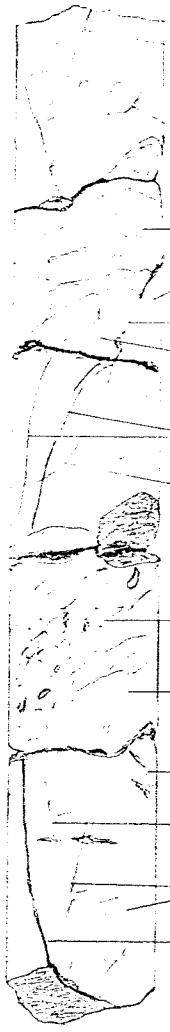
This piece is the most unique of all the core pieces in that a fracture zone approximately 3 cm (1¼" ±) wide with lots of vugs cuts across the core piece at 40° to 50° to the axial plane of the core. The zone is lighter in color than the surrounding rock and the presence of the vugs gives it a spongy appearance. (Note: the fracture at the bottom of core piece 3T/3B forms the upper edge of the "spongy" fracture zone.) The lighter color of the zone is due to the increased rock alteration. When the rock is wetted, the zone takes on a mosaic-like appearance of chunks of moderately altered rock surrounded by intensely altered rock. In the moderately altered rock chunks, only the quartz and argillite clasts have distinct to fuzzy grain boundaries. Translucent, creamy, and yellowish-green blotches are probably what is left of

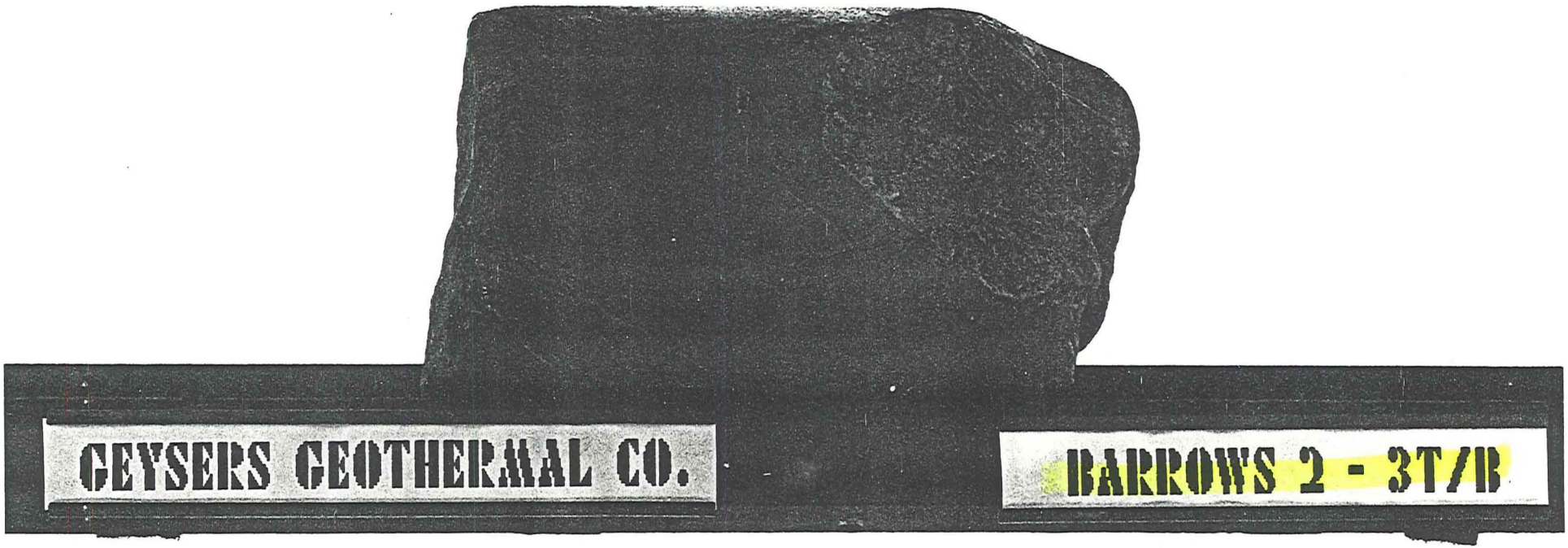
the feldspars. Some of these have green margins of chlorite (?). The matrix has been altered to chlorite (?) and some epidote (?) and has a yellowish-green to green, mottled appearance. In the intensely altered rock, the grain boundaries are completely obliterated. Only quartz and epidote are recognizable. These areas are yellowish or whitish. There are crystals along the margins of the vugs. Looking along the broken surface (between 3T/3B and 4T/4B) where the "spongy" fracture zone is exposed, the crystals appear to be axinite with possible adularia, prehnite, and quartz present. The rock bordering the zone is more altered (like the chunks within the zone) than the overall rock alteration of the entire core. Tourmaline veinlets are the next most prominent feature of this core piece. These veinlets along with the other mineralized fractures, with the exception of the near vertical hairlike quartz filled fractures, are all present in this core piece, and are all disrupted by the "spongy" fracture zone. Their occurrence is much the same as already given and no further descriptions will be given here.

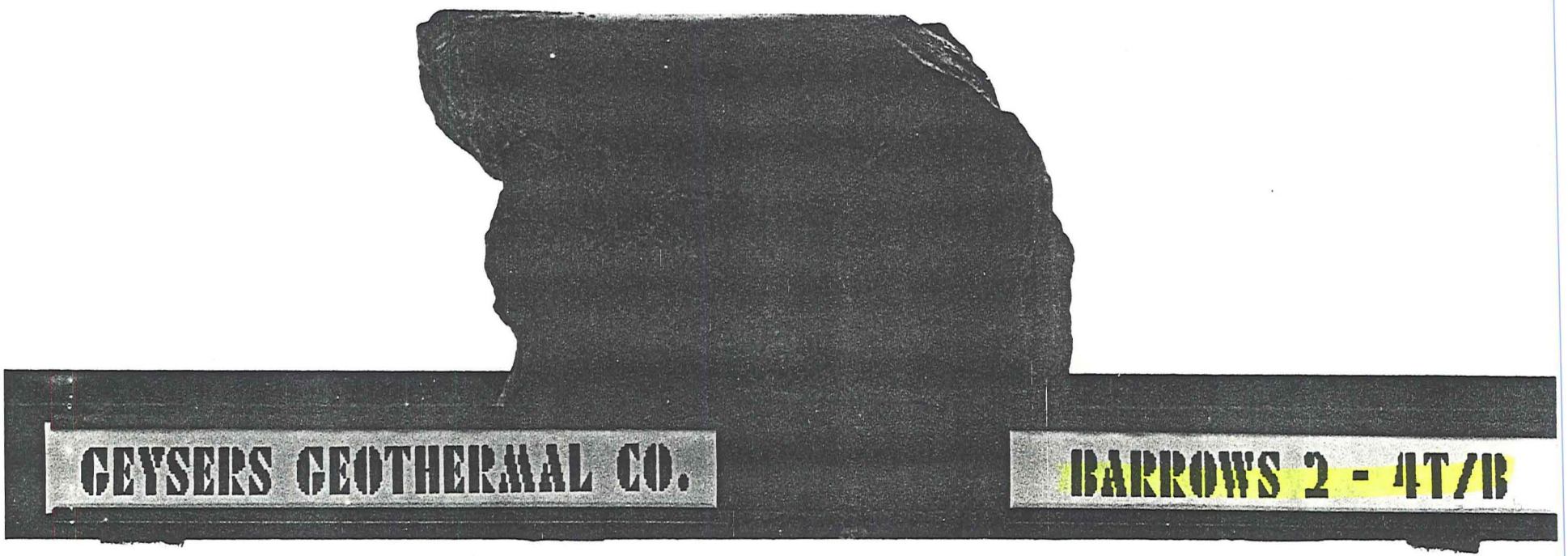
Fifth piece - 5813'7" ± to 5814'1" ± (5T/5B)

There are now two pieces instead of one as the core split along a near vertical fracture. The veinlets and fractures in these pieces are as those previously described. There are a few things that are different in this core piece than in the previous ones. Towards the top of the core piece (i.e. in proximity to the "spongy" fracture) there are "blotches" of milky-white to translucent quartz that are cross cut in a few places by the younger mineralized (quartz) fractures. Some of the "blotches"

appear to have one or more straight edges or are strung out and surrounded by altered rock suggesting that these areas may be remnants of older, larger quartz filled stringers that have been broken apart and partially resorbed by continued alteration processes. (In other words, are these like the mosaic-like pattern of rock chunks and quartz/epidote areas seen in the "spongy" fracture zone and that now exist as remnants from some earlier zone?) The other "feature" is an area of extremely fine grained (silt size) altered rock (?) cross cut by a cobweb-like network of tourmaline and tourmaline/quartz veinlets. This irregular shape stands out even when the core is dry. It appears as a darker colored shape. Under the microscope, extremely fine grained yellowish-green "chloritized" rock (?) is surrounded by and rapidly grades into the altered graywacke. This material may be the remnant of preferentially stressed rock that was attacked and altered by hydrothermal fluids and then fractured again with formation of the tourmaline veinlets.


1
2
3
4
5
Quartz veinlets
Quartz veinlets (old)
> Among tourmaline veinlets
Network of tourmaline veinlets
Open fracture
Quartz veinlets
Young quartz veinlets
Extension of open fracture
"Spongy" fracture zone
Tourmaline veinlets
Quartz veinlets (some vugs)
Young quartz veinlets
Tourmaline veinlets
Fracture along which core piece broke
1cm=2ft.


GEYSERS GEOTHERMAL CO.
BARROWS 2 - 3T/B


GEYSERS GEOTHERMAL CO.
BARROWS 2 - 4T/B

GEYSERS GEOTHERMAL COMPANY
MISC. WELLS

DATE : 3-26-86
FORMATION :
DRLG. FLUID:
LOCATION :

FILE NO. : 32020-15092
API WELL NO.:
LABORATORY : MIDLAND, TEXAS

FULL DIAMETER ANALYSIS - SUMMATION OF FLUIDS

SAMPLE NUMBER	DEPTH FEET	PERM MAXIMUM	PERM 90 DEG	PERM VERTICAL	FLD POR	OIL% POR	WTR% POR	GRAIN DEN M	
1	BARROWS 2 3T/B	0.64	<0.01	11.	3.0	0.0	8.3	2.68	
(2)	BARROWS 2 4T/B	0.30	0.26	0.70	4.7	0.0	8.3	2.71	
3	CA-958-3A 1CT/B	0.44	0.39	<0.01	1.3	0.0	22.2	2.72	
4	CA-958-3A 2BT/B	0.18	0.13	0.11	1.3	0.0	22.2	2.72	
5	CA-958-3A 5AT	0.12	0.07	0.38	0.5	0.0	50.0	2.70	
6	CA-958-6	0.56	0.39	1.6	1.9	0.0	62.5	2.71	
7	CA-1862-4 1BT/B	3.3	0.85	VF	1.9	0.0	46.0	2.76	VERTICALLY FRACTURED
8	CA-1862-4 1CT/B	0.30	0.25	0.35	1.9	0.0	43.5	2.76	
9	CA-1862-17 FT/B	0.30	0.21	0.41	1.2	0.0	40.0	2.67	
* 10	CA-1862-17G	0.12		0.01	1.6	0.0	75.0	2.66	
11	MLM-3 1CT/B	<0.01	<0.01	<0.01	2.2	0.0	87.5	2.72	
12	MLM-3 3A	<0.01	<0.01	<0.01	1.7	0.0	33.3	2.69	
13	MLM-3 6B	<0.01	<0.01	0.06	2.8	0.0	14.6	2.69	
14	MLM-3 8AT	6.9	0.22	2.3	9.4	0.0	14.9	2.78	

* INDICATES PLUG PERMEABILITY

CORE LABORATORIES, INC.

Petroleum Reservoir Engineering

DALLAS, TEXAS

GEYSERS GEOTHERMAL COMPANY
MISC. WELLS

DATE : 3-26-86
FORMATION :
DRLG. FLUID :
LOCATION :

FILE NO. : 32020-15092
API WELL NO. :
LABORATORY : MIDLAND, TEXAS

FULL DIAMETER ANALYSIS

	SAMPLE NUMBER	DEPTH FEET	PERM MAXIMUM	PERM 90 DEG	PERM VERTICAL	HE FOR	OIL% FOR	WTR% FOR	GRAIN DEN M	
	1	BARROWS 2 3T/B	0.64	<0.01	11.	3.0	0.0	91.7	2.68	
	2	BARROWS 2 4T/B	0.30	0.26	0.70	5.5	0.0	85.7	2.74	
	3	CA-958-3A 1CT/B	0.44	0.39	<0.01	1.4	0.0	90.0	2.72	
	4	CA-958-3A 2BT/B	0.18	0.13	0.11	1.4	0.0	90.0	2.72	
	5	CA-958-3A 5AT	0.12	0.07	0.38	0.9	0.0	57.1	2.71	
	6	CA-958-6	0.56	0.39	1.6	2.6	0.0	72.7	2.73	
	7	CA-1862-4 1BT/B	3.3	0.85	VF	2.1	0.0	92.5	2.77	VERTICALLY FRACTURED
	8	CA-1862-4 1CT/B	0.30	0.25	0.35	2.4	0.0	79.3	2.77	
	9	CA-1862-17 FT/B	0.30	0.21	0.41	1.7	0.0	85.7	2.68	
*	10	CA-1862-17G	0.12		0.01	1.8	0.0	66.3	2.66	
	11	MLM-3 1CT/B	<0.01	<0.01	<0.01	2.5	0.0	88.9	2.72	
	12	MLM-3 3A	<0.01	<0.01	<0.01	2.7	0.0	60.0	2.72	
	13	MLM-3 6B	<0.01	<0.01	0.06	3.5	0.0	80.4	2.71	
	14	MLM-3 8AT	6.9	0.22	2.3	9.5	0.0	97.9	2.79	

* INDICATES PLUG PERMEABILITY

2.73 avg.

2.72 w/o 9.5

GEYSERS GEOTHERMAL COMPANY
3\26\86
32020-15092

SAMPLE NUMBER	WELL NAME & NUMBER	PORE VOLUME BY SUMMNATION OF FLUIDS (cc)	PORE VOLUME BY HELIUM INJECTION (cc)	WATER LOSS (gm)	INJECTED SATURATION (gm)	GRAIN DENSITY BY SUMMNATION OF FLUIDS (gm/cc)	GRAIN DENSITY BY HELIUM INJECTION (gm/cc)	BULK DENSITY (gm/cc)	BULK VOLUME BY CALIPER (cc)	BULK VOLUME BY ARCHIMEDES (cc)
1	Barrows 3T/B	12.00	12.00	1.00	11.00	2.68	2.65	2.63	402.774	398.00
2	Barrows 4T/B	24.00	28.00	2.00	22.00	2.71	2.72	2.63	509.755	507.00
3	CA-958-3A 1CT/B	9.00	10.00	2.00	7.00	2.72	2.70	2.70	719.630	714.00
4	CA-958-3A 2BT/B	9.00	10.00	2.00	7.00	2.72	2.71	2.70	716.518	713.00
5	CA-958-3A 5AT	4.00	7.00	2.00	2.00	2.70	2.70	2.69	763.022	759.00
6	CA-958-6	8.00	11.00	5.00	3.00	2.71	2.73	2.68	417.485	416.00
7	CA-1862-4 1BT/B	37.00	40.00	17.00	20.00	2.76	2.77	2.73	1937.778	1936.00
8	CA-1862-4 1CT/B	23.00	29.00	10.00	13.00	2.76	2.76	2.72	1212.895	1207.00
9	CA-1862-17 FT/B	5.00	7.00	2.00	3.00	2.67	2.68	2.65		410.00
10	CA-1862-17G	8.00	9.05	4.00	4.00	2.66	2.66	2.63		503.00
11	MLM-3 1CT/B	8.00	9.00	7.00	1.00	2.72	2.70	2.68	365.819	363.00
12	MLM-3 3A	15.00	25.00	5.00	10.00	2.69	2.70	2.65	910.715	904.00
13	MLM-3 6B	41.00	51.00	6.00	35.00	2.69	2.71	2.64	1451.641	1452.00
14	MLM-3 8AT	47.00	48.00	7.00	40.00	2.78	2.76	2.61	505.180	500.00

2.67 avg.

CORE LABORATORIES, INC.

Petroleum Reservoir Engineering

DALLAS, TEXAS

GEYSERS GEOTHERMAL COMPANY
MISC. WELLS

DATE : 3-26-86
FORMATION :
DRLG. FLUID :
LOCATION :

FILE NO. : 32020-15092
API WELL NO. :
LABORATORY : MIDLAND, TEXAS

FULL DIAMETER ANALYSIS

SAMPLE NUMBER	DEPTH FEET	PERM MAXIMUM	PERM 90 DEG	PERM VERTICAL	HE POR	OIL% POR	WTR% POR	GRAIN DEN M	
1	BARROWS 2 3T/B	0.64	<0.01	11.	3.0	0.0	91.7	2.68	
2	BARROWS 2 4T/B	0.30	0.26	0.70	5.5	0.0	85.7	2.74	
3	CA-958-3A 1CT/B	0.44	0.39	<0.01	1.4	0.0	90.0	2.72	
4	CA-958-3A 2BT/B	0.18	0.13	0.11	1.4	0.0	90.0	2.72	
5	CA-958-3A 5AT	0.12	0.07	0.38	0.9	0.0	57.1	2.71	
6	CA-958-6	0.56	0.39	1.6	2.6	0.0	72.7	2.73	
7	CA-1862-4 1BT/B	3.3	0.85	VF	2.1	0.0	92.5	2.77	VERTICALLY FRACTURED
8	CA-1862-4 1CT/B	0.30	0.25	0.35	2.4	0.0	79.3	2.77	
9	CA-1862-17 FT/B	0.30	0.21	0.41	1.7	0.0	85.7	2.68	
* 10	CA-1862-17G	0.12		0.01	1.8	0.0	66.3	2.66	
11	MLM-3 1CT/B	<0.01	<0.01	<0.01	2.5	0.0	88.9	2.72	
12	MLM-3 3A	<0.01	<0.01	<0.01	2.7	0.0	60.0	2.72	
13	MLM-3 6B	<0.01	<0.01	0.06	3.5	0.0	80.4	2.71	
14	MLM-3 8AT	6.9	0.22	2.3	9.5	0.0	97.9	2.79	

* INDICATES PLUG PERMEABILITY

2.93 avg.

2.42 w/o 9.5

GEYSERS GEOTHERMAL COMPANY
3\26\86
32020-15092

SAMPLE NUMBER	WELL NAME & NUMBER	PORE VOLUME BY SUMMNATION OF FLUIDS (cc)	PORE VOLUME BY HELIUM INJECTION (cc)	WATER LOSS (gm)	INJECTED SATURATION (gm)	GRAIN DENSITY BY SUMMNATION OF FLUIDS (gm/cc)	GRAIN DENSITY BY HELIUM INJECTION (gm/cc)	BULK DENSITY (gm/cc)	BULK VOLUME BY CALIPER (cc)	BULK VOLUME BY ARCHIMEDES (cc)
1	Barrows 3T/B	12.00	12.00	1.00	11.00	2.68	2.65	2.63	402.774	398.00
2	Barrows 4T/B	24.00	28.00	2.00	22.00	2.71	2.72	2.63	509.755	507.00
3	CA-958-3A 1CT/B	9.00	10.00	2.00	7.00	2.72	2.70	2.70	719.630	714.00
4	CA-958-3A 2BT/B	9.00	10.00	2.00	7.00	2.72	2.71	2.70	716.518	713.00
5	CA-958-3A 5AT	4.00	7.00	2.00	2.00	2.70	2.70	2.69	763.022	759.00
6	CA-958-6	8.00	11.00	5.00	3.00	2.71	2.73	2.68	417.485	416.00
7	CA-1862-4 1BT/B	37.00	40.00	17.00	20.00	2.76	2.77	2.73	1937.778	1936.00
8	CA-1862-4 1CT/B	23.00	29.00	10.00	13.00	2.76	2.76	2.72	1212.895	1207.00
9	CA-1862-17 FT/B	5.00	7.00	2.00	3.00	2.67	2.68	2.65		410.00
10	CA-1862-17G	8.00	9.05	4.00	4.00	2.66	2.66	2.63		503.00
11	MLM-3 1CT/B	8.00	9.00	7.00	1.00	2.72	2.70	2.68	365.819	363.00
12	MLM-3 3A	15.00	25.00	5.00	10.00	2.69	2.70	2.65	910.715	904.00
13	MLM-3 6B	41.00	51.00	6.00	35.00	2.69	2.71	2.64	1451.641	1452.00
14	MLM-3 8AT	47.00	48.00	7.00	40.00	2.78	2.76	2.61	505.180	500.00

2.67 avg.

CORE LABORATORIES, INC.

Special Core Analysis

04/30/86

File SCAL-308-86032

EFFECTIVE PERMEABILITY TO OIL

Geysers Geothermal Company — Wells As Noted

Well I.D.	Sample Number	Porosity, percent	Permeability to Air, millidarcys	Effective Overburden Pressure, psi	Specific Permeability to Water, millidarcys	Permeability Ratio, water/air
(4T/B) Barrows 2	2	4.6	0.48	6800	0.027	0.056
CA 958-3A	4	1.4	0.089	2860	0.0015	0.017
CA 1862-4	7	2.6	0.28	5210	*	-
CA 1862-17	10H**	0.9	0.10	8140	0.0017	0.017
MLM 3	14	9.1	1.8	5190	0.040	0.022

*Effectively impermeable with 5210 psi effective confining pressure and 100 psi injection pressure

**1-inch diameter core plug

04/30/86

CORE LABORATORIES, INC.
Special Core Analysis

File SCAL-308-86032

PERMEABILITY TO AIR AND POROSITY

Geysers Geothermal Company — Wells As Noted

Well Identification	Sample Number	Permeability to Air, millidarcys	Porosity, percent
Barrows 2	2	0.48	4.6
CA 958-3A	4	0.089	1.4
CA 1862-4	7	0.28	2.6
CA 1862-17	10H*	0.10	0.9
MLM 3	14	1.8	9.1

*1-inch diameter core plug

WELL: BAR 2
LOCATION: 1799515E 400947N
SURFACE ELEVATION: 2222.
CASING SHOE: 3230.
FLOWRATE (KLBS/HR): 174.

COMMENTS: INITIAL PSIG AT 4769 AND 4774=133 AND 23 RESPECTIVELY.TOTAL BLED DOWN TO 60PSI. WATER LEVEL AT 6300' AS PER PTS LOG 6/18/86.

M.D.	T.V.D	N(-S)	E(-W)	COMP. INC
0.	0.	0.	0.	0.
200.	200.	0.	-3.	-100.
400.	400.	2.	-5.	-100.
600.	600.	4.	-4.	-100.
800.	800.	6.	-2.	-100.
1000.	1000.	9.	2.	-100.
1043.	1043.	10.	3.	0.
1200.	1200.	10.	15.	-100.
1400.	1400.	11.	28.	-100.
1600.	1600.	16.	39.	-100.
1800.	1799.	24.	48.	-100.
2000.	1998.	35.	54.	-100.
2067.	2065.	39.	56.	0.
2200.	2197.	49.	59.	-100.
2400.	2396.	67.	61.	-100.
2600.	2595.	87.	62.	-100.
2800.	2793.	110.	60.	-100.
3000.	2991.	135.	56.	-100.
3200.	3188.	163.	50.	-100.
3230.	3218.	167.	49.	0.
3230.	3218.	167.	49.	-10.
3400.	3386.	193.	40.	-100.
3600.	3583.	225.	29.	-100.
3800.	3780.	261.	18.	-100.
4000.	3976.	300.	6.	-100.
4030.	4005.	306.	4.	0.
4200.	4170.	347.	-8.	-100.
4400.	4363.	395.	-21.	-100.
4487.	4448.	416.	-27.	7.
4600.	4557.	444.	-35.	-100.
4769.	4721.	485.	-47.	51.
4774.	4725.	486.	-47.	9.
4800.	4751.	492.	-49.	-100.
5000.	4944.	541.	-63.	-100.
5060.	5002.	556.	-67.	0.
5200.	5137. 5200	590.	-76.	-100.
5400.	5331.	639.	-89.	-100.
5600.	5524.	689.	-103.	-100.
5800.	5717.	738.	-119.	-100.
5821.	5737.	743.	-121.	10.
6000.	5910.	788.	-136.	-100.
6060.	5968.	803.	-141.	0.
6122.	6027.	821.	-150.	25.
6200.	6101.	843.	-160.	-100.
6206.	6107.	845.	-161.	96.
6260.	6158.	860.	-168.	60.
6400.	6292.	898.	-185.	-100.
6600.	6484.	949.	-207.	-100.
6800.	6677.	997.	-226.	-100.
7000.	6871.	1042.	-241.	-100.
7020.	6891.	1046.	-243.	7.
7057.	6927.	1054.	-245.	0.
7200.	7067.	1083.	-254.	-100.
7239.	7105.	1091.	-256.	0.

5200 - 5137 / 5331 - 5137 x

OPEN HOLE DESCRIPTION

SIZE (IN)	**** INTERVAL ****** TOP	BOTTOM
8.75	3230.	6978.
8.50	6978.	7239.

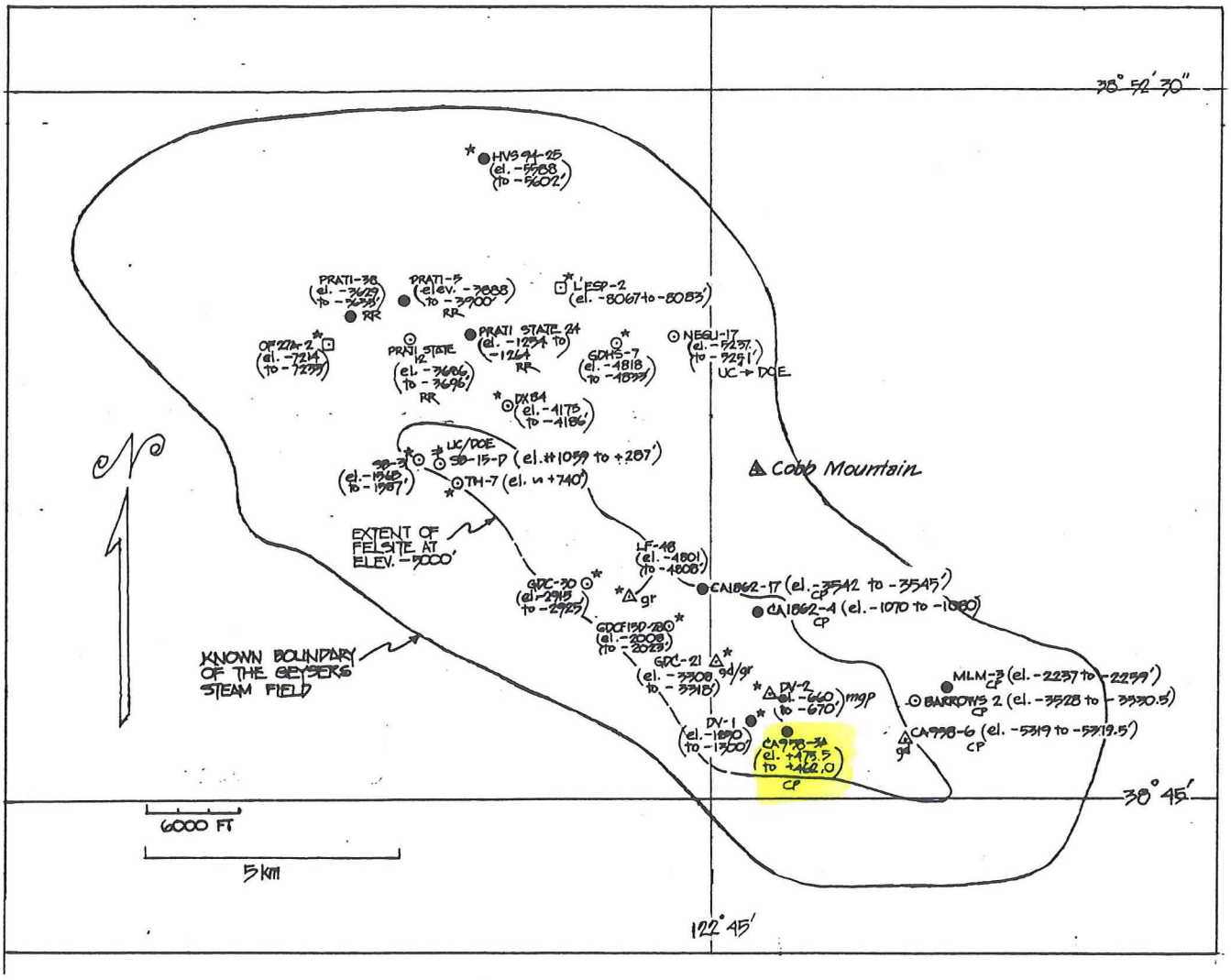
CA958-3A

Sample Depth or Depth Interval	Sample Type (e.g. full-dia. core, rubble, etc.)	Purpose of Sampling (e.g. for fluid-inclusion study	Sampler (Investigator) and Institution	Date Sam-pled	Date of Sample Return
① 744.5-744.7m (2442.7-2443.1 ft)	WHOLE-CORE	ADSORPTION MEAS.	JEAN COOK for. CENGIZ SATIK STANFORD UNIV.	06/24/93	
② portion of piece 1C-7B 2441.6 ft (744.2m)	CORE CHUNK	"	CENGIZ SATIK STANFORD UNIV.	04/19/95	

Core Sample Record

Well or Borehole CA-958-3A Core Depth Interval 2440.5-2454' (743.8-747.9m)

CA9758-3A



CORE LOCATIONS AND ROCK TYPES

ABOVE FIRST STEAM ENTRY

● GRAYWACKE

BELOW FIRST STEAM ENTRY

"normal" steam reservoir
- ⊙ GRAYWACKE
- △ "FELSITE"
  - mgp = microgranite porphyry
  - sparsely porphyritic: gd/gr = hybrid granite/granodiorite; gd = granodiorite; gr = granite

"high-temp." steam reservoir
- ⊡ HORNFELSIC GRAYWACKE

* Continuous core from above and below first steam entry.

* Unocal Proprietary cores

UC — other Unocal cores
RR — Russian River Energy
CP — Calpine
DOE — Dept. of Energy/Geothermal Div.

Location at core depth/elev. — well designation

○ MLM-3 (el. -2237 to -2299')

Core elevation interval

LOCATION MAP — CORES FROM THE GEYSERS STEAM FIELD

Well Name / Company / Well Elev. (at ground level)	Core Location (Top of Core)	Core Depth or Depth Interval — Drilled Depth (DD) / True Vertical Depth (TVD)	Core Elevation or Elevation Interval	First Steam Entry in Well — Drilled Depth (DD) / True Vertical Depth (TVD) / Elevation (EL.)	Rock Type	Comments
PRATI STATE 12 / GEO/CCOC/RREC / EL. 2435 ft	1280 ft S, 820 ft E of NW cor. sec 1, T11N, R9W (MDBM) Sonoma Co., Calif.	DD 6256-6266 ft / TVD 6121-6131 ft	-3686 to -3696 ft	DD 4778 ft / TVD 4718 ft / EL. -2283 ft	graywacke w/ minor argillite	4"-dia. core, most sawn in half longitudinally / poor core recovery / highly fragmented and milled / heavily sampled
PRATI STATE 24 / GEO/CCOC/RREC / EL. 2435 ft	∿1250 ft S, 390 ft W of NE cor. sec 1, T11N, R9W (MDBM) Sonoma Co., Calif.	DD 3983-3993 ft / TVD ∿3850-3860 ft*	(approx.) -1254 to -1264 ft *	DD 6070 ft * * →	graywacke and argillite	4"-dia. core * no drift survey received with core
CA958-3A / Aminoil/Calpine / EL. 2900 ft	850 ft N, 1700 ft E of SW cor. sec 34, T.11N, R8W (MDBM) Sonoma Co., Calif.	DD 2440.5-2454 ft / TVD 2424.5-2438 ft	+475.5 to +462.0 ft	DD 3770 ft / TVD 3711 ft / EL -811 ft	schistose graywacke	4"-dia. core / some pcs. sawn in half longitudinally
CA958-6 / Aminoil/Calpine / EL. 2200 ft.	80 ft N, 830 ft W of SE cor. Sec. 35, T11N, R8W (MDBM) Lake Co., Calif.	DD 7842-7842.5 ft / TVD 7519-7519.5 ft	-5319.0 to -5319.5 ft	DD 5671 ft / TVD 5502 ft / EL -3302 ft	biotite-hornblende-orthopyroxene granodiorite, sparsely porphyritic	4"-dia core / 1 pc. remaining, ∿1" long
CA1862-4 / Aminoil/Calpine / ELEV. 3373 ft	1150 ft S 300 ft W of NE cor. sec 28, T11N, R8W (MDBM) Sonoma Co., Calif.	DD 4455-4465 ft / TVD 4443-4453 ft	-1070 to -1080 ft	DD 4530 ft / TVD 4517 ft / EL. -1144 ft	schistose graywacke	"

CA958-3A

Geysers Core Samples

STORED AT ESRI AS OF 04/13/95

CA-9F3-3A

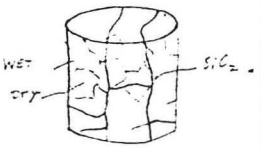
DESCRIPTIONS BY W.T. BOX & M.K. TWICHELL (AMINOIL USA) 1979-1981

Descriptive Log of Core - CA956-3* (Logged from Top)
Cored Interval - 2440' 5" to 2454'

* OLD DESIGNATION

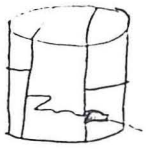
1 A.) 2440'5" to 2440'10" Moderately well foliated, med. gray-green graywacke, foliation predominantly alignment of dark rock frags; foliation is essentially flat in relation to core. Small crenulation in vicinity of high angle micro-fractures. Foliation also results from mod. internal cataclysis. Small (.1 to .6 inch) pods or lenses of SiO_2 occur in small area <2% of core. Pods & lenses generally associate with mod. to high angle 50-90° frac. but also occur parallel to foliation. Section unfractured except for 1 vertical frac. filled with light green siliceous material. Probably mixture of chlorite & SiO_2 some dis. sulfides.

When core dries, form polygonal pattern on surface, the wet areas appear to be silicified zone with some cataclysis. Pod of SiO_2 align along these zones probable slight ø in these zones. Zones are penetrative of entire core. Small vugs present in some frac. zones. Zones very thin - .1 to .05 inch.

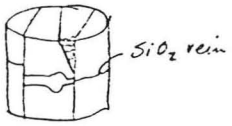


1 B.) 2440'10" to 2441'3" Moderately foliated graywacke A/A pods & lenses of SiO_2 are present 5% of core. SiO_2 band .05 in. thick, encircles core. Pred. SiO_2 but some green chloritic (?) material present. Horiz. vein offset by penetrative vertical cataclastic zones. Vertical zones are chlorite - SiO_2 with diss. sulfides (<1% of fract. fill).

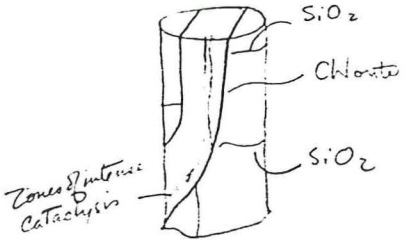
Offset of horiz. SiO_2 vein .5 inch to .1 inch. Pods of SiO_2 are truncated by vert. frac. Polygonal drying pattern observed, but core does dry entirely indicating maybe moisture results from washing core.



1 C.) 2441'3" to 2441'9" Similar to above section, zones of vert. cataclysis assoc. with crenulation of foliation and offset of horiz. SiO_2 vein. Portion of vertic. frac. .5 inch wide may be 2 zones. Polygonal drying pattern also present.



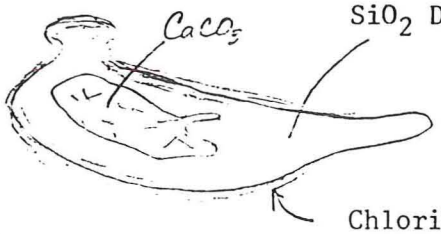
D. Vertical frac. to depth are across all core. Some zones are very green (chlorite) and others appear cataclastic. Some alt. present along these frac.



PHOTO

1 D.) 2441'9" to 2442'9" Moderately foliated gray-green silicic graywacke A/A. Graywacke contains abundant Chl. in matrix and vert. vein. Chl. vein appears to truncate SiO_2 horiz. veing. Zone of cataclysis (crenulation extend vertically through core).

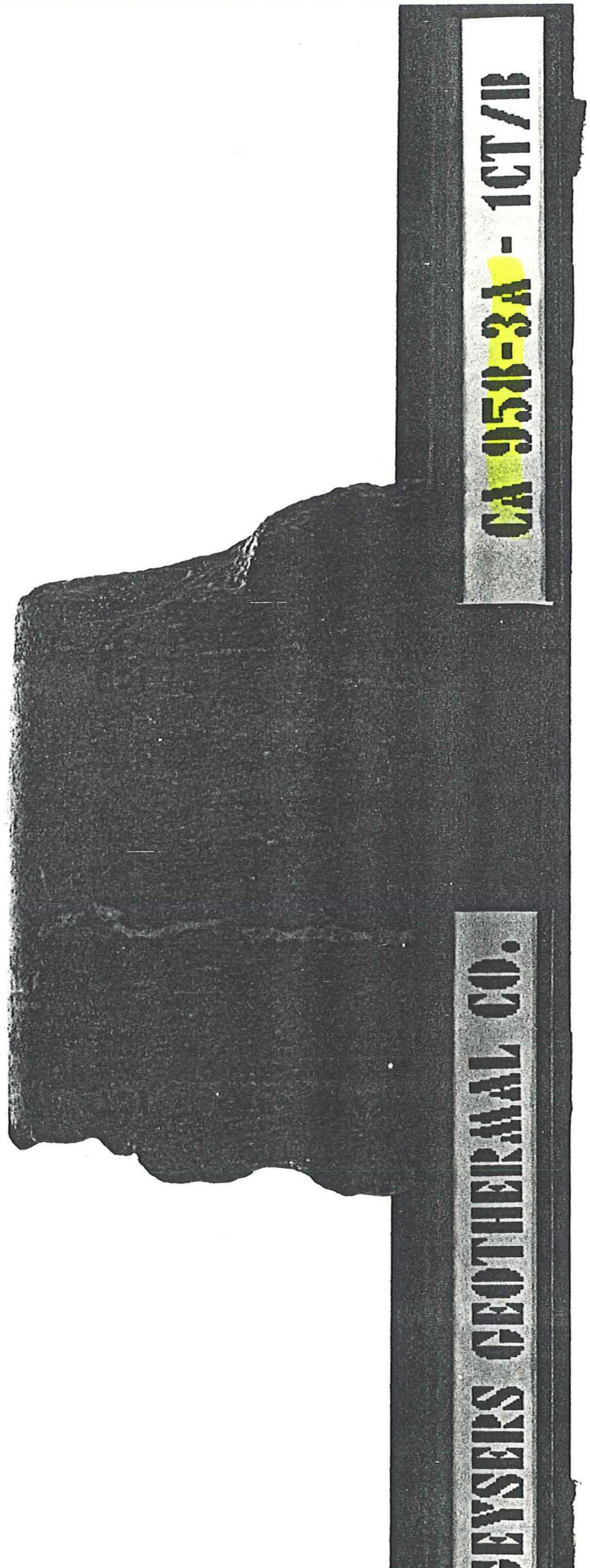
At 2442. Vug .8 inch x 1.4 inch filled with Chl(?) → SiO_2 (sulf.) → $CaCO_3$



SiO_2 Dk. gray-purplish ~~in~~ with sulfides.

Chloritic halo may not be void. fill but alt. of graywacke.

WTB/MKT/1979-81



Near vertical SiO_2 frac. contains small vug w/sulfide.

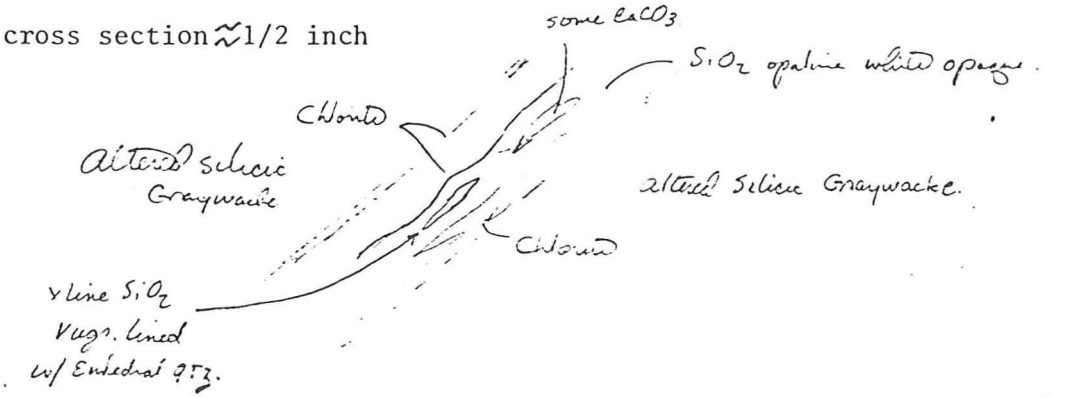
Foliation high crenulated near bottom of section below 2446' 7".

Alt. consists primarily of silicification w/Chl. (Serp.?) and $CaCO_3$ vug filling. Dk. blk. blocky minerals (Tour.) are also present in alt. material. Appear to align on foliation Calcite filling on core is at tip of vein exposed in next section of core. Polygonal drying pattern noted.

E.) 2442'9" To 2443'2" Altered graywacke highly crenulated. Vein across entire sect. .4 inch thick. Crenulation truncated by vein material.

Vein fill is complex. Composed of Chl. (Serp.?) near outer edge qtz. (opaline and Xline) with $CaCO_3$ occuring in pocket (vugs) in portions of vein.

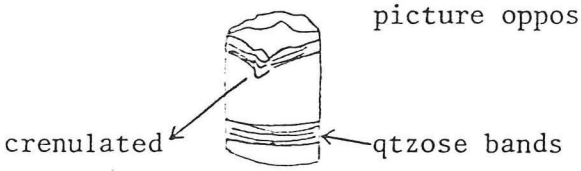
F. Vein cross section ≈1/2 inch



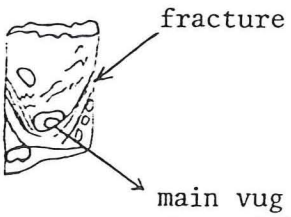
Described by W. T. Box

Core Description
Box #2 - 2443' 2" to 2446' 1" (5 pieces)

2A. Total length 1st piece - 6"; has near vertical fracture running top to bottom; fracture has numerous vugs that are partially to totally filled with qtz. (milky & clear xline), pink stained qtz or axinite, epidote (small amount), silky white pectolite? (small amount), and chlorite? Vugs are rimmed with more chloritic matrix to gw. Total look to fracture is intermittent white, green, and gray banding with vugs elongate in direction of banding. Total size of the vugs (including mineral infilled portion) range from 1/4" to 1-1/2". Fracture trends at right angle to the gw foliation. Foliation developed along bedding planes in gw. More qtzose bands that are gray in color are interlayered with greener lithic gw at bottom of piece.



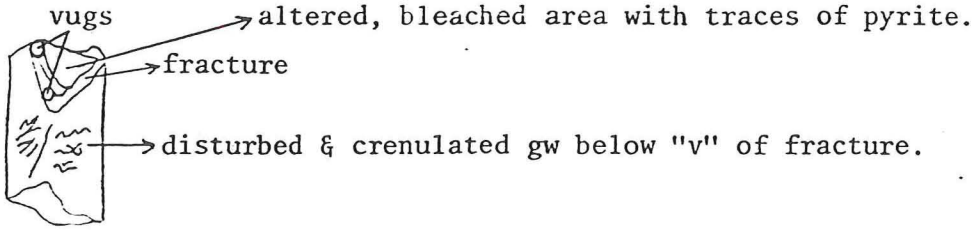
Gw foliation disturbed to crenulated 1" from chloritic rim of fracture.



Bottom of piece of very coarse grained lithic gw not as highly foliated as top of piece. Fracture width at top of piece is 1"... at bottom is well defined vein with rim of chloritic material with infill of xline qtz, pink mineral, & some pectolite? 5/16" in width. Small green chloritic veins crosscut all foliation. Two largest vugs are not within chloritic rim of fracture. Bottom of piece also has elongated vug filled with needle-like xls. of actinolite? Size of vug is 3/4" x 3/16"...this vug not associated with major fracture.

Composition of gw hard to determine-milky qtz. & stretched out black & gray lithic frags with chloritic matrix most prominent. Polygonal drying patterns only prominent on gw section opposite side with fracture.

2B. Total length 2nd piece - 7-1/2". Fracture from bottom of 1st piece slices through top portion of 2nd piece. Total length of the fracture before it penetrates side of core is 2-3/4".



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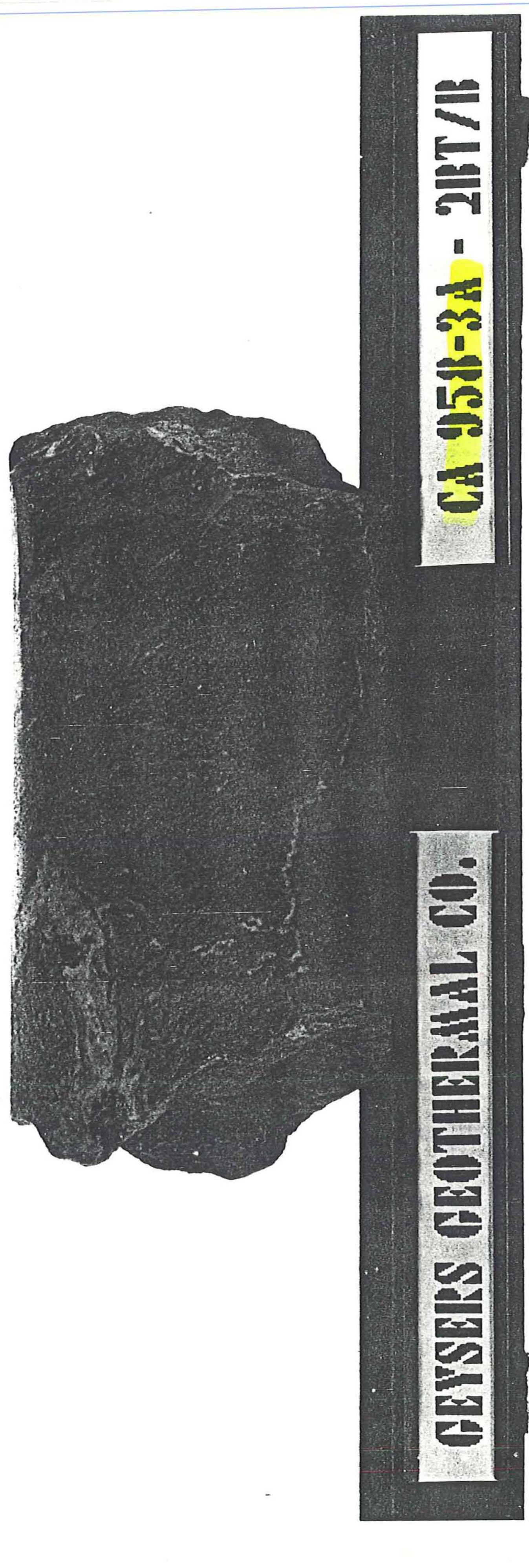

CA 958-3A
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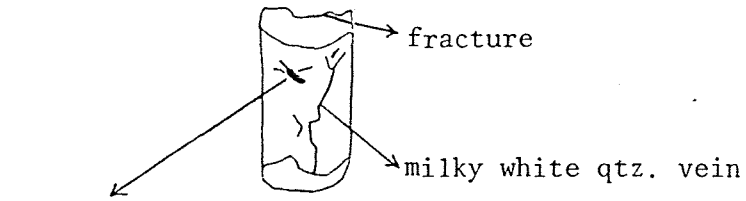
Gw on outer side of fracture (away from core center) is more highly altered. Polygonal drying pattern developed along sheared gw "ridges" or on vertical to steeply dipping chlorite filled fractures. Chlorite fractures are youngest as cross cut foliation & milky qtz. veins.

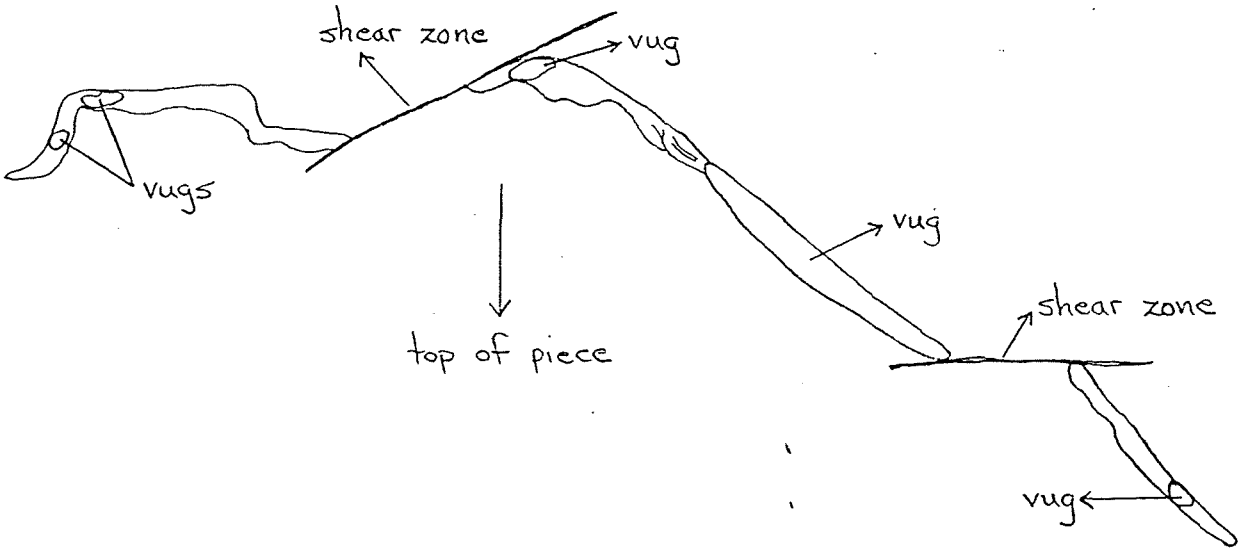


Gw composition A/A only black lith frags are siliceous argillite & gray lith frags look like chert.

Vug at bottom of piece in center of core is 1-1/4" x 1" with actinolite/chlorite rim & qtz. & rosey pink mineral in interior. This vug is definitely not associated with any fracture as it is surrounded by foliated gw.

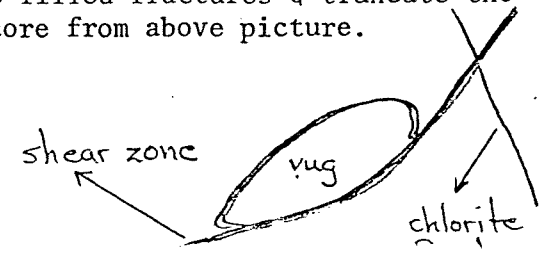
Crenulated "ridges" of gw run at variable angles to the predominant foliation. The two longest "ridges" are 45° & 80° to the foliation. Only 2 short chloritic fractures were seen.

2C. Total length 3rd piece - 6". Piece is mostly gw with qtz. stringers in disturbed & crenulated gw. Three distinct qtz. veins are really one long, narrow infilled vug that has been pulled apart along 2 shear zones denoted by 1 mm wide gray qtzose stringers (may be aligned & stretched out matrix & qtz. clasts from gw) & microscopic veinlets of chlorite. Entire length of vug is 7" around curvature of core.



Top of piece has vug described for bottom of 2nd piece.

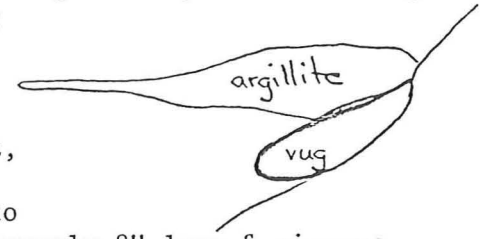
These narrow shear zones cut across the chlorite filled fractures & truncate the infilled vugs. Below view is on other side of core from above picture.

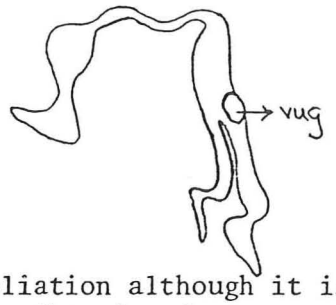


Plane of foliation of gw cuts axial plane of core at approx. 40° angle. Tourmaline emplaced parallel to foliation of gw. Polygonal drying pattern seems to be related to zones of weakness namely shear zones, around vugs, chlorite fractures, & gw pressure ridges (crenulation zones).

2D. Total length 4th piece - 15". Upper 8" is mostly gw with lower 7" being a huge fracture that the core penetrated. Fracture plane is parallel to gw foliation. Gw becomes quite crenulated & disturbed 2" to 3" from margin of fracture.

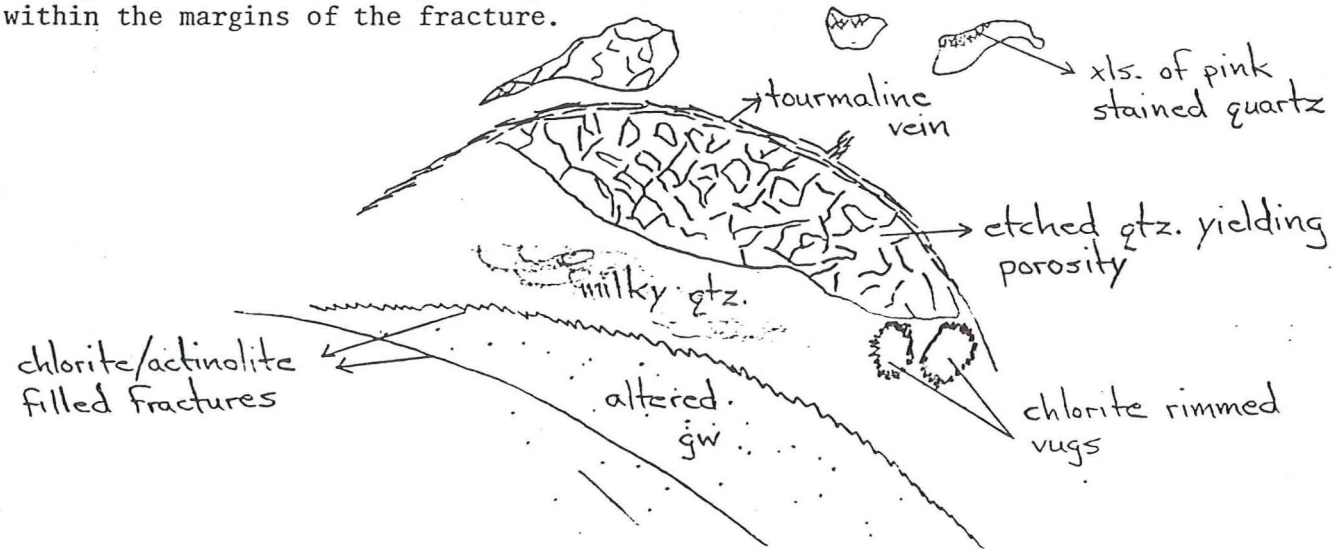
Description of 8" gw portion: Upper 5" to 6" not disturbed; foliation still at 40° angle to axial plane of core; a large, dark gray siliceous argillite fragment is truncated by an infilled vug on the fragment's right side; bottom of argillite fragment is 1-1/2" from top of 15" piece of core; two large stretched out infilled vugs occur in gw portion...the smaller of the two is 4-1/4" long & is elongated parallel to the foliation; rim is chlorite and/or actinolite, then milky qtz, & some calcite growing out into open space; the larger infilled vug is in the disturbed gw next to the fracture & cuts across the foliation...it is rougly 8" long & sinuous.





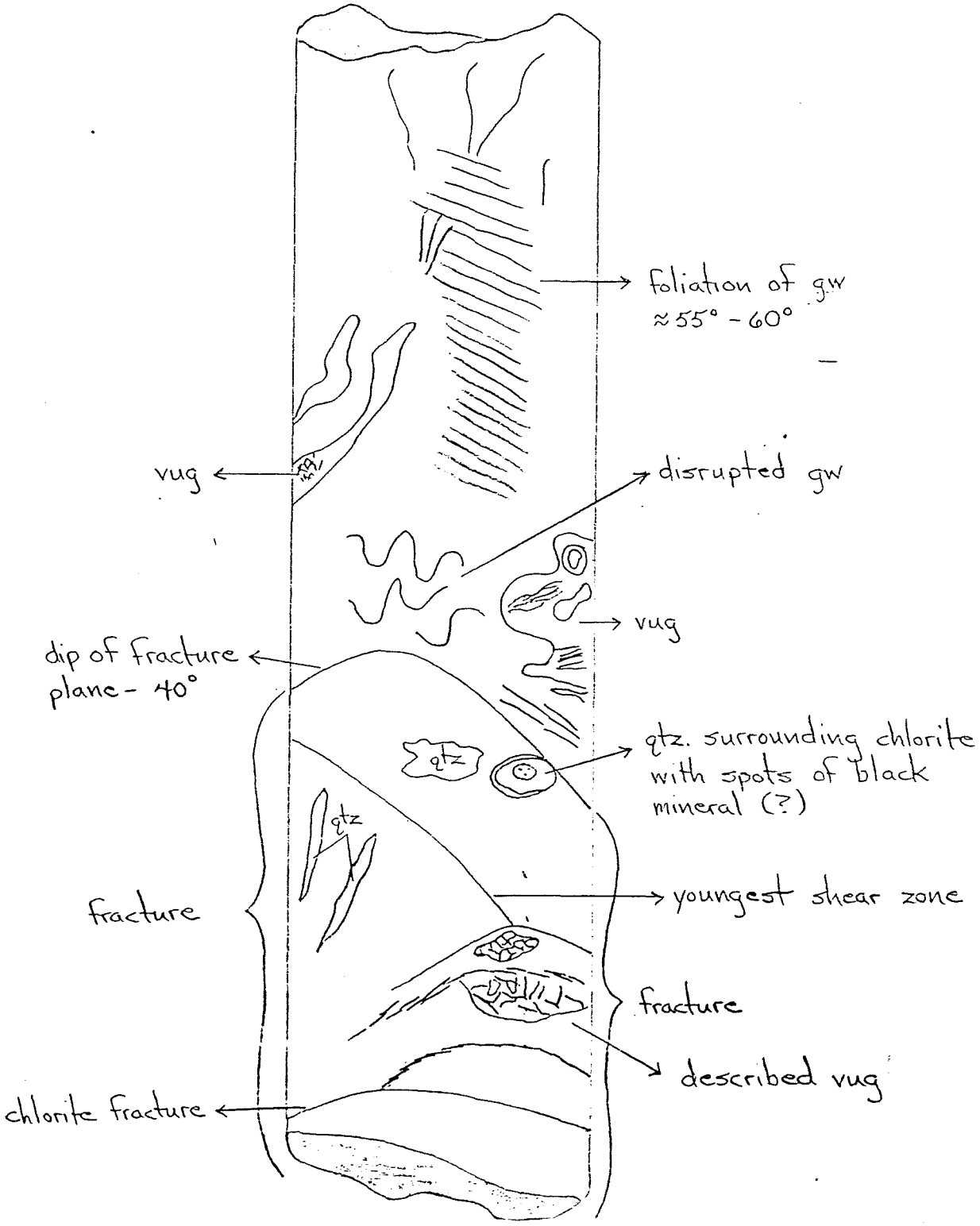
Qtz stringers are fairly common & usually cross cut the foliation; several small vugs are present & may be either the rimmed qtzose variety or the chloritic/actinolite variety. Tourmaline is fairly abundant within the 2" to 3" disturbed zone & seems to have been precipitated parallel to the gw foliation although it is prominent to the top of the 15" piece also along foliation. Chlorite fractures are present but usually trend into infilled vugs. The narrow shear zones, denoted by stretched out, pulverized gw clasts & matrix, seem to be the youngest as they truncate the qtz. stringers & vugs, & cut across the narrow chlorite filled fractures.

Main fracture is predominantly green in color with splotches of milky white qtz. & narrow chloritic? filled fractures most of which trend parallel to the main fracture margin. Gw texture ranges from areas where it is intact to areas where it is completely obliterated leaving only a green, grainy mass with microscopic stringers of light green colored chlorite or clay threading through the mass. The most prominent infilled vug with porosity left is at the side of the core & well within the margins of the fracture.

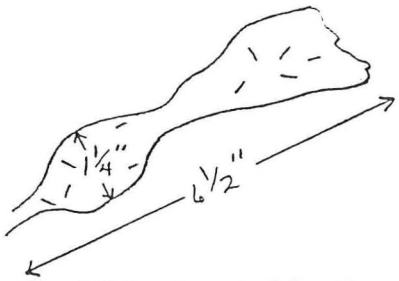


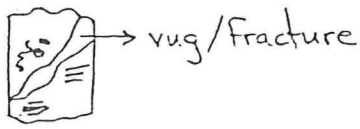
Tourmaline occurrence is rare within the fracture as compared to that in the foliated gw; the tourmaline seems to have been disrupted along with the gw throughout most of the fracture although there are some tourmaline veins. Sulfide content is low in both the foliated gw & in the fracture. Again the youngest event seems to be a narrow (1 mm wide) shear zone of crushed qtz. material that cuts across the disrupted green altered gw mass & the chloritic/actinolite fractures.

Sketch of 15" piece (scale 1/2" = 1")



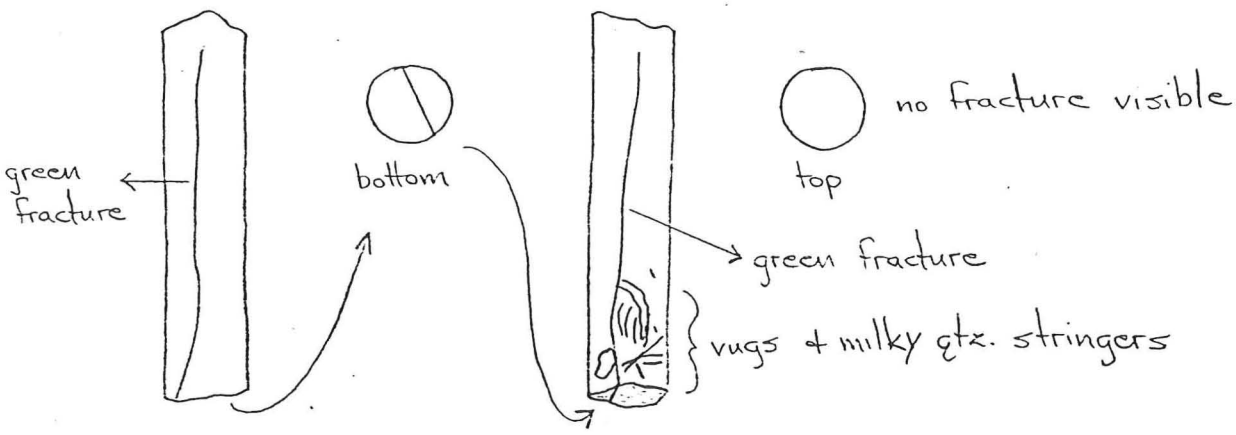
2E. Total length 5th piece - 6.5". This piece is a continuation of the fracture from the bottom of the above piece. The edge of the bottom portion of the fracture is different from the top edge in that there is a large, filled-in vug/fracture that is boudin shaped. Plane of vug/fracture is 40° from axial plane of core piece. The vug/fracture is filled with predominantly milky qtz. with some green segments that may be tourmaline and/or chlorite. Porosity is not as pronounced in this portion of the entire fracture that runs into the above piece. Portions of this piece are completely disrupted so that only a green to whitish-green grainy mass is visible. Pyrite & some microscopic black mineral are present along with some microscopic fractures both within & outside the main fracture. Some of the green chloritic areas may be altered lithic clasts - should have thin section from such an area for determination.





Box #3 2446' 1" to 2448' 9" (2 pieces)

3A. Total length of this piece is 20-1/2". The entire piece is predominantly greenish-gray, semischisotse gw that is fairly well disturbed throughout the entire length of the core piece. No distinct foliation trend is developed in this core piece. The most prominent features are infilled vugs (milky qtz. with green chlorite/actinolite grainy borders), milky qtz. veins, & narrow chlorite filled fractures. The longest green fracture (1-2 mm width) runs the entire length of the core piece & runs roughly parallel to the axial plane of the core...it is most distinct at the bottom of the piece and the plane of the fracture may be followed almost to the top of the piece but then is lost when trying to pick out its path through the core at its top end.



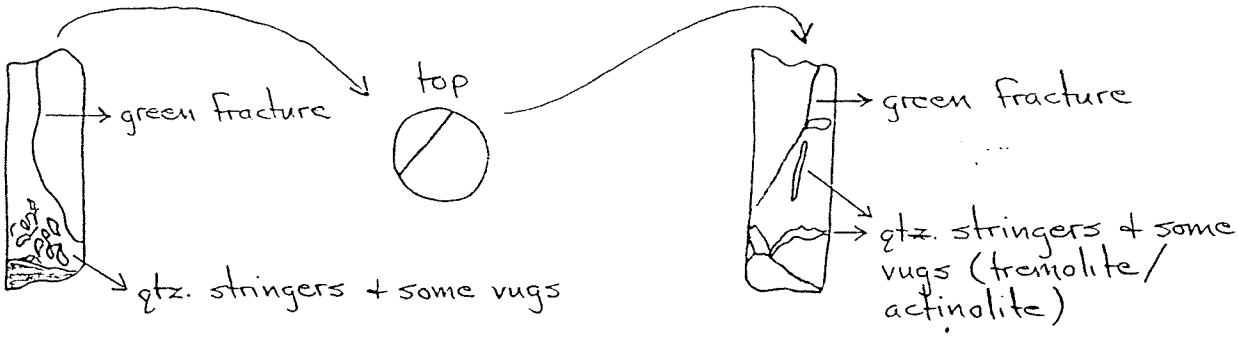
Most of the tremolite/actinolite rimmed qtz. center infilled vugs have some calcite in their center along with purplish qtz. or axinite. They are also elongated parallel to the gw foliation immediately surrounding the vug.

The most disrupted vuggy areas contain tremolite/actinolite xls penetrating milky qtz. These vugs & milky qtz. stringers are scattered throughout the core piece & are not related to any major fracture system although the largest concentration is in one area near the bottom of the core piece.

The narrow green fractures cut across the milky qtz. stringers & either cut or offset the gray qtz. veins. There is no dominant pattern or trend to any of the fractures or veins.

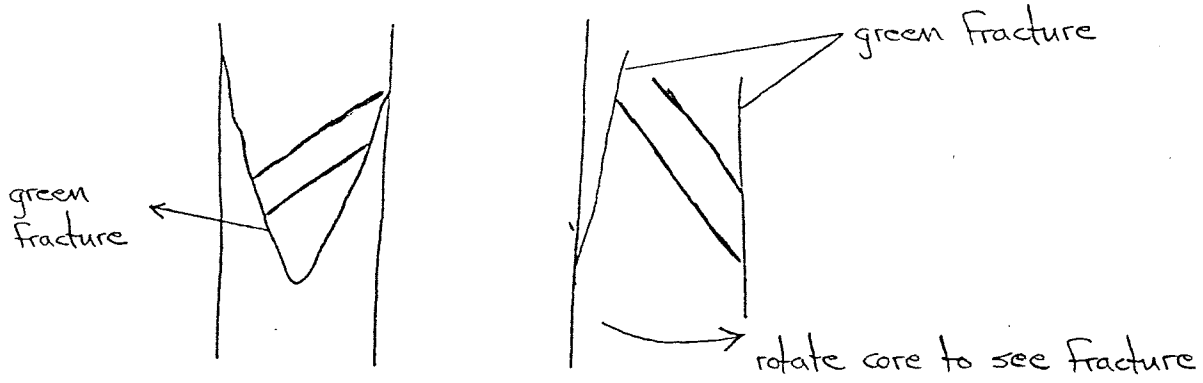
This piece does have a polygonal pattern of qtzose material in small (1-3 mm) veins that may be crushed gw material over most of the disrupted gw of the core piece. Most of these zones have chloritic? veinlets in with gw material.

3B. Total length 2nd piece - 13". The most obvious feature noted as this piece came out of the box is that the gw is predominantly grayer in color than those pieces above & that the greenest colored gw occurs around vugs, green features, & some highly disrupted gw. Most of the gw, when foliation is undisturbed, is dipping at 50° to axial plane of core. The occurrence of tourmaline is not readily apparent in the gw. The green fracture from the piece above continues into this piece... the plane of the fracture penetrates the side of the core 9" down from top of piece.

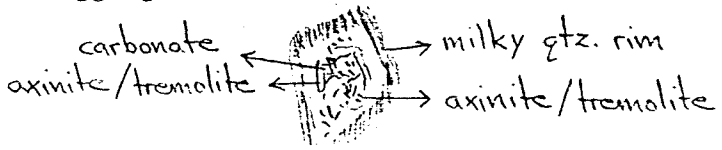


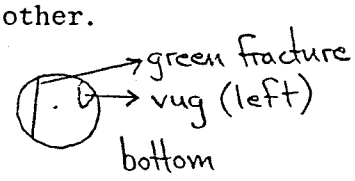
The vugs in this piece are different than those seen above as they have a bluish, silky appearing carbonate (fizzes with HCl) in the center of the vug with or without a soft, gold colored metal (gold or sulfide?) Only 6 vugs contain the metal.

Light to dark gray qtzose material from gw is stretched out into variable linear & lensoid zones that cut across the milky qtz. stringers but which are cut by the green fractures. These qtzose zones trend at 45° to the core's axial plane & form a discontinuous plane through the core piece that changes direction at the green fracture.



A large vug 1-1/2" x 3/4" is located at the side of the core piece on the bottom edge. This vug has a milky qtz. rim with an interior of xline carbonate on one side & a xline aggregate of axinite?/tremolite/actinolite on the other.





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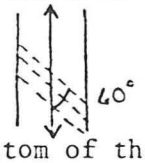
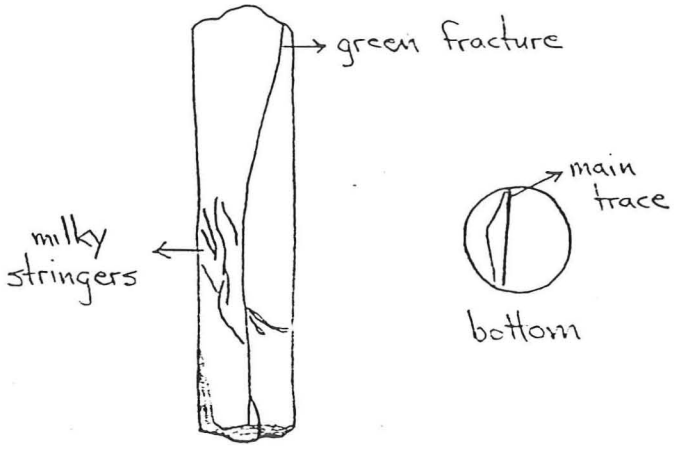
Gw in this piece ranges from green close in to fractures & vugs to med. gray with microscopic chloritic (?) matrix. Most of the gw seems to be med. grained, poorly sorted, & foliated. It also does not have the large gray lithic clasts that box #2 had, although smaller (up to 3 mm) lithic clasts are present.

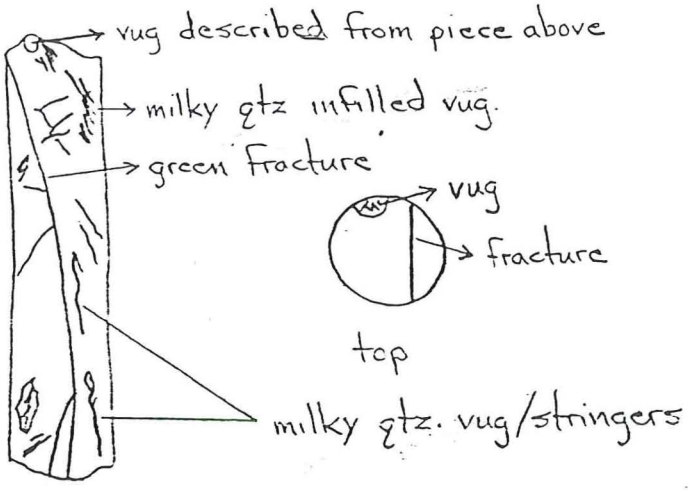
Box #4 2448' 9" to 2451' (1 piece, soon 2)

4A. Entire length 29". The core piece is greener towards the top & grayer towards the bottom; the top has more infilled vuggy areas with greenish disrupted gw around the vuggy areas. The gw is predominantly disrupted in the upper half of the piece but the lower half has a 60° dip to the axial plane of the core.



The green fracture at the bottom of the above core piece extends through the entire length of this core piece. The trend of this green fracture is roughly 10° off the axial plane of the core in the upper 14" of the piece & parallel to the axial plane in the lower portion.

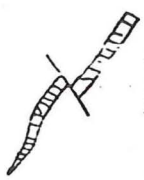




Vug composition is as the piece above with 6 vugs with the gold metal, some with bluish carbonate, & one vug having 2 kinds of sulfide (the gold metal & a brownish-bronze soft metal).

The gw is crenulated or folded due to stress resulting in drag folds, crenulations, folding of stretched out black argillite clasts, & micro-brecciation of said argillite frags. & emplacement of qtz. veinlets. Numerous pressure ridges are present at various angles to the gw foliation.

1/16" x 7/8"



argillite fragment faulted and shot through with qtz. veinlets.

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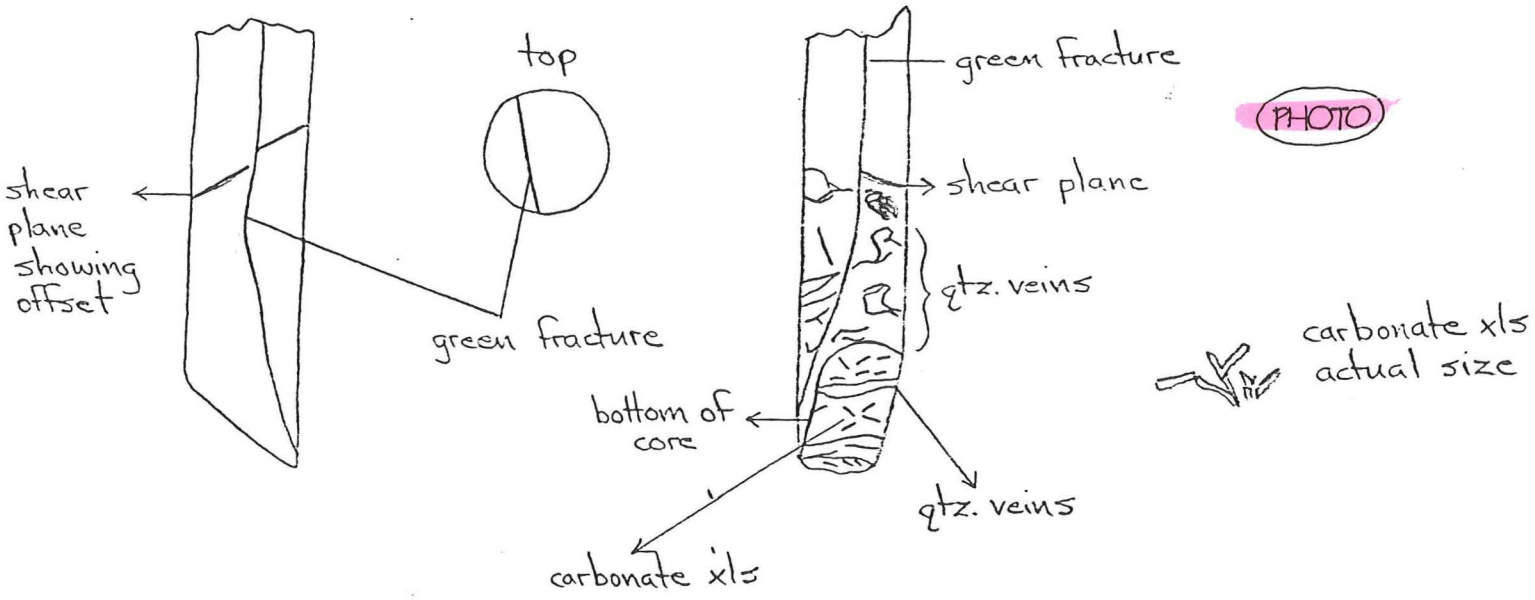
In this piece, milky qtz. stringers may show a stairstep parting. Green fractures are displaced by pressure ridges as are the milky qtz. stringers. Green fractures displace milky qtz. stringers & related infilled fractures & vugs.

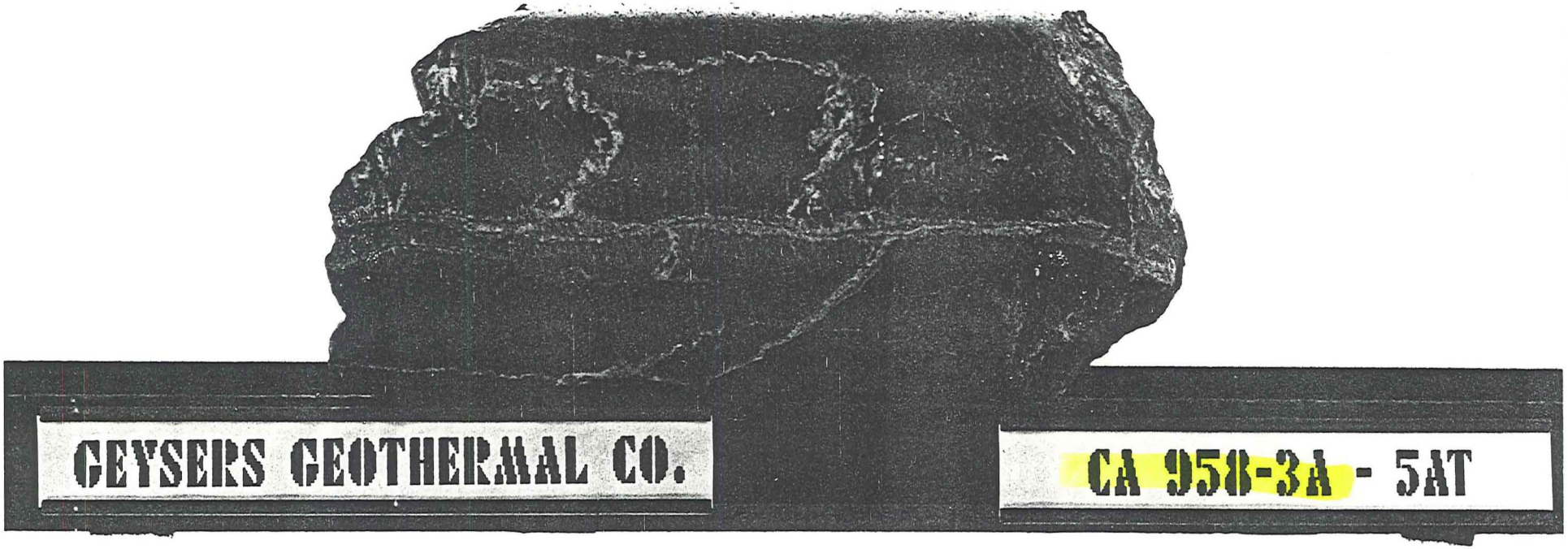
2451' to 2454'

Box #5 (3 pieces, top piece about ready to break 1/3 of way down).

5A. Entire length first piece 21". The top 1/3 of the piece is mainly gw with minute crenulated texture; the lower 2/3 is full of discontinuous fractures & stringers up to 1" in width filled with milky qtz. Most of these are subparallel to the gw foliation. The division between the med. to coarse grained lithic gw in the upper 1/3 & the stretched out, sheared, & locally pulverized gw with abundant milky qtz. veins of the lower 2/3 is a shear plane of finely ground gw material & a finely laminated, gray to cloudy white qtz. vein. Several vugs of the carbonate/tremolite/purple mineral variety are found along this shear plane. The shear plane is 60° from the axial plane of the core & looks to be parallel to the gw foliation. The gw below the shear plane appears to be much finer but in reality is stretched & ground out gw clasts most prominent towards the shear plane but extending to the bottom of the piece. Small black looking tourmaline xls occur sporatically with microscopic chlorite veinlets in areas of highly disrupted gw (shear fractures?) or sometimes with green fractures. The large vertical green fracture from the above piece runs the entire length of this piece exiting at one side at the bottom.



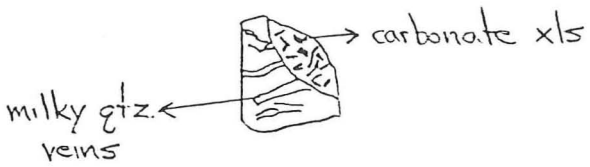
Again as in the above pieces, the milky qtz. veins are distorted & disrupted, some follow the gw foliation, others do not. An interested note, when applying HCl to the milky qtz. veins, there is some fizzing indicating only a small amount of carbonate present...however, when HCl was applied to veins at bottom of piece that cut the veins at a 90° angle, a great amount of fizzing took place indicating


GEYSERS GEOTHERMAL CO.
CA 956-3A - 5AT

CA-958-3A WTB/MKT/1979-81

much more cabonate than originally thought. Perhaps the zone of weakness that this piece broke along had carbonate xls precipitated along its length & these xls are splayed across the milky qtz. veins exposed along the cut. The green fracture displaces the shear plane on one side of the core by 5/8"...there is no defined displacement on the other side of the core as the shear plane is not well developed along a defined zone (right sketch above).

5B. 2nd piece - 5". This piece is a continuation of the bottom of the piece above. Basically the large milky white qtz. veins are the most prominent feature in the gray stretched out, ground up gw. Carbonate xls are splayed across the cut surface as in piece above.



5C. 3rd piece - 13-1/2". This piece is predominantly gray, finely crenulated gw from top to bottom. Not many qtz. veins are present in this piece. Some of the gw material has been pulverized & stretched out into finely laminated lenses. The piece is hard to describe because it has been cut & scraped by the blades in the end of the core barrel. A few vugs, mainly of milky qtz., some tremolite/actinolite, & purple mineral are present. Basically most prominent are the small folds & crenulations that have disrupted the gw.

Described by Mary K. Twichell

/aa

3/19/79

04/30/86

CORE LABORATORIES, INC.
Special Core Analysis

File SCAL-308-86032

PERMEABILITY TO AIR AND POROSITY

Geysers Geothermal Company — Wells As Noted

Well Identification	Sample Number	Permeability to Air, millidarcys	Porosity, percent
Barrows 2	2	0.48	4.6
(2BT/B) CA 958-3A	4	0.089	1.4
CA 1862-4	7	0.28	2.6
CA 1862-17	10H*	0.10	0.9
MLM 3	14	1.8	9.1

*1-inch diameter core plug

04/30/86

CORE LABORATORIES, INC.
Special Core Analysis

File SCAL-308-86032

EFFECTIVE PERMEABILITY TO OIL

Geysers Geothermal Company — Wells As Noted

Well I.D.	Sample Number	Porosity, percent	Permeability to Air, millidarcys	Effective Overburden Pressure, psi	Specific Permeability to Water, millidarcys	Permeability Ratio, water/air
Barrows 2	2	4.6	0.48	6800	0.027	0.056
(2BT/B) CA 958-3A	4	1.4	0.089	2860	0.0015	0.017
CA 1862-4	7	2.6	0.28	5210	*	-
CA 1862-17	10H**	0.9	0.10	8140	0.0017	0.017
MLM 3	14	9.1	1.8	5190	0.040	0.022

*Effectively impermeable with 5210 psi effective confining pressure and 100 psi injection pressure

**1-inch diameter core plug

GEYSERS GEOTHERMAL COMPANY
MISC. WELLS

DATE : 3-26-86
FORMATION :
DRLG. FLUID:
LOCATION :

FILE NO. : 32020-15092
API WELL NO.:
LABORATORY : MIDLAND, TEXAS

FULL DIAMETER ANALYSIS - SUMMATION OF FLUIDS

	SAMPLE NUMBER	DEPTH FEET	PERM MAXIMUM	PERM 90 DEG	PERM VERTICAL	FLD FOR	OIL% FOR	WTR% FOR	GRAIN DEN M	
	1	BARROWS 2 3T/B	0.64	<0.01	11.	3.0	0.0	8.3	2.68	
	2	BARROWS 2 4T/B	0.30	0.26	0.70	4.7	0.0	8.3	2.71	
	3	CA-958-3A 1CT/B	0.44	0.39	<0.01	1.3	0.0	22.2	2.72	
	④	CA-958-3A 2BT/B	0.18	0.13	0.11	1.3	0.0	22.2	2.72	
	5	CA-958-3A 5AT	0.12	0.07	0.38	0.5	0.0	50.0	2.70	
	6	CA-958-6	0.56	0.39	1.6	1.9	0.0	62.5	2.71	
	7	CA-1862-4 1BT/B	3.3	0.85	VF	1.9	0.0	46.0	2.76	VERTICALLY FRACTURED
	8	CA-1862-4 1CT/B	0.30	0.25	0.35	1.9	0.0	43.5	2.76	
	9	CA-1862-17 FT/B	0.30	0.21	0.41	1.2	0.0	40.0	2.67	
*	10	CA-1862-17G	0.12		0.01	1.6	0.0	75.0	2.66	
	11	MLM-3 1CT/B	<0.01	<0.01	<0.01	2.2	0.0	87.5	2.72	
	12	MLM-3 3A	<0.01	<0.01	<0.01	1.7	0.0	33.3	2.69	
	13	MLM-3 6B	<0.01	<0.01	0.06	2.8	0.0	14.6	2.69	
	14	MLM-3 8AT	6.9	0.22	2.3	9.4	0.0	14.9	2.78	

* INDICATES PLUG PERMEABILITY

WELL: 958-3A
LOCATION: 1791167E 399807N
SURFACE ELEVATION: 2958.
CASING SHOE: 2408.
FLOWRATE (KLBS/HR): 192.

COMMENTS: Didn't reach felsite

M.D.	T.V.D	N(-S)	E(-W)	COMP. INC
0.	0.	0.	0.	0.
200.	200.	-2.	-3.	-100.
400.	400.	-3.	-7.	-100.
498.	498.	-3.	-8.	0.
600.	600.	-3.	-10.	-100.
800.	800.	-2.	-12.	-100.
1000.	1000.	0.	-15.	-100.
1049.	1049.	1.	-15.	0.
1200.	1201.	-1.	-14.	-100.
1400.	1401.	3.	-15.	-100.
1557.	1557.	12.	-18.	0.
1600.	1600.	14.	-19.	-100.
1800.	1799.	33.	-25.	-100.
2000.	1996.	63.	-33.	-100.
2127.	2120.	89.	-39.	0.
2200.	2191.	107.	-43.	-100.
2285.	2273.	128.	-48.	0.
2400.	2384.	158.	-55.	-100.
2408.	2392.	160.	-55.	0.
2408.	2392.	160.	-55.	-10.
2558.	2537.	195.	-64.	0.
2600.	2578.	205.	-67.	-100.
2800.	2771.	254.	-81.	-100.
3000.	2965.	301.	-95.	-100.
3051.	3014.	313.	-99.	0.
3200.	3159.	347.	-109.	-100.
3400.	3353.	393.	-123.	-100.
3516.	3466.	420.	-131.	0.
3600.	3547.	440.	-137.	-100.
3770.	3711.	480.	-150.	230.
3800.	3740.	488.	-152.	-100.
3884.	3822.	508.	-160.	0.
3925.	3862.	518.	-164.	0.

OPEN HOLE DESCRIPTION

	**** INTERVAL ******	
SIZE (IN)	TOP	BOTTOM
10.63	2408.	3928.

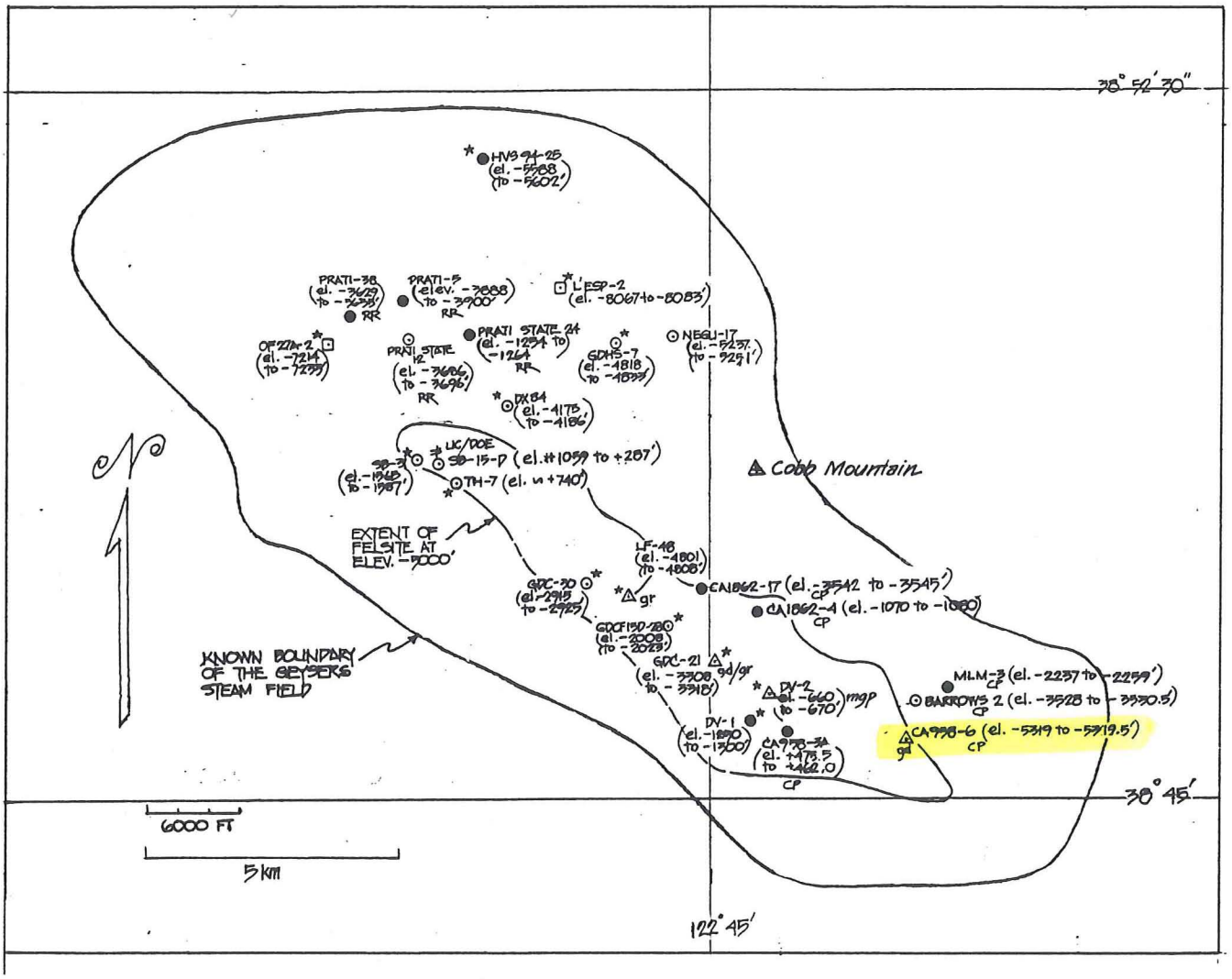
CA958-6

Sample Depth or Depth Interval	Sample Type (e.g. full-dia. core, rubble, etc.)	Purpose of Sampling (e.g. for fluid-inclusion study	Sampler (Investigator) and Institution	Date Sam-pled	Date of Sample Return
① 7842' (2390 m)	PARTIAL CORE	ADSORTION STUDIES	CENGIZ SATIK STANFORD UNIV.	04/06/95	

Core Sample Record

Well or Borehole CA 958-6 Core Depth Interval 7842'-7842.5

CA 958-6



CORE LOCATIONS AND ROCK TYPES

ABOVE FIRST STEAM ENTRY

● GRAYWACKE

BELOW FIRST STEAM ENTRY

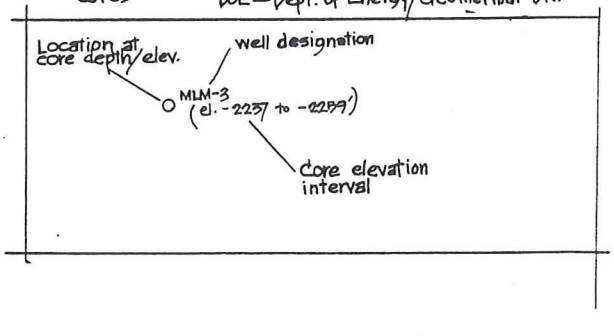
"normal" steam reservoir
- ⊙ GRAYWACKE
- △ "FELSITE"
  - mgp = microgranite porphyry
  - sparsely porphyritic: gd/gr = hybrid granite/granodiorite; gd = granodiorite; gr = granite

"high-temp." steam reservoir
- ⊡ HORNFELSIC GRAYWACKE

\# Continuous core from above and below first steam entry.

* Unocal proprietary cores

UC — other Unocal cores
RR — Russian River Energy
CP — Calpine
DOE — Dept. of Energy/Geothermal Div.



LOCATION MAP — CORES FROM THE GEYSERS STEAM FIELD

Well Name / Company / Well Elev. (at ground level)	Core Location (Top of Core)	Core Depth or Depth Interval — Drilled Depth (DD) / True Vertical Depth (TVD)	Core Elevation or Elevation Interval	First Steam Entry in Well — Drilled Depth (DD) / True Vertical Depth (TVD) / Elevation (EL.)	Rock Type	Comments
PRATI STATE 12 GEO/CCOC/RREC EL. 2435 ft	1280 ft S, 820 ft E of NW cor. sec 1, T11N, R9W (MDBM) Sonoma Co., Calif.	DD 6256-6266 ft TVD 6121-6131 ft	-3686 to -3696 ft	DD 4778 ft TVD 4718 ft EL. -2283 ft	graywacke w/ minor argillite	4"-dia. core, most sawn in half longitudinally poor core recovery highly fragmented and milled heavily sampled
PRATI STATE 24 GEO/CCOC/RREC EL. 2435 ft	∿1250 ft S, 390 ft W of NE cor. sec 1, T11N, R9W (MDBM) Sonoma Co., Calif.	DD 3983-3993 ft TVD ∿3850-3860 ft*	(approx.) -1254 to -1264 ft *	DD 6070 ft *	graywacke and argillite	4"-dia. core * no drift survey received with core
CA958-3A Aminoil/Calpine EL. 2900 ft	850 ft N, 1700 ft E of SW cor. sec 34, T.11N, R8W (MDBM) Sonoma Co., Calif.	DD 2440.5-2454 ft TVD 2424.5-2438 ft	+475.5 to +462.0 ft	DD 3770 ft TVD 3711 ft EL -811 ft	schistose graywacke	4"-dia. core some pcs. sawn in half longitudinally
CA958-6 Aminoil/Calpine EL. 2200 ft.	80 ft N, 830 ft W of SE cor. Sec. 35, T11N, R8W (MDBM) Lake Co., Calif.	DD 7842-7842.5 ft TVD 7519-7519.5 ft	-5319.0 to -5319.5 ft	DD 5671 ft TVD 5502 ft EL -3302 ft	biotite-hornblende-orthopyroxene granodiorite, sparsely porphyritic	4"-dia core 1 pc. remaining, ∿1" long
CA1862-4 Aminoil/Calpine ELEV. 3373 ft	1150 ft S 700 ft W of NE cor. sec 28, T11N, R8W (MDBM) Sonoma Co., Calif.	DD 4455-4465 ft TVD 4443-4453 ft	-1070 to -1080 ft	DD 4530 ft TVD 4517 ft EL. -1144 ft	schistose graywacke	〃

CA958-6

Geysers Core Samples

STORED AT ESRI AS OF 04/15/95

DESCRIBED BY MARY K. TWITCHELL

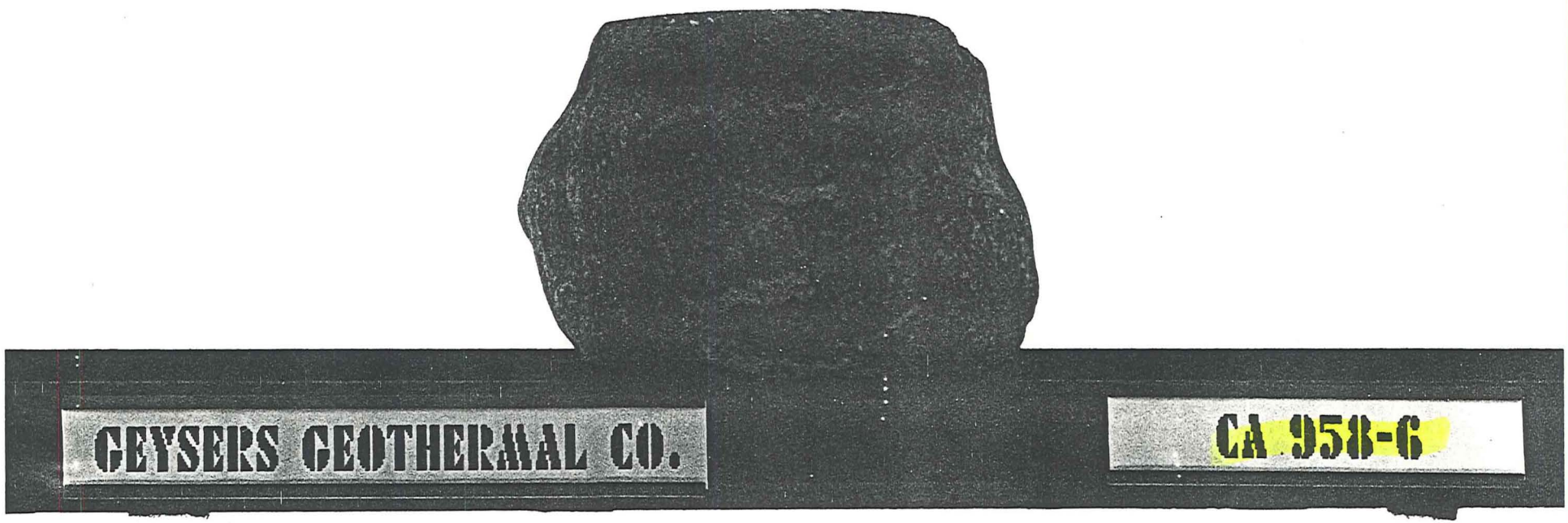
Core Description - CA 958-6 (Felsite)

An attempt to core the felsite at the bottom of the CA 958-6 well was made on October 10, 1984 (during the workover to convert the well to an injection well for Unit 16). The core depth was 7842 feet. Two feet of rock was cored in a four hour period. Approximately six inches of core was recovered (25% recovery). One core piece, approximately 5" in length, and three smaller chunks, approximately 2"×2½", 2"×2½", and 1"×1" in dimensions, were recovered. The ends of the core piece and all three chunks are well rounded and smooth indicating that the core had broken and ground against itself during the drilling process. In addition, there are ridges and grooves, especially along one side of the core piece that may have formed as the core wedged in the core barrel and "plucking" of the rock took place.

The rock is a medium gray pyroxene biotite porphyry. There is a greenish cast to the rock. The minor constituent, the biotite phenocrysts, on average, are very small (< 1 mm) but some range to 3mm. Phenocrysts of feldspar are fairly abundant. The largest singular crystalline phenocrysts (5mm±) display Carlsbad twinning. Most of the feldspar ranges from gray, translucent to cream or white, opaque, with a small amount being clear. There are some large, whitish irregularly shaped patches mainly composed of feldspar crystals but with some associated large crystals (3mm) of red-brown biotite and anhedral quartz.* I would guess that the phenocrysts are potassium feldspar and some plagioclase and that the groundmass is probably mostly plagioclase. The major phenocryst constituent is pyroxene(s) which has altered to chlorite. It is this that imparts the green cast to the rock. Some of the pyroxene(s)

*Some epidote is associated with these patches.

are still relatively "fresh", maintaining an anhedral, vitreous, dark green appearance. Most, however, have altered to a light to medium green, soft chlorite or chlorite-like mineral. It is difficult to estimate how much quartz is present but I would guess (based upon cleavage, nature of fracturing, luster, etc.) that the feldspar content far exceeds the quartz content.



(FELSITE granodiorite

CORE LABORATORIES, INC.
Petroleum Reser r Engineering
DALLAS, TEXAS

GEYSERS GEOTHERMAL COMPANY
MISC. WELLS

DATE : 3-26-86
FORMATION :
DRLG. FLUID:
LOCATION :

FILE NO. : 32020-15092
API WELL NO.:
LABORATORY : MIDLAND, TEXAS

FULL DIAMETER ANALYSIS - SUMMATION OF FLUIDS

	SAMPLE NUMBER	DEPTH FEET	PERM MAXIMUM	PERM 90 DEG	PERM VERTICAL	FLD POR	OIL% POR	WTR% POR	GRAIN DEN M	
	1	BARROWS 2 3T/B	0.64	<0.01	11.	3.0	0.0	8.3	2.68	
	2	BARROWS 2 4T/B	0.30	0.26	0.70	4.7	0.0	8.3	2.71	
	3	CA-958-3A 1CT/B	0.44	0.39	<0.01	1.3	0.0	22.2	2.72	
	4	CA-958-3A 2BT/B	0.18	0.13	0.11	1.3	0.0	22.2	2.72	
	5	CA-958-3A 5AT	0.12	0.07	0.38	0.5	0.0	50.0	2.70	
	6	CA-958-6	0.56	0.39	1.6	1.9	0.0	62.5	2.71	FELSITE 7842' (GRANODIORITE)
	7	CA-1862-4 1BT/B	3.3	0.85	VF	1.9	0.0	46.0	2.76	VERTICALLY FRACTURED
	8	CA-1862-4 1CT/B	0.30	0.25	0.35	1.9	0.0	43.5	2.76	
	9	CA-1862-17 FT/B	0.30	0.21	0.41	1.2	0.0	40.0	2.67	
*	10	CA-1862-17G	0.12		0.01	1.6	0.0	75.0	2.66	
	11	MLM-3 1CT/B	<0.01	<0.01	<0.01	2.2	0.0	87.5	2.72	
	12	MLM-3 3A	<0.01	<0.01	<0.01	1.7	0.0	33.3	2.69	
	13	MLM-3 6B	<0.01	<0.01	0.06	2.8	0.0	14.6	2.69	
	14	MLM-3 8AT	6.9	0.22	2.3	9.4	0.0	14.9	2.78	

* INDICATES PLUG PERMEABILITY

CORE LABORATORIES, INC.

Petroleum Reservoir Engineering

DALLAS, TEXAS

GEYSERS GEOTHERMAL COMPANY
MISC. WELLS

DATE : 3-26-86
FORMATION :
DRLG. FLUID :
LOCATION :

FILE NO. : 32020-15092
API WELL NO. :
LABORATORY : MIDLAND, TEXAS

FULL DIAMETER ANALYSIS

SAMPLE NUMBER	DEPTH FEET	PERM MAXIMUM	PERM 90 DEG	PERM VERTICAL	HE POR	OIL% POR	WTR% POR	GRAIN DEN M	
1	BARROWS 2 3T/B	0.64	<0.01	11.	3.0	0.0	91.7	2.68	
2	BARROWS 2 4T/B	0.30	0.26	0.70	5.5	0.0	85.7	2.74	
3	CA-958-3A 1CT/B	0.44	0.39	<0.01	1.4	0.0	90.0	2.72	
4	CA-958-3A 2BT/B	0.18	0.13	0.11	1.4	0.0	90.0	2.72	
5	CA-958-3A 5AT	0.12	0.07	0.38	0.9	0.0	57.1	2.71	
6	CA-958-6	0.56	0.39	1.6	2.6	0.0	72.7	2.73	
7	CA-1862-4 1BT/B	3.3	0.85	VF	2.1	0.0	92.5	2.77	VERTICALLY FRACTURED
8	CA-1862-4 1CT/B	0.30	0.25	0.35	2.4	0.0	79.3	2.77	
9	CA-1862-17 FT/B	0.30	0.21	0.41	1.7	0.0	85.7	2.68	
* 10	CA-1862-17G	0.12		0.01	1.8	0.0	66.3	2.66	
11	MLM-3 1CT/B	<0.01	<0.01	<0.01	2.5	0.0	88.9	2.72	
12	MLM-3 3A	<0.01	<0.01	<0.01	2.7	0.0	60.0	2.72	
13	MLM-3 6B	<0.01	<0.01	0.06	3.5	0.0	80.4	2.71	
14	MLM-3 8AT	6.9	0.22	2.3	9.5	0.0	97.9	2.79	

* INDICATES PLUG PERMEABILITY

2.93 avg.

2.72 w/o 9.5

GEYSERS GEOTHERMAL COMPANY
3\26\86
32020-15092

SAMPLE NUMBER	WELL NAME & NUMBER	PORE VOLUME BY SUMMNATION OF FLUIDS (cc)	PORE VOLUME BY HELIUM INJECTION (cc)	WATER LOSS (gm)	INJECTED SATURATION (gm)	GRAIN DENSITY BY SUMMNATION OF FLUIDS (gm/cc)	GRAIN DENSITY BY HELIUM INJECTION (gm/cc)	BULK DENSITY (gm/cc)	BULK VOLUME BY CALIPER (cc)	BULK VOLUME BY ARCHIMEDES (cc)
1	Barrows 3T/B	12.00	12.00	1.00	11.00	2.68	2.65	2.63	402.774	398.00
2	Barrows 4T/B	24.00	28.00	2.00	22.00	2.71	2.72	2.63	509.755	507.00
3	CA-958-3A 1CT/B	9.00	10.00	2.00	7.00	2.72	2.70	2.70	719.630	714.00
4	CA-958-3A 2BT/B	9.00	10.00	2.00	7.00	2.72	2.71	2.70	716.518	713.00
5	CA-958-3A 5AT	4.00	7.00	2.00	2.00	2.70	2.70	2.69	763.022	759.00
6	CA-958-6	8.00	11.00	5.00	3.00	2.71	2.73	2.68	417.485	416.00
7	CA-1862-4 1BT/B	37.00	40.00	17.00	20.00	2.76	2.77	2.73	1937.778	1936.00
8	CA-1862-4 1CT/B	23.00	29.00	10.00	13.00	2.76	2.76	2.72	1212.895	1207.00
9	CA-1862-17 FT/B	5.00	7.00	2.00	3.00	2.67	2.68	2.65		410.00
10	CA-1862-17G	8.00	9.05	4.00	4.00	2.66	2.66	2.63		503.00
11	MLM-3 1CT/B	8.00	9.00	7.00	1.00	2.72	2.70	2.68	365.819	363.00
12	MLM-3 3A	15.00	25.00	5.00	10.00	2.69	2.70	2.65	910.715	904.00
13	MLM-3 6B	41.00	51.00	6.00	35.00	2.69	2.71	2.64	1451.641	1452.00
14	MLM-3 8AT	47.00	48.00	7.00	40.00	2.78	2.76	2.61	505.180	500.00

2.67 avg.

WELL: 958-6
LOCATION: 1799503E 400953N
SURFACE ELEVATION: 2222.
CASING SHOE: 4052.
FLOWRATE (KLBS/HR): 70.

COMMENTS: CONVERTED TO INJECTION
WELL WITH 6.63" CSG TO 7834'. BH.LOC EXTRAPOLATED

M.D.	T.V.D	N(-S)	E(-W)	COMP. INC
0.	0.	0.	0.	0.
200.	200.	1.	1.	-100.
400.	400.	3.	4.	-100.
597.	597.	6.	9.	0.
600.	600.	6.	9.	-100.
800.	799.	11.	15.	-100.
1000.	999.	15.	23.	-100.
1061.	1060.	17.	26.	0.
1200.	1199.	24.	34.	-100.
1400.	1398.	29.	45.	-100.
1478.	1476.	29.	49.	0.
1600.	1599.	27.	60.	-100.
1800.	1798.	18.	66.	-100.
1854.	1852.	14.	65.	0.
2000.	1997.	3.	54.	-100.
2134.	2129.	-14.	40.	0.
2200.	2192.	-31.	29.	-100.
2400.	2382.	-82.	-3.	-100.
2590.	2564.	-129.	-32.	0.
2600.	2574.	-131.	-33.	-100.
2800.	2766.	-179.	-59.	-100.
3000.	2958.	-228.	-86.	-100.
3128.	3081.	-260.	-103.	0.
3200.	3149.	-280.	-113.	-100.
3400.	3340.	-333.	-141.	-100.
3600.	3532.	-383.	-167.	-100.
3601.	3533.	-383.	-167.	0.
3800.	3726.	-424.	-189.	-100.
4000.	3919.	-469.	-213.	-100.
4052.	3969.	-481.	-219.	0.
4052.	3969.	-481.	-219.	-10.
4200.	4112.	-516.	-237.	-100.
4400.	4304.	-567.	-263.	-100.
4507.	4406.	-595.	-277.	0.
4600.	4494.	-621.	-290.	-100.
4800.	4684.	-679.	-318.	-100.
5000.	4873.	-738.	-347.	-100.
5066.	4935.	-758.	-356.	0.
5200.	5061.	-800.	-375.	-100.
5400.	5248.	-863.	-403.	-100.
5600.	5436.	-927.	-431.	-100.
5671.	5502.	-950.	-441.	10.
5730.	5557.	-969.	-449.	10.
5800.	5623.	-992.	-459.	-100.
5805.	5627.	-994.	-460.	24.
5989.	5799.	-1054.	-485.	70.
6000.	5809.	-1058.	-487.	-100.
6064.	5869.	-1079.	-496.	0.
6200.	5996.	-1124.	-516.	-100.
6400.	6182.	-1191.	-545.	-100.
6410.	6191.	-1194.	-547.	8.
6600.	6368.	-1259.	-574.	-100.
6800.	6554.	-1328.	-601.	-100.
7000.	6740.	-1397.	-628.	-100.
7062.	6797.	-1419.	-636.	0.
7200.	6925.	-1469.	-653.	-100.
7400.	7109.	-1540.	-678.	-100.
7600.	7294.	-1612.	-703.	-100.
7686.	7374.	-1643.	-714.	0.
7800.	7479.	-1684.	-728.	-100.
7820.	7498.	-1691.	-731.	0.

— 3280 E/

OPEN HOLE DESCRIPTION

SIZE (IN)	**** INTERVAL ****** TOP	BOTTOM
8.75	4052.	7820.

AMINOIL

MWS WTB
LTS
10/9/84

INTEROFFICE COMMUNICATION

AMN–3091

TO	AT	DATE
C. J. Von Hoene	Santa Rosa	May 3, 1984
FROM	**AT**	
M. K. Stroh-Twichell	Santa Rosa	

SUBJECT

Proposed Coring of Felsite in the CA 958-6 Well

It is increasingly evident that various reservoir parameters have been and continue to be strongly affected by the occurrence of felsite. (The term felsite is applied to any light colored samples of acidic igneous rocks that have been drilled at some depth beneath Franciscan assemblage rock.) These were discussed during the technical review session held April 26, 1984 for T. W. Ehring. Major topics included the following:

a. Geological structures -- Fracture orientation and distribution in the surrounding Franciscan assemblage was modified due to the intrusion of the felsite.

b. Geochemistry -- Felsite may directly affect oxygen isotope and boron values, and indirectly impact gas and steam content (e.g. through its influence on permeability and reservoir temperatures).

c. Petrology -- Heat from intrusion of the felsite metamorphosed the surrounding rock to a hornfels. Circulation of heated liquids through the rocks have altered them and left certain minerals crystallized in the fractures.

d. Reservoir rock characteristics -- In analyzing fluid movement through the rock sequence, two major categories of reservoir rocks must be considered: 1.) Franciscan assemblage and 2.) felsite and hornfels.

It is important that more tangible data be collected concerning felsite in order to fully understand its impact on the evolution of the hydrothermal system. There is an excellent opportunity to gather more data on felsite by retrieving a core from the bottom of the CA 958-6 well during its workover and recompletion to an injection well for Unit 16. Retrieval costs, inclusive of rig time, are approximately $10,000. Proposed core analyses include compositional determination, age dating, oxygen isotope value determination, porosity and permeability, and any fracture characterization studies that may be possible given that fractures are present in the cored piece. These analyses are of minimal cost, less than $3,000. The above analyses will furnish data needed to refine the structural geology and geochemical models, and for determination of reservoir rock characteristics that are quite different from Franciscan assemblage rocks. Your approval of this project is requested.

Mary K. Stroh-Twichell

M. K. Stroh-Twichell

cc: W. T. Box, Jr.
J. R. Counsil
K. L. Enedy

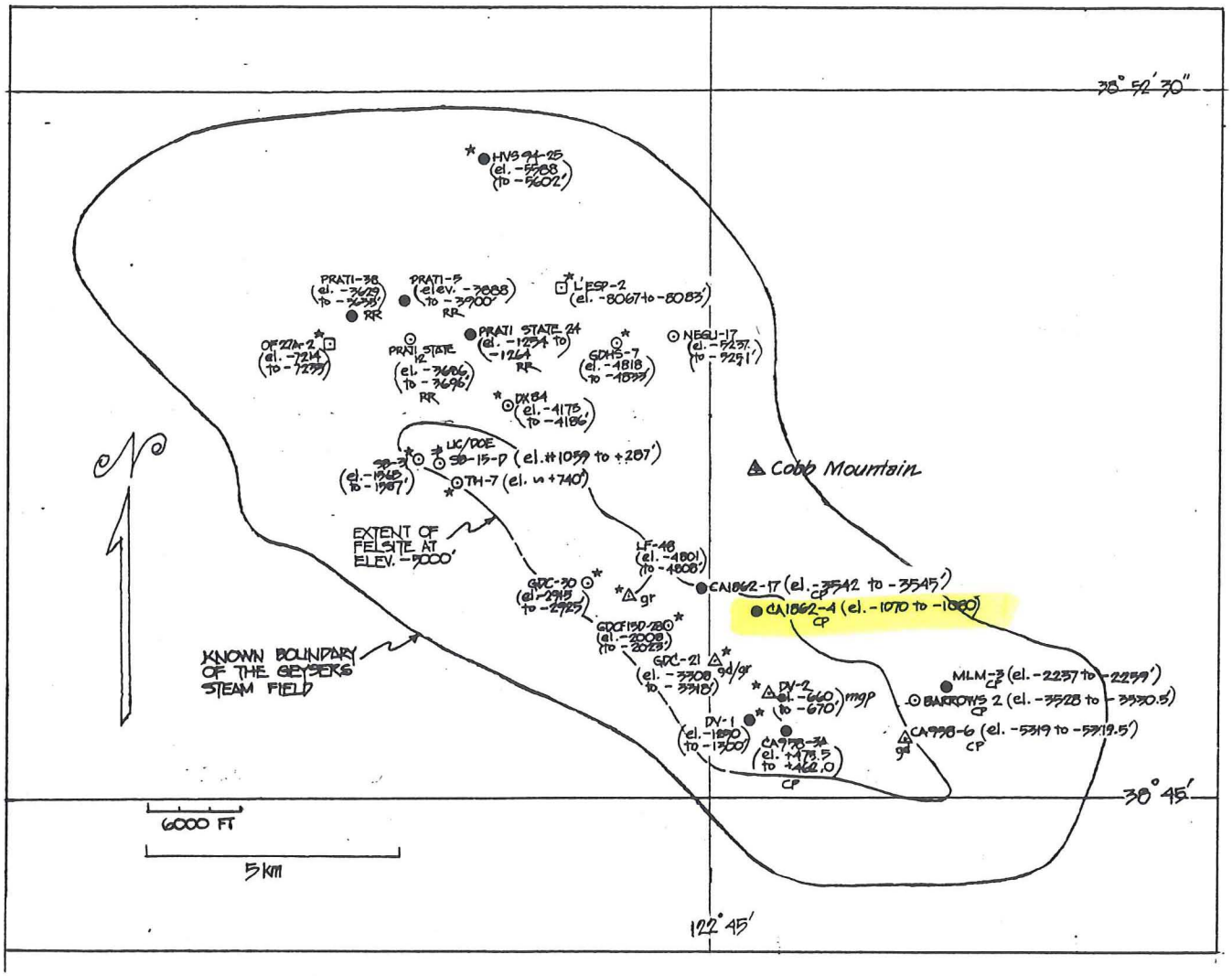
Approved for Injector AFE
C. J. Von Hoene 9/25/84

Sample Depth or Depth Interval	Sample Type (e.g. full-dia. core, rubble, etc.)	Purpose of Sampling (e.g. for fluid-inclusion study	Sampler (Investigator) and Institution	Date Sampled	Date of Sample Return
(1) ~4455' (1357.8 m)	partial core	ADSORPTION STUDIES	CENGIZ SATIK STANFORD UNIV.	04/06/95	
(2) ~4464.8-4465 (1360.8-1360.9')	"	"	"	"	
(3) 4460.7' (1359.6 m) (pc. 1C-T/B)	"	"	"	04/19/95	
(4) 4457' (1358.4 m) (pc. 1B-T/B)	"	"	"	"	

Core Sample Record

Well or Borehole CA1862-A Core Depth Interval 4455-4465' (1357.8-1360.9 m)

CA 1862-4



CORE LOCATIONS AND ROCK TYPES

ABOVE FIRST STEAM ENTRY

● GRAYWACKE

BELOW FIRST STEAM ENTRY

"normal" steam reservoir
- ⊙ GRAYWACKE
- △ "FELSITE"
  - mgp = microgranite porphyry
  - sparsely porphyritic: gd/gr = hybrid granite/granodiorite; gd = granodiorite; gr = granite

"high-temp." steam reservoir
- ⊡ HORNFELSIC GRAYWACKE

* Continuous core from above and below first steam entry.

* Unocal Proprietary cores

UC — other Unocal cores
RR — Russian River Energy
CP — Calpine
DOE — Dept. of Energy/Geothermal Div.

Location at core depth/elev. — well designation

○ MLM-3 (el. -2237 to -2299')

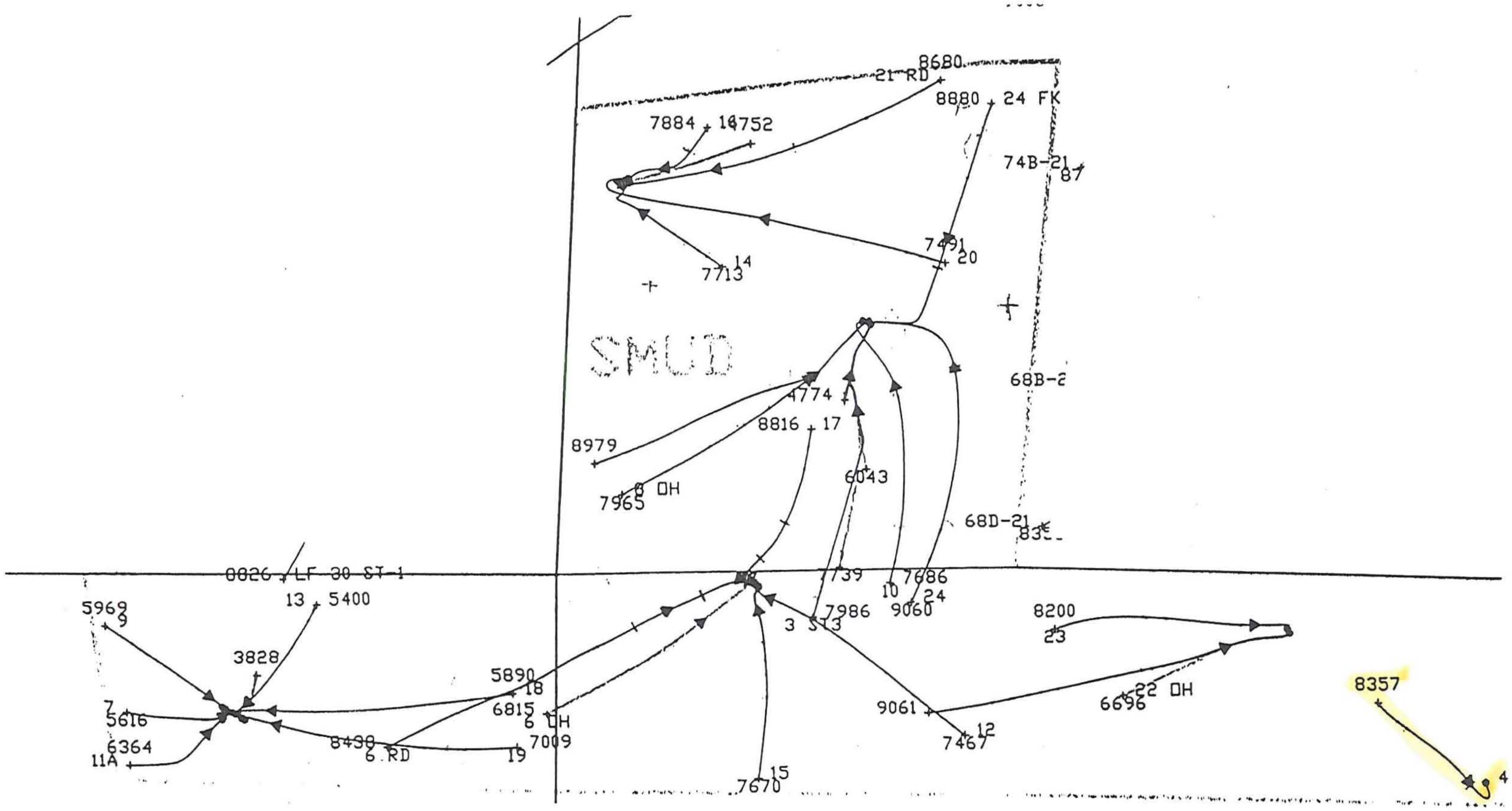
core elevation interval

LOCATION MAP — CORES FROM THE GEYSERS STEAM FIELD

Well Name / Company / Well Elev. (at ground level)	Core Location (Top of Core)	Core Depth or Depth Interval / Drilled Depth (DD) / True Vertical Depth (TVD)	Core Elevation or Elevation Interval	First Steam Entry in Well / Drilled Depth (DD) / True Vertical Depth (TVD) / Elevation (EL.)	Rock Type	Comments
PRATI STATE 12 / GEO/CCOC/RREC / EL. 2435 ft	1280 ft S, 820 ft E of NW cor. sec 1, T11N, R9W (MDBM) Sonoma Co., Calif.	DD 6256-6266 ft / TVD 6121-6131 ft	-3686 to -3696 ft	DD 4778 ft / TVD 4718 ft / EL. -2283 ft	graywacke w/ minor argillite	4"-dia. core, most sawn in half longitudinally / poor core recovery / highly fragmented and milled / heavily sampled
PRATI STATE 24 / GEO/CCOC/RREC / EL. 2435 ft	~1250 ft S, 390 ft W of NE cor. sec 1, T11N, R9W (MDBM) Sonoma Co., Calif.	DD 3983-3993 ft / TVD 3955-3965 ft	-1520 to -1530 ft	DD 6070 ft / TVD 6002 ft / EL. -3567 ft	graywacke and argillite	4"-dia. core
CA958-3A / Aminoil/Calpine / EL. 2900 ft	850 ft N, 1700 ft E of SW cor. sec 34, T.11N, R8W (MDBM) Sonoma Co., Calif.	DD 2440.5-2454 ft / TVD 2424.5-2438 ft	+475.5 to +462.0 ft	DD 3770 ft / TVD 3711 ft / EL -811 ft	schistose graywacke	4"-dia. core / some pcs. sawn in half longitudinally for imaging
CA958-6 / Aminoil/Calpine / EL. 2200 ft.	80 ft N, 870 ft W of SE cor. sec. 35, T11N, R8W (MDBM) Lake Co., Calif.	DD 7842-7842.5 ft / TVD 7519-7519.5 ft	-5319.0 to -5319.5 ft	DD 5671 ft / TVD 5502 ft / EL -3302 ft	biotite-hornblende-orthopyroxene granodiorite, sparsely porphyritic	4"-dia core / 1 pc. remaining, ~1" long
CA1862-4 / Aminoil/Calpine / ELEV. 3373 ft	1150 ft S 300 ft W of NE cor. sec 28, T11N, R8W (MDBM) Sonoma Co., Calif.	DD 4455-4465 ft / TVD 4443-4453 ft	-1070 to -1080 ft	DD 4530 ft / TVD 4517 ft / EL. -1144 ft but MAJOR LOST CIRCULATION ZONE DD 4241-4311' → TVD 4230-4300 / EL. -857 to -927' } SUSPECT THIS WOULD HAVE BEEN A STEAM ENTRY HAD AIR BEEN THE DRILLING FLUID	schistose metagraywacke or graywacke semischist	"

Geysers Core Samples

STORED AT ESRI AS OF 04/15/95


8680
21 RD
8880
24 FK
7884
16
4752
74B-21
87
7491
20
14
7713
SMUD
68B-2
4774
8816
17
8979
6043
8 DH
7965
68D-21
8026
LF 30 ST-1
739
7686
10
24
9060
13
5400
5969
9
7986
3
ST3
8200
23
3828
5890
18
6815
6 DH
9061
22 DH
6696
8357
7
5616
6364
11A
8430
6 RD
7009
19
12
7467
15
7670
4

1862-4

1" : 1000'

1862 -

WELL: 4
LOCATION: 1789407E 407003N
SURFACE ELEVATION: 3395.
CASING SHOE: 4429.
FLOWRATE (KLBS/HR): 70.

COMMENTS: FISH LEFT IN HOLE - TOP AT 7310.

M.D.	T.V.D	N(-S)	E(-W)	COMP. INC
0.	0.	0.	0.	0.
200.	200.	-5.	0.	-100.
400.	400.	-10.	1.	-100.
600.	600.	-15.	2.	-100.
800.	800.	-20.	4.	-100.
1000.	1000.	-26.	6.	-100.
1049.	1049.	-27.	7.	0.
1200.	1200.	-31.	12.	-100.
1400.	1400.	-36.	17.	-100.
1600.	1600.	-42.	21.	-100.
1800.	1799.	-49.	24.	-100.
2000.	1999.	-57.	25.	-100.
2059.	2058.	-59.	25.	0.
2200.	2199.	-74.	27.	-100.
2400.	2399.	-91.	27.	-100.
2600.	2599.	-103.	24.	-100.
2800.	2798.	-109.	19.	-100.
3000.	2997.	-110.	11.	-100.
3017.	3014.	-110.	10.	0.
3200.	3195.	-97.	-6.	-100.
3400.	3394.	-83.	-23.	-100.
3600.	3592.	-68.	-39.	-100.
3800.	3791.	-52.	-55.	-100.
4000.	3989.	-35.	-70.	-100.
4021.	4010.	-34.	-72.	0.
4200.	4189.	-17.	-81.	-100.
4241.	4230.	-13.	-83.	-1.
4400.	4388.	2.	-92.	-100.
4429.	4417.	4.	-94.	-10. ← CORE
4530.	4517.	14.	-101.	25.
4600.	4587.	21.	-105.	-100.
4800.	4785.	40.	-120.	-100.
5000.	4982.	59.	-135.	-100.
5036.	5018.	62.	-138.	0.
5145.	5125.	73.	-146.	5.
5200.	5178.	78.	-151.	-100.
5268.	5245.	84.	-157.	5.
5400.	5374.	97.	-168.	-100.
5600.	5570.	117.	-188.	-100.
5800.	5767.	137.	-209.	-100.
6000.	5964.	158.	-233.	-100.
6003.	5967.	158.	-233.	0.
6200.	6164.	177.	-261.	-100.
6400.	6362.	198.	-289.	-100.
6600.	6561.	220.	-319.	-100.
6800.	6758.	242.	-349.	-100.
7000.	6956.	266.	-380.	-100.
7035.	6990.	270.	-386.	0.
7200.	7150.	289.	-420.	-100.
7295.	7243.	301.	-439.	100.
7400.	7345.	314.	-458.	-100.
7597.	7538.	340.	-492.	20.
7600.	7540.	340.	-493.	-100.
7800.	7736.	368.	-524.	-100.
8000.	7932.	398.	-551.	-100.
8035.	7966.	403.	-555.	0.
8200.	8128.	429.	-574.	-100.
8357.	8282.	454.	-590.	0.

OPEN HOLE DESCRIPTION

SIZE (IN)	**** INTERVAL ****** TOP	BOTTOM
8.75	4429.	8357.

DESCRIPTION BY M.K. TWICHELL (AMINOIL USA) 1981

CA 1862-4 (82-28) Core Description

On Thursday, March 20, 1980, ten feet of foliated graywacke was cored in the CA 1862-4 (82-28) well. The cored interval was from 4455 feet to 4465 feet. All ten feet of the core was recovered. A true measurement of the core is not possible due to the fragmented nature of some of the core samples.

Tray #1 (Top of core--core interval 4455' to 4458' 2'')

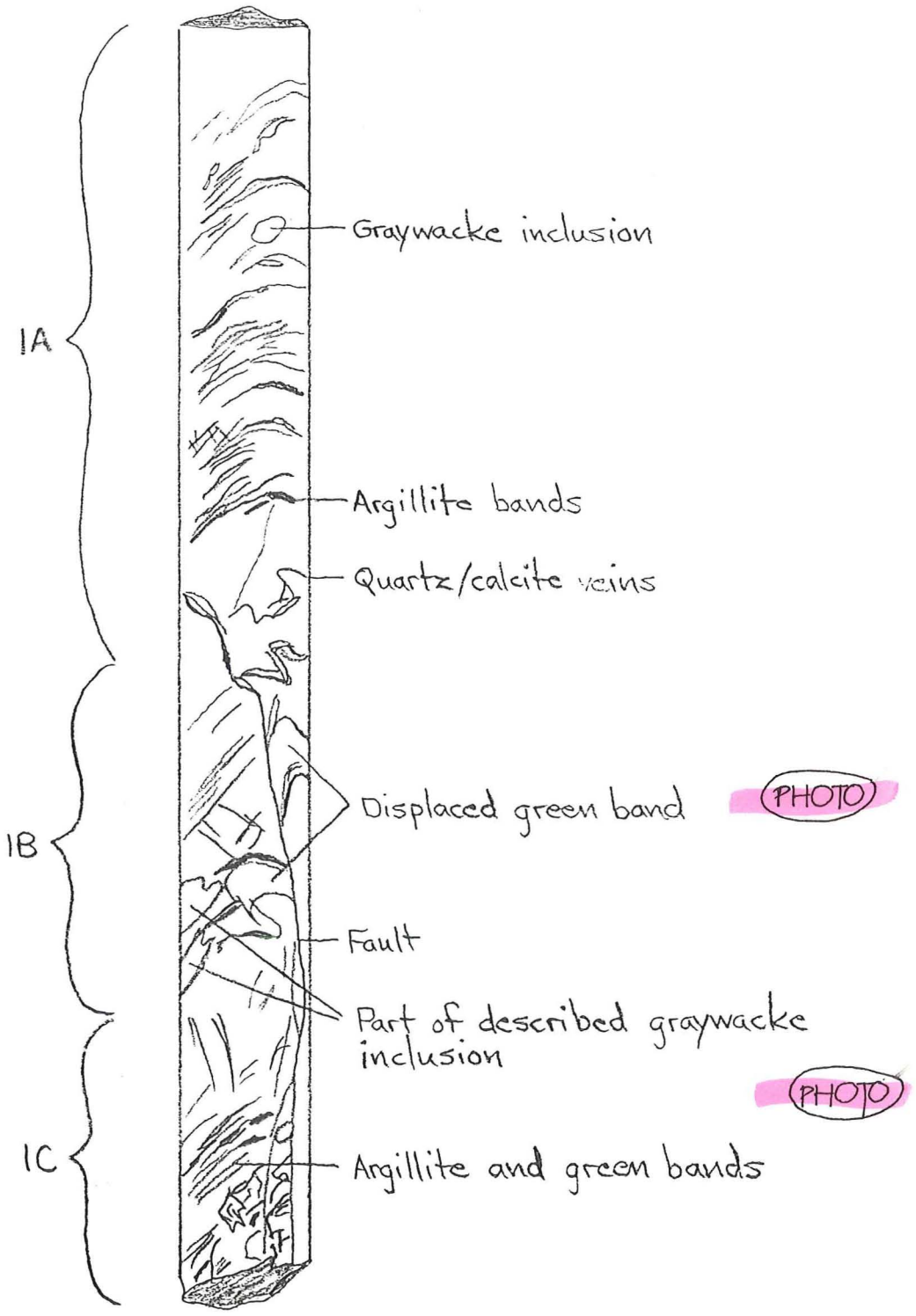
The entire length of the pieces filling tray #1 is 38''. All pieces are foliated graywacke with stringers and pods of altered rock parallel to and cross cutting the foliation.

Section 1A (4455' - 4456' 7'') - foliated graywacke; light, med., dark gray to green color; med. to coarse grained; poorly sorted; quartz-clasts are sometimes distinct in with a black, argillaceous to micaceous partings and discontinuous stringers; also green, chloritic "matrix" present; none of the other clasts are identifiable due to small size but guess that the light gray clasts are probable feldspar and chert, and the darker gray clasts are lith frags. of one sort or another. The strong foliated texture is due to discontinuous black bands of argillite and argillaceous partings that are microscopic to 7mm in width. There are also discontinuous green bands of highly variable width (microscopic to 1 cm) that are probably completely chloritized and altered, very fine grained, mylonized graywacke material. Highly irregular pods and stringers, yellowish-pink, white, and light gray in color, parallel the foliation as well as cut across it. These are composed of pinkish calcite and milky white to translucent quartz. The minerals are mixed together with calcite veinlets penetrating the quartz in a mosaic type pattern. No zonation of quartz at the margin and calcite in the interior was noted. Some of the pods and stringers have green chlorite associated with the above two minerals. It is believed that the pods of calcite and quartz were formed from preferential dissolution of graywacke inclusions (pebble size) that were initially in the graywacke and that were of different composition and/or underwent a different tectonic history (stressed differently) than the graywacke the inclusions were imbedded in. Some of the pods still have some relict graywacke that has not been completely resorbed. (Evidence for graywacke inclusions comes from compression and warping of the graywacke / argillite layers beneath the inclusion, and no deformation of the layers surrounding the inclusion as rock material was deposited around it.) The foliation is approximately at 50° to the axial plane of the core. Many of the argillite bands are highly deformed. Small scale vertical faults, crenulations, folds, and irregular, broken contortions of the argillite bands are all present. The green "graywacke" bands are warped and folded but not to the same degree as the argillite bands. The argillaceous partings within the graywacke are often crenulated and the graywacke itself has a cataclastic texture. Argillite bands appear in both

the graywacke and the green "graywacke" bands. The calcite/quartz veinlets and stringers are both parallel to and cross cut the foliation. They are found in all of the above rock types. They are highly irregular in width, ranging from microscopic to 6mm, and often appear to be discontinuous along their length because of this. Most of the larger stringers parallel the foliation. The high angle calcite/quartz filled fractures range from parallel to the axial plane to 40° from the axial plane of the core. Maximum width of these fractures is roughly 2mm. Some of these cannot be traced as through going fractures but are lost in the calcite/quartz stringers that parallel the foliation. The most common sulfide was pyrite, and only a thin "seam" was found where cubic pyrite was disseminated in coarse, unchloritized graywacke along either side of a thin (< 1/4 mm) argillite band. The pyrite crystals were less than 1/2mm in size. Using the binocular microscope on high power (40X), cubic pyrite, drusy pyrrhotite, and a very small amount of crystalline sphalerite was found in a small lense (1/2cm by 2cm) of altered, chloritized graywacke parallel to the foliation. This lense was surrounded by argillite and "green" chloritized graywacke bands.

Section 1B (4456' 7" - 4457' 6") - foliated graywacke as described above. The prominent features in this core piece are a large (approx. 5 1/2" by 5"), altered graywacke inclusion and a faulted and folded green chloritized "graywacke" band. The altered graywacke inclusion is grayish-white and contains gray, translucent quartz clasts (up to 1mm in size), and is cross cut by numerous creamy pink colored calcite veins ranging up to 5mm in width. Under high power (40X) binocular examination, there is quartz associated with some of the calcite veins. A few veins have small (1mm) vuggy areas where microscopic quartz crystals protrude through the calcite into the open space. Surrounding the calcite veins is gray, translucent, drusy quartz and a soft, earthy, white clay(?). These occupy most of the area not cut by the calcite veins. Sporadic rare traces of cubic pyrite and sphalerite are present in this inclusion. The green chloritized band displaced by a fault is irregular in thickness and interfingers with smaller, dark gray to black argillite bands. The bands form a prominent chevron fold in proximity to the fault. The axial plane of the fold trends roughly parallel to the fault plane. There is approx. 2" displacement of the green band. The fault itself trends at 20° to the axial plane of the core. It is mineralized over much of its length but in some places is defined by strung out cataclastic graywacke and micaceous argillite bands. The mineralization along the fault is much the same as in the graywacke inclusion. However, white, silky to fibrous natrolite (?) "laths" are present in the quartz and calcite mineralization of the fault. The laths are less than 2mm in length. Under high power examination (40X), small stringers of chlorite/serpentinite containing sphalerite and sometimes pyrite and minor pyrrhotite are present within the cataclastic graywacke or along the margins of quartz/calcite stringers in proximity to the green band. These closely resemble the smaller, discontinuous argillite bands.

PHOTO


Graywacke inclusion
Argillite bands
Quartz/calcite veins
Displaced green band
PHOTO
Fault
Part of described graywacke inclusion
PHOTO
Argillite and green bands
1A
1B
1C
1 cm = 2"

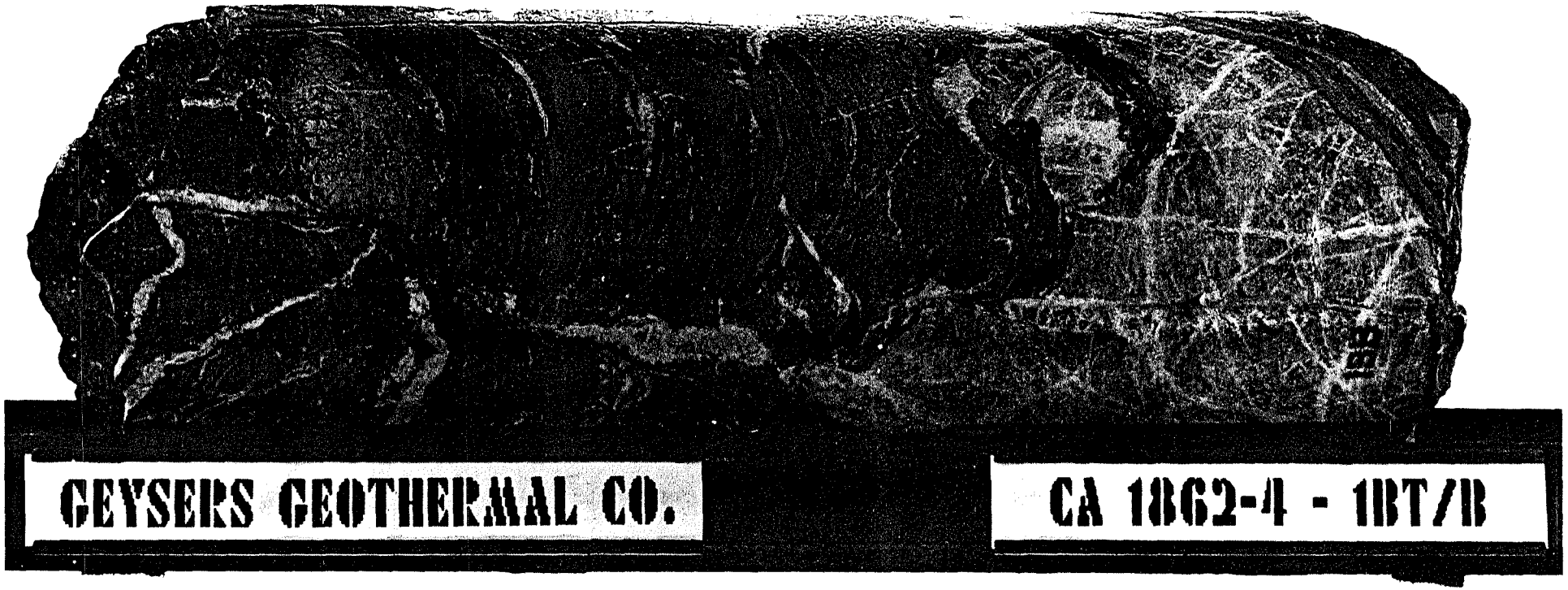
Section 1C (4457' 6'' - 4458' 2'') - continued foliated, chloritized, cataclastic graywacke as described for Section 1A the fault continues into this piece of the core. The fault plane ranges between 5° and 10° from the axial plane of the core. A thin (1mm in width) band of cataclastic graywacke and argillite strung out parallel to the fault marks the fault's plane through the core piece. On one side of this plane, the foliated graywacke butts up against the strung out graywacke and argillite. On the other side, a zone 2 1/2 to 3 cm in width of disrupted graywacke inclusions, argillite stringers, green bands, and quartz/calcite veins and stringers butt up against the strung out graywacke/argillite. This zone appears to have both plastic deformation ("flow" of argillaceous and green bands into the zone) and brittle deformation (fault gouge). The fault displaces an interval of argillite and green bands that parallel the foliation. The quartz/calcite veins and stringers both parallel and cross cut the foliation as described in Section 1A. A white clay(?) and traces of chlorite are associated with the quartz and chlorite of many of the veins. A reddish-brown, soft substance is present in some of the vuggy areas of the more vertical quartz/calcite veins. This may be something introduced from the drilling process. Some traces of sphalerite and pyrite were noted in chloritized and altered graywacke under high power (40X) binocular scope examination. Some serpentinite(?) was also noted in these areas. A few graywacke inclusions showed metamorphism into the blueschist facies. These inclusions were found in the argillite/green band/graywacke interval.

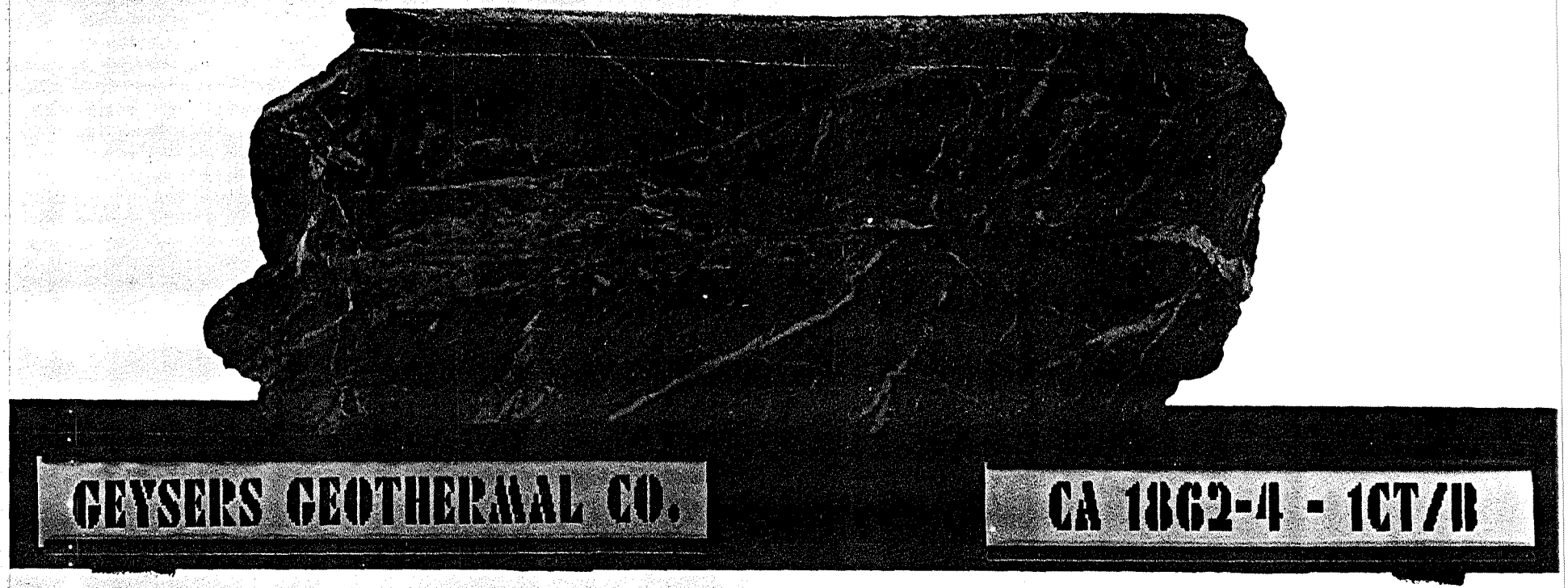
PHOTO

Tray #2 (cored interval 4458' 2'' to 4460' 8'')

The entire length of the pieces filling tray #2 is 29''. All the pieces are foliated graywacke. The first piece is the most variable with large graywacke inclusions and green "graywacke" bands within the foliated graywacke.

Section 2A (4458' 2'' - 4459' 3'') - foliated, altered, chloritized graywacke as described in section 1A. Parts of this core section contain coarse to very coarse, poorly sorted graywacke. The fault described in Sections 1B and 1C divide the main foliated graywacke body from the foliated graywacke containing the altered graywacke inclusions and green "graywacke" bands. The fault is well defined in the top 5'' of this core piece with green bands and quartz/calcite stringers butting against coarse, foliated graywacke along a thin (1/4 mm) seam of strung out argillaceous material and probable mylonized graywacke material. This part of the fault trends at 5° to the axial plane of the core. The lower 8'' of the fault is poorly defined and at times is lost in the chaos of foliated graywacke, quartz/calcite stringers, and green bands. The graywacke inclusions are of variable size and shape (mostly large ranging between 3'' and 6'' in longest dimension), and of variable composition and degree of alteration. The inclusion containing blueschist minerals (as observed by its bluish color) is the most compact, least altered and mineralized inclusion in this core piece. Another inclusion whose composition is probably quartz-feldspathic for the most part is partially altered (under 40X power, small chloritized patches are visible) and cut by quartz/calcite veins. Small patches of white clay are also


GEYSERS GEOTHERMAL CO.
CA 1862-4 - 1BT/B



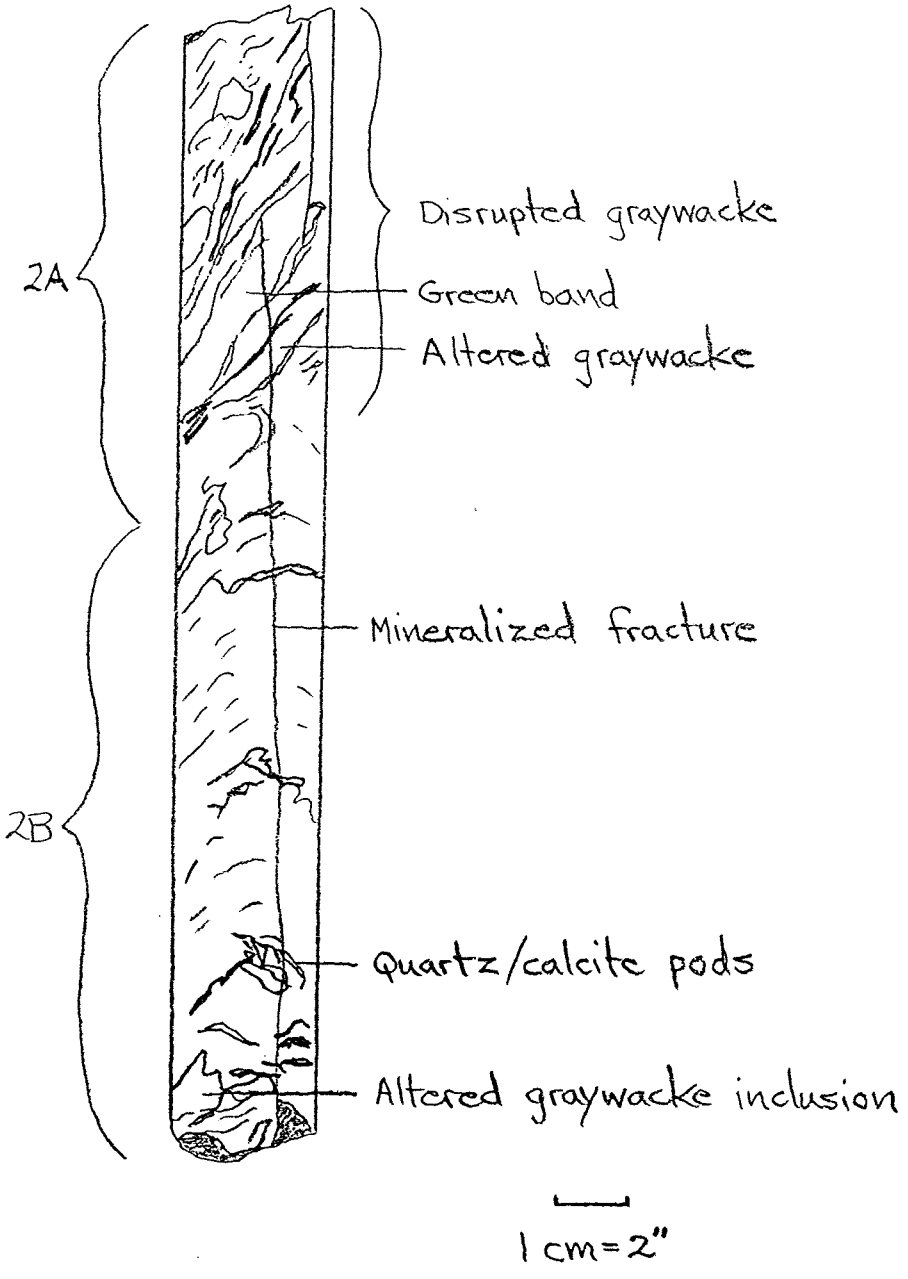
GEYSERS GEOTHERMAL CO.

CA 1862-4 - 1CT/B

present throughout the inclusion. This inclusion is surrounded by an envelope of mylonized graywacke and argillite ranging from 1mm to 1 cm in width. The quartz/calcite veins do not penetrate through this envelope. In a few places the mylonized material appears to flow into the veins. In one area the vein inside the inclusion appears to connect with a small quartz/calcite stringer outside the inclusion by a finer grained, more mylonized and offset band of graywacke and argillite than that surrounding the inclusion. I believe the fluid that altered and mineralized this inclusion was introduced along such paths as described above. Once in the inclusion, the fluid moved through fractures within the inclusion altering the matrix component to chlorite and precipitating quartz then pinkish calcite in the fractures. A third large inclusion is quite different from those previously described. It appears to be totally altered to quartz and small patches of white clay with pinkish calcite veins cutting across the quartz in a random pattern. Most of the margin of this inclusion is irregular and diffuse as if the foliated graywacke and chloritic bands surrounding the inclusion are being absorbed by it. A few patches of graywacke are completely surrounded by the altered material. Again, most of the altered material is compactly contained with little communication with quartz/calcite pods and stringers outside the inclusion. Sporadic trace amounts of sphalerite and pyrite imbedded in chlorite/serpentinite were noted parallel to the foliation under high power (40X). A mineralized fracture parallel to the axial plane of the core cross cuts all features (green bands, argillite bands, inclusions, quartz/calcite stringers, etc). Only two minerals are present in the fracture; quartz, predominantly translucent, gray, and anhedral but forming clear, enhedral crystals in the vuggy areas, and calcite. The fracture is 1mm or less in width. The minerals, at times, entirely plug the fracture.

Section 2B (4459' 3'' - 4460' 8'') - section 2B is composed of four pieces of core; three pieces having broken off of the main piece. This section is predominantly foliated graywacke with smaller quartz/calcite stringers than in the sections above. (Examination under high power (40X) of the graywacke reveals a strongly foliated, green and gray, medium to coarse grained graywacke. The more altered areas contain quartz clasts, feldspars that have been altered to a white clay, strung out argillaceous bands, chloritized matrix, and cubic pyrite and some possible pyrrhotite. A few blueschist fragments were present in the graywacke. All the graywacke constituents exhibit cataclastic texture. Chlorite is present in sporadic patches. Trace amounts of sphalerite are present here and there in the graywacke and are commonly associated with chlorite/serpentinite lenses and stringers.) The quartz/calcite pods and stringers are as described in section 1A. The larger pods have a few natrolite (?) laths in their interior. Small faults displace some of quartz/calcite stringers that are parallel to the foliation by as much as 1/2 cm. The mineralized fracture described for the end of section 2A above, continues through section 2B. Three pieces of the core broke along this fracture so that the mineralization is displayed along a planar surface. Quartz and calcite are the predominant minerals, with quartz forming along

the margins of the graywacke and calcite within. Pyrite and pyrrhotite are present throughout the above two fracture mineralization as seen under high power (40X) examination. Sphalerite is present here and there (again using 40X). The very end of this core section contains a section of discontinuous, stretched out graywacke and argillite bands, and quartz/calcite stringers. These have been displaced approximately 2 1/2 cm by a fault trending 25° from the axial plane of the core. This fault seems to parallel the smaller faults that displace the quartz/calcite stringers as described earlier for this section. Within the stretched out graywacke/argillite is a lense of altered (whitish) graywacke containing thin seams of pyrite. Sporadic traces of sphalerite sometimes accompany the pyrite. Minor amounts of pyrrhotite are present in the altered graywacke but does not seem to accompany the pyrite in the seams. Examination was done under 40X. The seams are less than 1/4 mm in width.



Tray #3 (cored interval 4460' 8'' to 4465')

The entire length of the pieces filling tray #3 is not possible due to the broken nature of the bottom of the core. The first two core sections in this tray total approximately 39''. The remaining broken pieces represent the bottom 13'' of the core. All pieces are foliated graywacke with an abundance of disrupted, altered graywacke inclusions.

Section 3A (4460' 8'' - 4462' 2'') - foliated graywacke containing many graywacke inclusions. The inclusions are of variable composition. Their degree of alteration is related to their initial composition and degree of deformation. One of the inclusions is a long (wrapping around half the core), stretch out, quartzose graywacke with thin, micaceous argillite bands that parallel the foliation within the main graywacke of the core. There are relatively few pinkish quartz/calcite veins and pods within this inclusion. Most of these veins are totally contained within the inclusion which is surrounded by chloritized, foliated graywacke or argillite. Another inclusion is green in color, containing quartz and two kinds of chlorite (?) one an aqua green color, the other an avocado green. This inclusion contains the largest (4cm X 4cm) quartz/calcite pod present in this core section. The inclusion contains quartz/calcite veins, most of which are not through-going into the surrounding chloritized, foliated graywacke. Pyrite is present here and there throughout the inclusion. Other graywacke inclusions have undergone blueschist facies metamorphism and are cut by only a few quartz/calcite veins. Still other inclusions are mostly quartzose with some chlorite present. These last contain the most quartz/calcite veins and pods. Deformation has been fairly severe in this core section. Small scale faults displacing the micaceous partings of the graywacke, the argillite and green bands, and the quartz/calcite stringers are numerous. Crenulations are readily apparent. Much of the graywacke is so disrupted and altered that the foliation is lost. Pyrite, pyrrhotite, and sphalerite can be found in the foliated, altered graywacke under high power (40X) but only in trace amounts. There is much more altered graywacke without sulfides than there is with. Pyrite is the most abundant sulfide in this core section. A piece of core broke from the main section along a mineralized fracture as described for section 2B. This mineralized fracture dies out approximately half way down the 3A section.

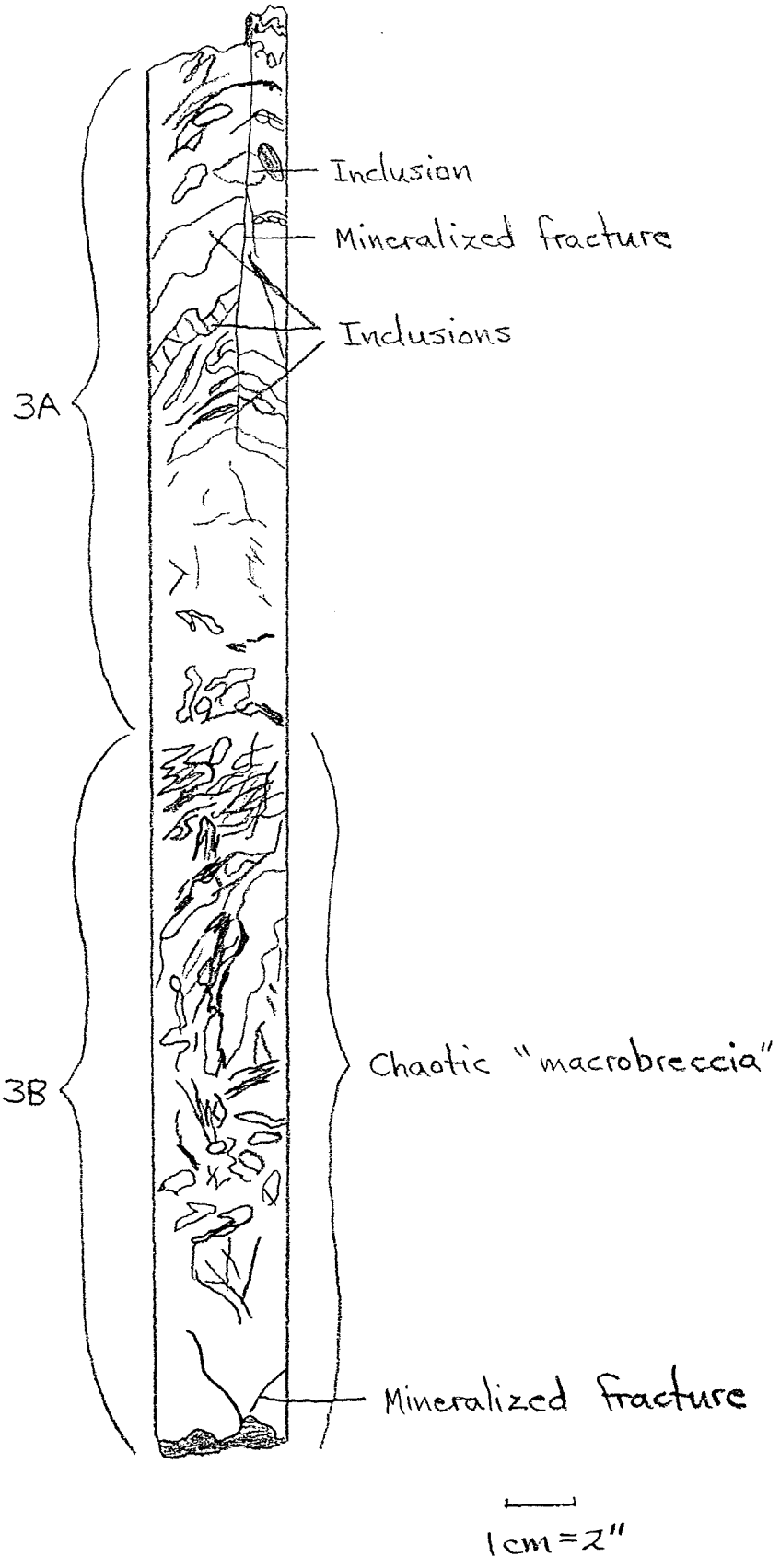
Section 3B (4462' 2'' - 4463' 11'') - foliated graywacke containing numerous graywacke inclusions of all shapes and sizes. This section is the most disrupted of the entire core. The foliated texture is completely disrupted in the upper 2/3 of this core section. Quartz/calcite veins and pods are numerous. Faults, folds, and crenulations as described for section 3A are numerous. They all serve to juxtapose the different rock types and alteration products into a chaotic macrobreccia. Large portions of the graywacke are totally chloritized or nearly so. The relict texture indicates differences in the grain size and primary composition before chloritization took place. The graywacke inclusions resemble those described for section 1A and 3A. Sulfides are most abundant in small, medium to very dark green patches and lenses of chlorite. Sphalerite,

pyrite, and pyrrhotite may all be present together within the lense or just pyrite with or sphalerite by itself. Usually sphalerite occupies the central portion of the chloritic patch. The bottom of this core section is broken into four pieces. Some of the breaks occurred along two mineralized fractures. One of the fractures trends at 25° to the axial plane of the core and contains quartz (first to crystallize out), calcite, and sphalerite. The other trends at 55° to the core's axial plane and contains just quartz and calcite. This last mineralized fracture may really be a quartz/calcite pod that has split in half.

The last 13" of the core (bottom) is broken apart and some pieces were lost on the rig floor. The remaining pieces resemble the chaotic "macrobreccia" of section 3B. Some of the pieces contain more argillite and darker gray argillaceous graywacke than observed in the sections above.

Described by Mary K. Twichell

MKT/jg


Inclusion
Mineralized fracture
Inclusions
3A
3B
Chaotic "macrobreccia"
Mineralized fracture
1cm=2"

04/30/86

CORE LABORATORIES, INC.

Special Core Analysis

File SCAL-308-86032

EFFECTIVE PERMEABILITY TO OIL

Geysers Geothermal Company — Wells As Noted

Well I.D.	Sample Number	Porosity, percent	Permeability to Air, millidarcys	Effective Overburden Pressure, psi	Specific Permeability to Water, millidarcys	Permeability Ratio, water/air
Barrows 2	2	4.6	0.48	6800	0.027	0.056
CA 958-3A	4	1.4	0.089	2860	0.0015	0.017
CA 1862-4	7	2.6	0.28	5210	*	-
CA 1862-17	10H**	0.9	0.10	8140	0.0017	0.017
MLM 3	14	9.1	1.8	5190	0.040	0.022

*Effectively impermeable with 5210 psi effective confining pressure and 100 psi injection pressure

**1-inch diameter core plug

04/30/86

CORE LABORATORIES, INC.
Special Core Analysis

File SCAL-308-86032

PERMEABILITY TO AIR AND POROSITY

Geysers Geothermal Company — Wells As Noted

Well Identification	Sample Number	Permeability to Air, millidarcys	Porosity, percent
Barrows 2	2	0.48	4.6
CA 958-3A	4	0.089	1.4
(IBT/B) CA 1862-4	⑦	0.28	2.6
~~CA 1862-17~~	~~10H*~~	~~0.10~~	~~0.9~~
MLM 3	14	1.8	9.1

*1-inch diameter core plug

GEYSERS GEOTHERMAL COMPANY
MISC. WELLS

DATE : 3-26-86
FORMATION :
DRLG. FLUID:
LOCATION :

FILE NO. : 32020-15092
API WELL NO.:
LABORATORY : MIDLAND, TEXAS

FULL DIAMETER ANALYSIS - SUMMATION OF FLUIDS

	SAMPLE NUMBER	DEPTH FEET	PERM MAXIMUM	PERM 90 DEG	PERM VERTICAL	FLD POR	OIL% POR	WTR% POR	GRAIN DEN M	
	1	BARROWS 2 3T/B	0.64	<0.01	11.	3.0	0.0	8.3	2.68	
	2	BARROWS 2 4T/B	0.30	0.26	0.70	4.7	0.0	8.3	2.71	
	3	CA-958-3A 1CT/B	0.44	0.39	<0.01	1.3	0.0	22.2	2.72	
	4	CA-958-3A 2BT/B	0.18	0.13	0.11	1.3	0.0	22.2	2.72	
	5	CA-958-3A 5AT	0.12	0.07	0.38	0.5	0.0	50.0	2.70	
	6	CA-958-6	0.56	0.39	1.6	1.9	0.0	62.5	2.71	
	(7)	CA-1862-4 1BT/B	3.3	0.85	VF	1.9	0.0	46.0	2.76	VERTICALLY FRACTURED
	8	CA-1862-4 1CT/B	0.30	0.25	0.35	1.9	0.0	43.5	2.76	
	9	CA-1862-17 FT/B	0.30	0.21	0.41	1.2	0.0	40.0	2.67	
*	10	CA-1862-17G	0.12		0.01	1.6	0.0	75.0	2.66	
	11	MLM-3 1CT/B	<0.01	<0.01	<0.01	2.2	0.0	87.5	2.72	
	12	MLM-3 3A	<0.01	<0.01	<0.01	1.7	0.0	33.3	2.69	
	13	MLM-3 6B	<0.01	<0.01	0.06	2.8	0.0	14.6	2.69	
	14	MLM-3 8AT	6.9	0.22	2.3	9.4	0.0	14.9	2.78	

* INDICATES PLUG PERMEABILITY

CORE LABORATORIES, INC.

Petroleum Reservoir Engineering

DALLAS, TEXAS

GEYSERS GEOTHERMAL COMPANY
MISC. WELLS

DATE : 3-26-86
FORMATION :
DRLG. FLUID :
LOCATION :

FILE NO. : 32020-15092
API WELL NO. :
LABORATORY : MIDLAND, TEXAS

FULL DIAMETER ANALYSIS

SAMPLE NUMBER	DEPTH FEET	PERM MAXIMUM	PERM 90 DEG	PERM VERTICAL	HE POR	OIL% POR	WTR% POR	GRAIN DEN M	
1	BARROWS 2 3T/B	0.64	<0.01	11.	3.0	0.0	91.7	2.68	
2	BARROWS 2 4T/B	0.30	0.26	0.70	5.5	0.0	85.7	2.74	
3	CA-958-3A 1CT/B	0.44	0.39	<0.01	1.4	0.0	90.0	2.72	
4	CA-958-3A 2BT/B	0.18	0.13	0.11	1.4	0.0	90.0	2.72	
5	CA-958-3A 5AT	0.12	0.07	0.38	0.9	0.0	57.1	2.71	
6	CA-958-6	0.56	0.39	1.6	2.6	0.0	72.7	2.73	
7	CA-1862-4 1BT/B	3.3	0.85	VF	2.1	0.0	92.5	2.77	VERTICALLY FRACTURED
8	CA-1862-4 1CT/B	0.30	0.25	0.35	2.4	0.0	79.3	2.77	
9	CA-1862-17 FT/B	0.30	0.21	0.41	1.7	0.0	85.7	2.68	
* 10	CA-1862-17G	0.12		0.01	1.8	0.0	66.3	2.66	
11	MLM-3 1CT/B	<0.01	<0.01	<0.01	2.5	0.0	88.9	2.72	
12	MLM-3 3A	<0.01	<0.01	<0.01	2.7	0.0	60.0	2.72	
13	MLM-3 6B	<0.01	<0.01	0.06	3.5	0.0	80.4	2.71	
14	MLM-3 8AT	6.9	0.22	2.3	9.5	0.0	97.9	2.79	

* INDICATES PLUG PERMEABILITY

2.93 avg.

2.42 w/o 9.5

GEYSERS GEOTHERMAL COMPANY
3\26\86
32020-15092

SAMPLE NUMBER	WELL NAME & NUMBER	PORE VOLUME BY SUMMNATION OF FLUIDS (cc)	PORE VOLUME BY HELIUM INJECTION (cc)	WATER LOSS (gm)	INJECTED SATURATION (gm)	GRAIN DENSITY BY SUMMNATION OF FLUIDS (gm/cc)	GRAIN DENSITY BY HELIUM INJECTION (gm/cc)	BULK DENSITY (gm/cc)	BULK VOLUME BY CALIPER (cc)	BULK VOLUME BY ARCHIMEDES (cc)
1	Barrows 3T/B	12.00	12.00	1.00	11.00	2.68	2.65	2.63	402.774	398.00
2	Barrows 4T/B	24.00	28.00	2.00	22.00	2.71	2.72	2.63	509.755	507.00
3	CA-958-3A 1CT/B	9.00	10.00	2.00	7.00	2.72	2.70	2.70	719.630	714.00
4	CA-958-3A 2BT/B	9.00	10.00	2.00	7.00	2.72	2.71	2.70	716.518	713.00
5	CA-958-3A 5AT	4.00	7.00	2.00	2.00	2.70	2.70	2.69	763.022	759.00
6	CA-958-6	8.00	11.00	5.00	3.00	2.71	2.73	2.68	417.485	416.00
7	CA-1862-4 1BT/B	37.00	40.00	17.00	20.00	2.76	2.77	2.73	1937.778	1936.00
8	CA-1862-4 1CT/B	23.00	29.00	10.00	13.00	2.76	2.76	2.72	1212.895	1207.00
9	CA-1862-17 FT/B	5.00	7.00	2.00	3.00	2.67	2.68	2.65		410.00
10	CA-1862-17G	8.00	9.05	4.00	4.00	2.66	2.66	2.63		503.00
11	MLM-3 1CT/B	8.00	9.00	7.00	1.00	2.72	2.70	2.68	365.819	363.00
12	MLM-3 3A	15.00	25.00	5.00	10.00	2.69	2.70	2.65	910.715	904.00
13	MLM-3 6B	41.00	51.00	6.00	35.00	2.69	2.71	2.64	1451.641	1452.00
14	MLM-3 8AT	47.00	48.00	7.00	40.00	2.78	2.76	2.61	505.180	500.00

2.67 avg.

1862 -

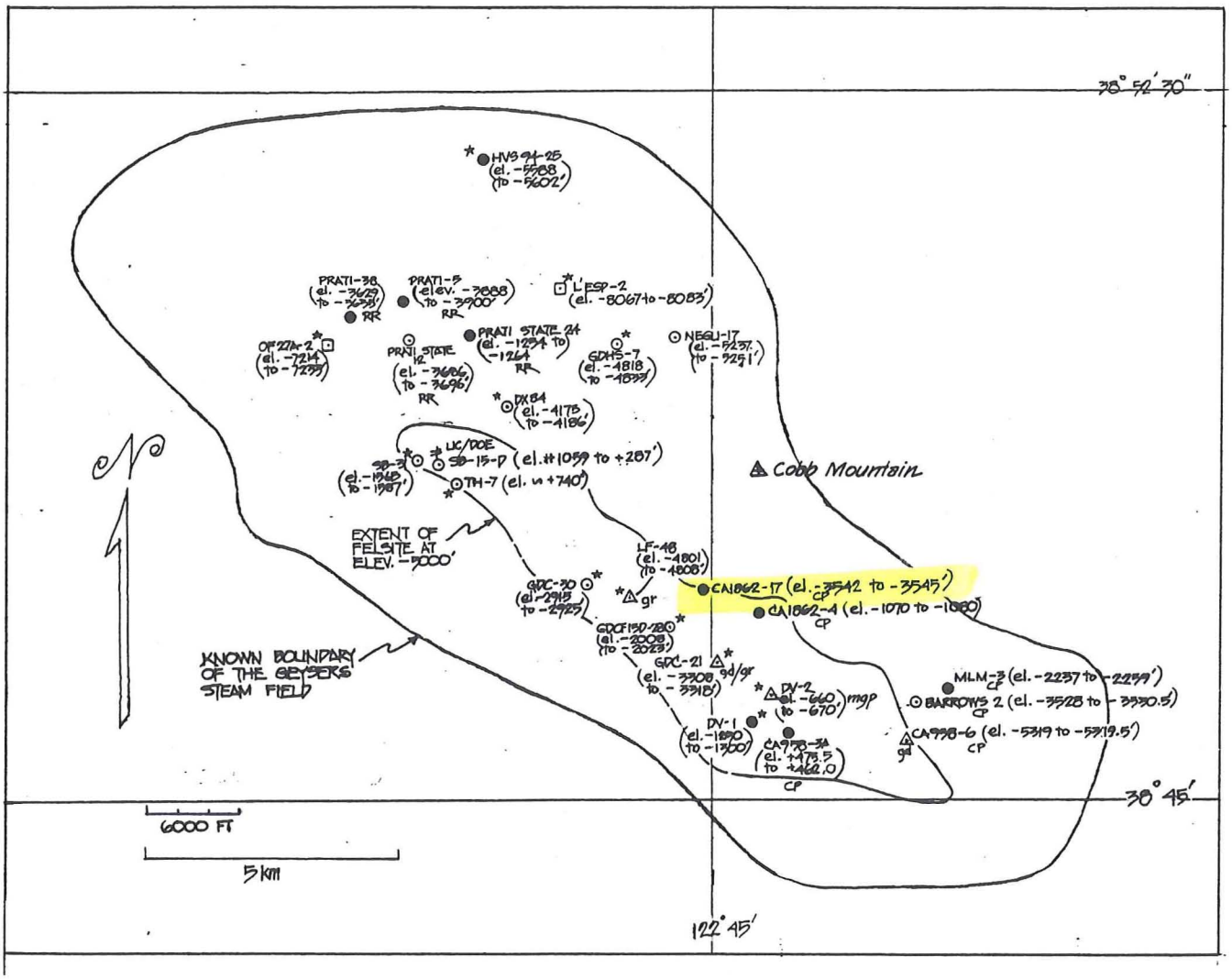
WELL: 4
LOCATION: 1789407E 407003N
SURFACE ELEVATION: 3395.
CASING SHOE: 4429.
FLOWRATE (KLBS/HR): 70.

COMMENTS: FISH LEFT IN HOLE - TOP AT 7310.

M.D.	T.V.D	N(-S)	E(-W)	COMP. INC
0.	0.	0.	0.	0.
200.	200.	-5.	0.	-100.
400.	400.	-10.	1.	-100.
600.	600.	-15.	2.	-100.
800.	800.	-20.	4.	-100.
1000.	1000.	-26.	6.	-100.
1049.	1049.	-27.	7.	0.
1200.	1200.	-31.	12.	-100.
1400.	1400.	-36.	17.	-100.
1600.	1600.	-42.	21.	-100.
1800.	1799.	-49.	24.	-100.
2000.	1999.	-57.	25.	-100.
2059.	2058.	-59.	25.	0.
2200.	2199.	-74.	27.	-100.
2400.	2399.	-91.	27.	-100.
2600.	2599.	-103.	24.	-100.
2800.	2798.	-109.	19.	-100.
3000.	2997.	-110.	11.	-100.
3017.	3014.	-110.	10.	0.
3200.	3195.	-97.	-6.	-100.
3400.	3394.	-83.	-23.	-100.
3600.	3592.	-68.	-39.	-100.
3800.	3791.	-52.	-55.	-100.
4000.	3989.	-35.	-70.	-100.
4021.	4010.	-34.	-72.	0.
4200.	4189.	-17.	-81.	-100.
4241.	4230.	-13.	-83.	-1.
4400.	4388.	2.	-92.	-100.
4429.	4417.	4.	-94.	-10.
4530.	4517.	14.	-101.	25.
4600.	4587.	21.	-105.	-100.
4800.	4785.	40.	-120.	-100.
5000.	4982.	59.	-135.	-100.
5036.	5018.	62.	-138.	0.
5145.	5125.	73.	-146.	5.
5200.	5178.	78.	-151.	-100.
5268.	5245.	84.	-157.	5.
5400.	5374.	97.	-168.	-100.
5600.	5570.	117.	-188.	-100.
5800.	5767.	137.	-209.	-100.
6000.	5964.	158.	-233.	-100.
6003.	5967.	158.	-233.	0.
6200.	6164.	177.	-261.	-100.
6400.	6362.	198.	-289.	-100.
6600.	6561.	220.	-319.	-100.
6800.	6758.	242.	-349.	-100.
7000.	6956.	266.	-380.	-100.
7035.	6990.	270.	-386.	0.
7200.	7150.	289.	-420.	-100.
7295.	7243.	301.	-439.	100.
7400.	7345.	314.	-458.	-100.
7597.	7538.	340.	-492.	20.
7600.	7540.	340.	-493.	-100.
7800.	7736.	368.	-524.	-100.
8000.	7932.	398.	-551.	-100.
8035.	7966.	403.	-555.	0.
8200.	8128.	429.	-574.	-100.
8357.	8282.	454.	-590.	0.

OPEN HOLE DESCRIPTION

	**** INTERVAL ******	
SIZE (IN)	TOP	BOTTOM
8.75	4429.	8357.



CORE LOCATIONS AND ROCK TYPES

ABOVE FIRST STEAM ENTRY

● GRAYWACKE

BELOW FIRST STEAM ENTRY

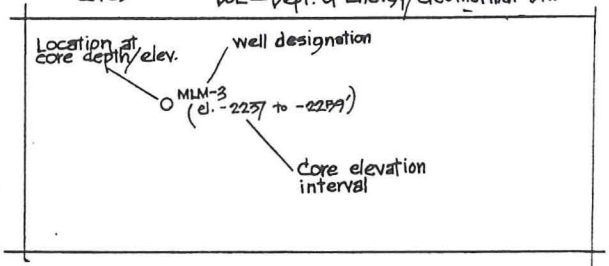
"normal" steam reservoir
- ⊙ GRAYWACKE
- △ "FELSITE"
  - mgp = microgranite porphyry
  - sparsely porphyritic: gd/gr = hybrid granite/granodiorite; gd = granodiorite; gr = granite

"high-temp." steam reservoir
- ⊡ HORNFELSIC GRAYWACKE

* continuous core from above and below first steam entry.

* Unocal Proprietary cores

UC – other Unocal cores
RR – Russian River Energy
CP – Calpine
DOE – Dept. of Energy/Geothermal Div.



LOCATION MAP — CORES FROM THE GEYSERS STEAM FIELD

Well Name / Company / Well Elev. (at ground level)	Core Location (Top of Core)	Core Depth or Depth Interval — Drilled Depth (DD) / True Vertical Depth (TVD)	Core Elevation or Elevation Interval	First Steam Entry in Well — Drilled Depth (DD) / True Vertical Depth (TVD) / Elevation (EL.)	Rock Type	Comments
CA 1862-17 Aminoil/ Calpine EL 3367 ft	310 ft N, 1300 ft E of SW cor sec 21, T 11 N, R8W, (MDBM) Sonoma Co., Calif.	DD 6958 - 6961 ft TVD 6909 - 6912 ft	-3542 to -3545 ft	DD 8000 ft TVD 7915 ft EL. -4548 ft	graywacke	4" - dia core
BARROWS 2 Aminoil/ Calpine EL. 2200 ft	1560 ft S, 270 ft W. of NE cor. Sec. 35, T11N, R8W (MDBM) Lake Co., Calif.	DD 5812 to 5814.5 ft TVD 5728 to 5730.5 ft	-3528 to -3530.5 ft	DD 4487 ft TVD 4448 ft EL. -2248 ft	"	" badly fragmented; only ~ 50% of core remains
MLM-3 Aminoil/ Calpine EL. 1958 ft	780 ft S 1800 ft E of NW cor. sec. 36, T11N, R8W (MDBM); Lake Co., Calif.	DD 4380 to 4382 ft TVD 4195 to 4217 ft	-2237 to -2259 ft	DD 6043 ft TVD 5780 ft EL. -3822 ft but MAJOR LOST CIRC. ZONE WHILE DRILLING W/MUD, AT: DD 4900 ft TVD 4166 ft EL. -2186 ft ... SUSPECT THIS WOULD HAVE BEEN A STEAM ENTRY IF THE DRILLING FLUID HAD BEEN AIR.	"	4" - dia. core

Geysers Core Samples

STORED AT ESRI AS OF 04/15/95

DESCRIBED
BY MARY TWICHELL
(AMINOIL USA)

Core Description - CA 1862-17

An attempt to core the hornfels sequence in the CA 1862-17 well was made on July 3, 1985. The cored interval was from 6958 to 6961 feet. Core drilling this three feet took approximately 3½ hours. Approximately fourteen inches of core was recovered (40% ± recovery).

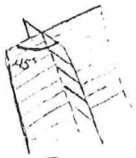
CA 1862-17

Sixth piece - "F"

The top of this piece is smooth in a couple of areas where the rock on top had ground down the surface. There seems to be a gap between the "D" and "E" pieces and the "F" piece as there does not seem to be any way to fit the pieces together. This gap may be where much of the core was lost.

This piece is cross cut by a series of veinlets. Their cross cutting relationships will be given from oldest to youngest. (Note: All the veinlets are near vertical features except for the youngest one.)

1. A somewhat wavy quartz veinlet of varying thickness (approximately ½ mm to 2mm) appears to be the oldest mineralized fracture. It trends at approximately 20° from the axial plane of the core.
2. Intersecting the quartz veinlet is a dark colored discontinuous fracture that has chlorite crystals here and there, and probable microscopic chlorite along the walls of the fracture. The intersection is roughly at a 45° angle. The fracture itself trends approximately 30° from the axial plane of the core. On the opposite side of the core piece the fracture splays and becomes a zone that is approximately 1½ cm thick with altered, "bleached" appearing rock between patches and two discontinuous veinlets of chlorite.



3. The above are intersected by very thin (≤ ¼ mm) chlorite veinlets that trend almost vertically. The core piece broke along one of these veinlets exposing the mineralization. Chlorite is the predominent mineral but yellow-green epidote

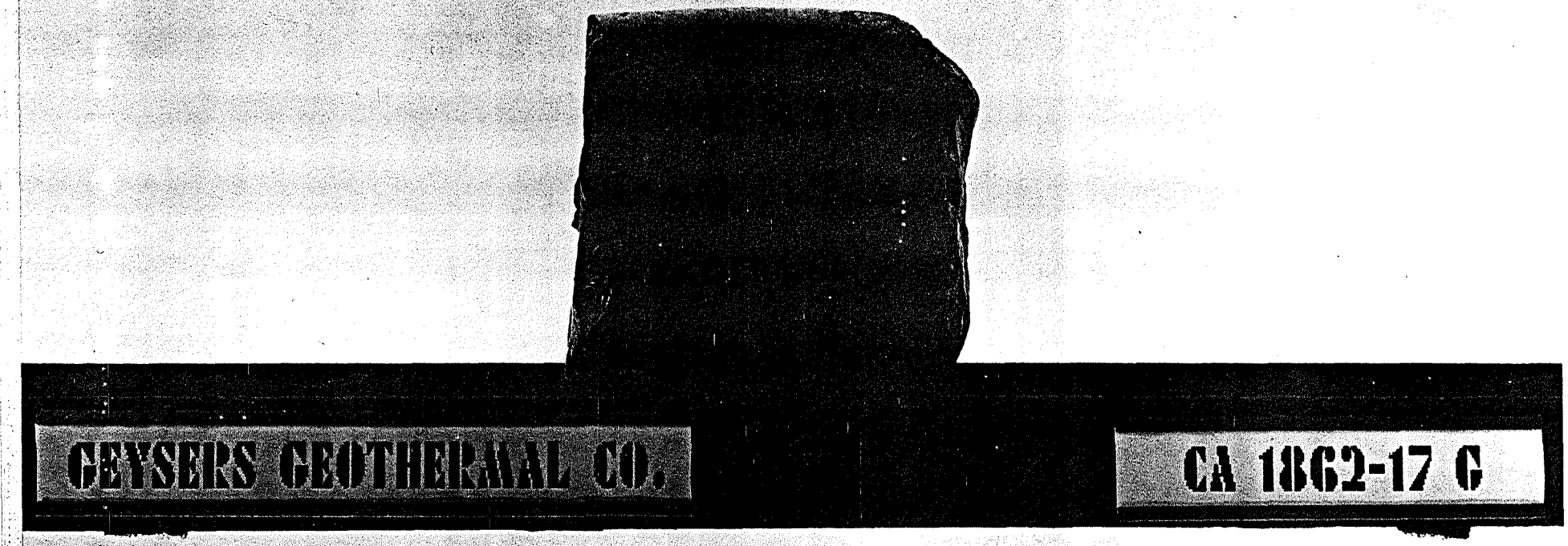
and a very small amount of pyrite is also present. These veinlets differ enough in their orientation as to intersect one another. In addition, hairlike fractures interconnect them.

4. The youngest feature in this piece trends approximately 60° from the axial plane of the core and seems to intersect the quartz veinlet at approximately 90°. It appears to be an unmineralized fracture, extremely thin (hairlike) in appearance.

Note: There is one vug (unless the softer material was plucked out) that is lined with chlorite. Its dimensions are approximately 15 mm x 4 mm. Some hairlike fractures that appear to be associated with the near vertical chlorite veinlets extend to this vug.

GEYSERS GEOTHERMAL CO.

CA 1862-17 - FT/B


GEYSERS GEOTHERMAL CO.
CA 1862-17 C

CORE LABORATORIES, INC.

Special Core Analysis

File SCAL-308-86032

PERMEABILITY TO AIR AND POROSITY

Geysers Geothermal Company — Wells As Noted

Well Identification	Sample Number	Permeability to Air, millidarcys	Porosity, percent
Barrows 2	2	0.48	4.6
CA 958-3A	4	0.089	1.4
CA 1862-4	7	0.28	2.6
(17G) CA 1862-17	10H*	0.10	0.9
MLM 3	14	1.8	9.1

*1-inch diameter core plug

GEYSERS GEOTHERMAL COMPANY
MISC. WELLS

DATE : 3-26-86
FORMATION :
DRLG. FLUID:
LOCATION :

FILE NO. : 32020-15092
API WELL NO.:
LABORATORY : MIDLAND, TEXAS

FULL DIAMETER ANALYSIS - SUMMATION OF FLUIDS

	SAMPLE NUMBER	DEPTH FEET	PERM MAXIMUM	PERM 90 DEG	PERM VERTICAL	FLD POR	OIL% POR	WTR% POR	GRAIN DEN M	
	1	BARROWS 2 3T/B	0.64	<0.01	11.	3.0	0.0	8.3	2.68	
	2	BARROWS 2 4T/B	0.30	0.26	0.70	4.7	0.0	8.3	2.71	
	3	CA-958-3A 1CT/B	0.44	0.39	<0.01	1.3	0.0	22.2	2.72	
	4	CA-958-3A 2BT/B	0.18	0.13	0.11	1.3	0.0	22.2	2.72	
	5	CA-958-3A 5AT	0.12	0.07	0.38	0.5	0.0	50.0	2.70	
	6	CA-958-6	0.56	0.39	1.6	1.9	0.0	62.5	2.71	
	7	CA-1862-4 1BT/B	3.3	0.85	VF	1.9	0.0	46.0	2.76	VERTICALLY FRACTURED
	8	CA-1862-4 1CT/B	0.30	0.25	0.35	1.9	0.0	43.5	2.76	
	9	CA-1862-17 FT/B	0.30	0.21	0.41	1.2	0.0	40.0	2.67	
*	10	CA-1862-17G	0.12		0.01	1.6	0.0	75.0	2.66	
	11	MLM-3 1CT/B	<0.01	<0.01	<0.01	2.2	0.0	87.5	2.72	
	12	MLM-3 3A	<0.01	<0.01	<0.01	1.7	0.0	33.3	2.69	
	13	MLM-3 6B	<0.01	<0.01	0.06	2.8	0.0	14.6	2.69	
	14	MLM-3 8AT	6.9	0.22	2.3	9.4	0.0	14.9	2.78	

* INDICATES PLUG PERMEABILITY

CORE LABORATORIES, INC.

Petroleum Reservoir Engineering

DALLAS, TEXAS

GEYSERS GEOTHERMAL COMPANY
MISC. WELLS

DATE : 3-26-86
FORMATION :
DRLG. FLUID :
LOCATION :

FILE NO. : 32020-15092
API WELL NO. :
LABORATORY : MIDLAND, TEXAS

FULL DIAMETER ANALYSIS

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2	BARROWS 2 4T/B	0.30	0.26	0.70	5.5	0.0	85.7	2.74	
3	CA-958-3A 1CT/B	0.44	0.39	<0.01	1.4	0.0	90.0	2.72	
4	CA-958-3A 2BT/B	0.18	0.13	0.11	1.4	0.0	90.0	2.72	
5	CA-958-3A 5AT	0.12	0.07	0.38	0.9	0.0	57.1	2.71	
6	CA-958-6	0.56	0.39	1.6	2.6	0.0	72.7	2.73	
7	CA-1862-4 1BT/B	3.3	0.85	VF	2.1	0.0	92.5	2.77	VERTICALLY FRACTURED
8	CA-1862-4 1CT/B	0.30	0.25	0.35	2.4	0.0	79.3	2.77	
9	CA-1862-17 FT/B	0.30	0.21	0.41	1.7	0.0	85.7	2.68	
* 10	CA-1862-17G	0.12		0.01	1.8	0.0	66.3	2.66	
11	MLM-3 1CT/B	<0.01	<0.01	<0.01	2.5	0.0	88.9	2.72	
12	MLM-3 3A	<0.01	<0.01	<0.01	2.7	0.0	60.0	2.72	
13	MLM-3 6B	<0.01	<0.01	0.06	3.5	0.0	80.4	2.71	
14	MLM-3 8AT	6.9	0.22	2.3	9.5	0.0	97.9	2.79	

* INDICATES PLUG PERMEABILITY

2.93 avg.

2.42 w/o 9.5

GEYSERS GEOTHERMAL COMPANY
3\26\86
32020-15092

SAMPLE NUMBER	WELL NAME & NUMBER	PORE VOLUME BY SUMMNATION OF FLUIDS (cc)	PORE VOLUME BY HELIUM INJECTION (cc)	WATER LOSS (gm)	INJECTED SATURATION (gm)	GRAIN DENSITY BY SUMMNATION OF FLUIDS (gm/cc)	GRAIN DENSITY BY HELIUM INJECTION (gm/cc)	BULK DENSITY (gm/cc)	BULK VOLUME BY CALIPER (cc)	BULK VOLUME BY ARCHIMEDES (cc)
1	Barrows 3T/B	12.00	12.00	1.00	11.00	2.68	2.65	2.63	402.774	398.00
2	Barrows 4T/B	24.00	28.00	2.00	22.00	2.71	2.72	2.63	509.755	507.00
3	CA-958-3A 1CT/B	9.00	10.00	2.00	7.00	2.72	2.70	2.70	719.630	714.00
4	CA-958-3A 2BT/B	9.00	10.00	2.00	7.00	2.72	2.71	2.70	716.518	713.00
5	CA-958-3A 5AT	4.00	7.00	2.00	2.00	2.70	2.70	2.69	763.022	759.00
6	CA-958-6	8.00	11.00	5.00	3.00	2.71	2.73	2.68	417.485	416.00
7	CA-1862-4 1BT/B	37.00	40.00	17.00	20.00	2.76	2.77	2.73	1937.778	1936.00
8	CA-1862-4 1CT/B	23.00	29.00	10.00	13.00	2.76	2.76	2.72	1212.895	1207.00
9	CA-1862-17 FT/B	5.00	7.00	2.00	3.00	2.67	2.68	2.65		410.00
10	CA-1862-17G	8.00	9.05	4.00	4.00	2.66	2.66	2.63		503.00
11	MLM-3 1CT/B	8.00	9.00	7.00	1.00	2.72	2.70	2.68	365.819	363.00
12	MLM-3 3A	15.00	25.00	5.00	10.00	2.69	2.70	2.65	910.715	904.00
13	MLM-3 6B	41.00	51.00	6.00	35.00	2.69	2.71	2.64	1451.641	1452.00
14	MLM-3 8AT	47.00	48.00	7.00	40.00	2.78	2.76	2.61	505.180	500.00

2.67 avg.

WELL: 17
LOCATION: 1785362E 408180N
SURFACE ELEVATION: 3389.
CASING SHOE: 4347.
FLOWRATE (KLBS/HR): 57.

COMMENTS: 4846'-5602'400+'WATER IN HOLE AFTER TRIP,6708' WATER INCR.TO 18 GPM WHIL DRILLING.WATER DECR W/SUBSEQ STM ENTRY. CONVERTED TO INJECTOR 5-85.

M.D.	T.V.D	N(-S)	E(-W)	COMP. INC
0.	0.	0.	0.	0.
200.	200.	0.	1.	-100.
254.	254.	0.	2.	0.
341.	341.	0.	4.	0.
400.	400.	0.	6.	-100.
401.	401.	0.	6.	0.
462.	462.	1.	8.	0.
534.	534.	1.	9.	0.
600.	600.	2.	11.	-100.
625.	625.	3.	12.	0.
718.	718.	6.	14.	0.
800.	800.	10.	17.	-100.
812.	812.	10.	17.	0.
906.	905.	14.	20.	0.
1000.	999.	18.	23.	-100.
1031.	1030.	20.	24.	0.
1155.	1154.	26.	26.	0.
1200.	1199.	28.	26.	-100.
1249.	1248.	30.	27.	0.
1342.	1341.	35.	29.	0.
1400.	1399.	37.	30.	-100.
1440.	1439.	38.	30.	0.
1558.	1557.	42.	32.	0.
1600.	1599.	43.	32.	-100.
1653.	1652.	44.	32.	0.
1748.	1747.	45.	32.	0.
1800.	1799.	46.	33.	-100.
1841.	1840.	46.	33.	0.
1887.	1886.	47.	32.	0.
1967.	1966.	46.	30.	0.
2000.	1999.	46.	28.	-100.
2061.	2060.	44.	26.	0.
2155.	2153.	42.	21.	0.
2200.	2198.	41.	19.	-100.
2249.	2247.	40.	17.	0.
2343.	2341.	38.	12.	0.
2400.	2398.	36.	8.	-100.
2436.	2434.	35.	6.	0.
2530.	2528.	33.	1.	0.
2600.	2598.	31.	-2.	-100.
2624.	2622.	30.	-4.	0.
2717.	2714.	28.	-8.	0.
2800.	2797.	27.	-12.	-100.
2808.	2805.	27.	-12.	0.
2902.	2899.	25.	-15.	0.
2995.	2992.	23.	-19.	0.
3000.	2997.	23.	-19.	-100.
3088.	3085.	21.	-22.	0.
3183.	3180.	19.	-26.	0.
3200.	3197.	18.	-27.	-100.
3276.	3273.	16.	-31.	0.
3400.	3397.	12.	-39.	-100.
3401.	3398.	12.	-39.	-1.
3413.	3410.	11.	-40.	0.
3478.	3474.	9.	-44.	-1.
3506.	3502.	8.	-46.	0.
3599.	3595.	4.	-53.	0.
3600.	3596.	4.	-53.	-100.
3724.	3719.	-2.	-63.	0.
3800.	3795.	-5.	-69.	-100.
3818.	3813.	-6.	-71.	0.
3913.	3908.	-11.	-78.	0.
3974.	3968.	-13.	-82.	0.
4000.	3994.	-14.	-83.	-100.
4006.	4000.	-14.	-83.	0.
4037.	4031.	-14.	-84.	0.
4068.	4062.	-14.	-84.	0.
4099.	4093.	-13.	-84.	0.
4130.	4124.	-13.	-83.	0.
4194.	4188.	-11.	-78.	0.
4200.	4194.	-11.	-78.	-100.

WELL: 17 (CONTINUED DATA)
LOCATION: 1785362E 408180N
SURFACE ELEVATION: 3389.
CASING SHOE: 4347.
FLOWRATE (KLBS/HR): 57.

COMMENTS: 4846'-5602'400+'WATER IN HOLE AFTER TRIP,6708' WATER INCR.TO 18 GPM WHIL DRILLING.WATER DECR W/SUBSEQ STM ENTRY. CONVERTED TO INJECTOR 5-85.

4252.	4246.	-7.	-73.	0.
4282.	4275.	-4.	-69.	0.
4347.	4340.	2.	-62.	-10.
4386.	4378.	6.	-57.	0.
4400.	4392.	8.	-56.	-100.
4479.	4469.	16.	-46.	0.
4571.	4560.	27.	-35.	0.
4600.	4589.	30.	-31.	-100.
4663.	4651.	38.	-23.	0.
4756.	4743.	51.	-12.	0.
4800.	4769.	54.	-9.	-100.
4841.	4800.	59.	-5.	0.
4934.	4917.	76.	10.	0.
5000.	4982.	85.	19.	-100.
5029.	5011.	89.	22.	0.
5123.	5103.	101.	34.	0.
5200.	5179.	111.	44.	-100.
5214.	5193.	113.	46.	0.
5290.	5268.	123.	55.	-2.
5304.	5281.	125.	57.	0.
5398.	5360.	135.	67.	0.
5400.	5362.	135.	68.	-100.
5584.	5556.	160.	92.	0.
5600.	5572.	162.	93.	-100.
5709.	5679.	175.	106.	0.
5800.	5770.	186.	117.	0.
5893.	5861.	198.	127.	0.
5987.	5954.	210.	136.	0.
6000.	5967.	212.	137.	-100.
6079.	6045.	222.	144.	0.
6172.	6137.	234.	152.	0.
6200.	6164.	238.	155.	-100.
6285.	6248.	251.	162.	0.
6359.	6321.	262.	168.	0.
6400.	6361.	269.	171.	-100.
6453.	6413.	277.	176.	0.
6542.	6501.	291.	184.	0.
6600.	6558.	301.	189.	-100.
6633.	6590.	307.	192.	0.
6708.	6663.	321.	199.	-2.
6725.	6680.	324.	200.	0.
6800.	6753.	338.	207.	-100.
6818.	6771.	341.	209.	0.
6910.	6861.	359.	217.	0.
7000.	6949.	377.	226.	-100.
7006.	6955.	378.	227.	0.
7099.	7045.	398.	236.	0.
7192.	7135.	419.	245.	0.
7200.	7143.	421.	246.	-100.
7283.	7223.	441.	253.	0.
7375.	7312.	463.	262.	0.
7400.	7336.	469.	264.	-100.
7469.	7403.	486.	270.	0.
7551.	7482.	506.	277.	0.
7600.	7530.	518.	281.	-100.
7659.	7587.	532.	286.	0.
7752.	7676.	556.	294.	0.
7800.	7722.	568.	298.	-100.
7845.	7766.	579.	301.	0.
8000.	7915.	619.	309.	10.
8200.	8108.	673.	320.	-100.
8216.	8123.	677.	321.	0.
8400.	8300.	728.	332.	-100.
8458.	8355.	744.	335.	8.
8469.	8366.	747.	336.	5.
8492.	8388.	754.	337.	0.
8600.	8491.	785.	342.	-100.
8800.	8682.	843.	350.	-100.
8816.	8697.	848.	351.	0.

OPEN HOLE DESCRIPTION

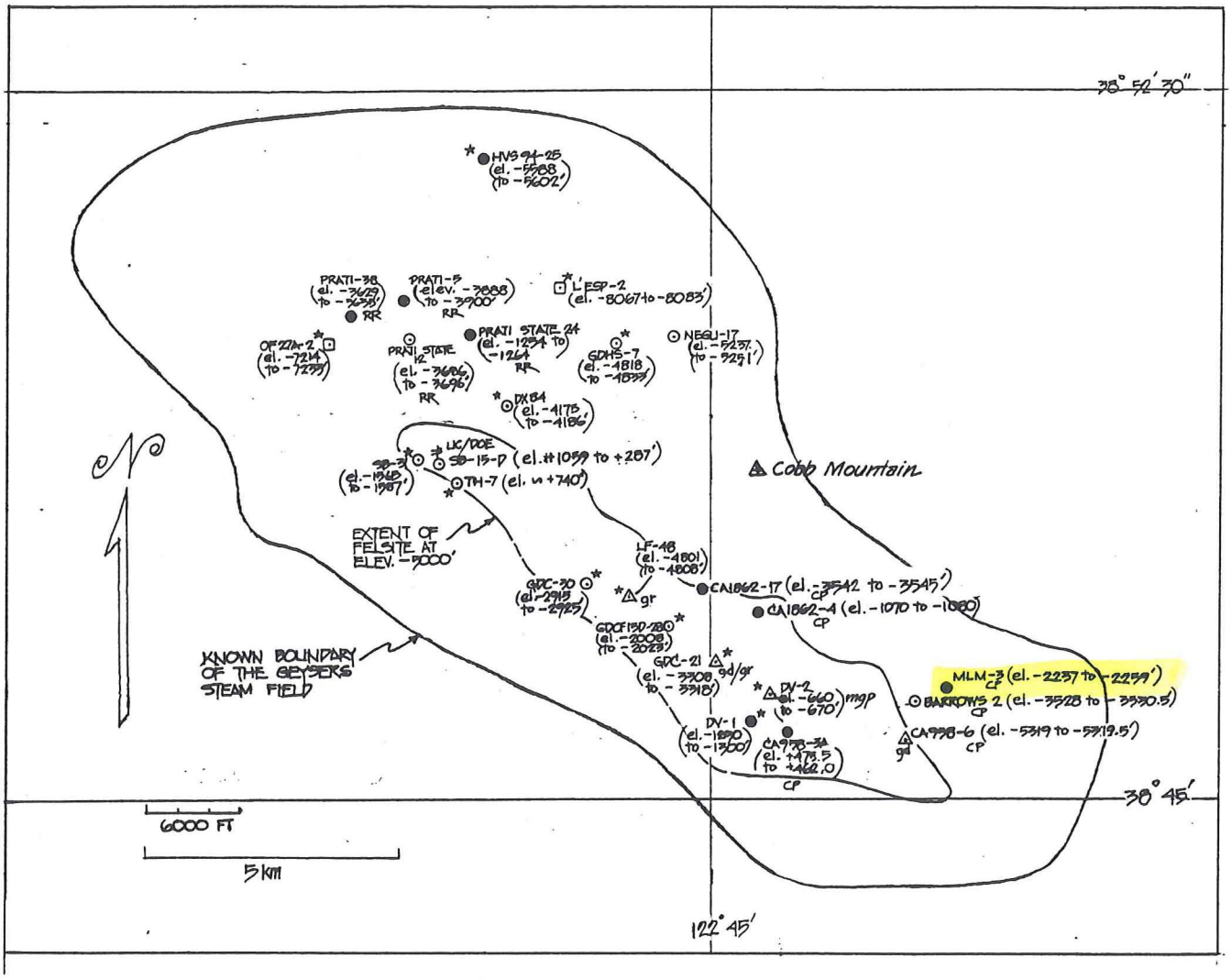
	**** INTERVAL ******	
SIZE (IN)	TOP	BOTTOM
10.63	4350.	8816.

Sample Depth or Depth Interval	Sample Type (e.g. full-dia. core, rubble, etc.)	Purpose of Sampling (e.g. for fluid-inclusion study	Sampler (Investigator) and Institution	Date Sampled	Date of Sample Return
① 4330.9' (1320 m)	FULL CORE	ADSORPTION MEAS	JEAN COOK for C. SATIK STANFORD UNIV.	06/24/93	
② 4340.8' (1323 m)	〃	〃	〃	〃	
③ 4347.3' (1325 m)	〃	〃	〃	〃	
④ 4336-4336.3' (1321⅝-1321⅝ m)	〃	〃	R. MESMER H. HOLMES OAK RIDGE NATL. LAB	10/25/94	
⑤ 4336.3-4336.5' (1321⅝-1321⅞ m)	〃 ?	〃	C. SATIK STANFORD UNIV.	11/17/94	
⑥ 4343.4-4343.5 (1323.8 m) (SMPL. "6T"	partial core	〃	〃	04/06/95	
⑦ APPROX. 4346' (1324.6 m) (SMPL. "6BB")	〃	〃	〃	〃	
⑧ 4335.1' (1321.3 m) (SMPL: "3A"	〃	〃	〃	04/19 18/95	
⑨ 4344.0' (1324 m) (SMPL: 6B)	〃	〃	〃	〃	
⑩ 4349.1' (1325⅝') (SMPL. "8AT")	〃	〃	〃	〃	

Core Sample Record

Well or Borehole MLM-3 (SOUTHEAST GEYSERS) Core Depth Interval 4330-4352' (1319.7-1326.4 m)

MLM-3



CORE LOCATIONS AND ROCK TYPES

ABOVE FIRST STEAM ENTRY

● GRAYWACKE

BELOW FIRST STEAM ENTRY

"normal" steam reservoir
- ⊙ GRAYWACKE
- △ "FELSITE"
  - mgp = microgranite porphyry
  - sparsely porphyritic: gd/gr = hybrid granite/granodiorite; gd = granodiorite; gr = granite

"high-temp." steam reservoir
- ⊡ HORNFELSIC GRAYWACKE

Continuous core from above and below first steam entry.

* Unocal Proprietary cores

UC — other Unocal cores
RR — Russian River Energy
CP — Calpine
DOE — Dept. of Energy/Geothermal Div.

Location at core depth/elev. — well designation

⊙ MLM-3 (el. -2237 to -2259')

core elevation interval

LOCATION MAP — CORES FROM THE GEYSERS STEAM FIELD

Well Name / Company / Well Elev. (at ground level)	Core Location (Top of Core)	Core Depth or Depth Interval — Drilled Depth (DD) / True Vertical Depth (TVD)	Core Elevation or Elevation Interval	First Steam Entry in Well — Drilled Depth (DD) / True Vertical Depth (TVD) / Elevation (EL.)	Rock Type	Comments
CA 1862-17 Aminoil/ Calpine EL 3367 ft	310 ft N, 1300 ft E of SW cor sec 21, T 11N, R8W, (MDBM) Sonoma Co., Calif.	DD 6958 - 6961 ft TVD 6909 - 6912 ft	-3542 to -3545 ft	DD 8000 ft TVD 7917 ft EL. -4548 ft	graywacke	4" - dia core
BARROWS 2 Aminoil/ Calpine EL. 2200 ft	1560 ft S, 270 ft W. of NE cor. sec. 35, T11N, R8W (MDBM) Lake Co., Calif.	DD 5812 to 5814.5 ft TVD 5728 to 5730.5 ft	-3528 to -3530.5 ft	DD 4487 ft TVD 4448 ft EL. -2248 ft	"	" badly fragmented; only ~ 50% of core remains
MLM-3 Aminoil/ Calpine EL. 1958 ft	780 ft S 1800 ft E of NW cor. sec. 36, T11N, R8W (MDBM); Lake Co., Calif.	DD 4330 to 4352 ft TVD 4195 to 4217 ft	-2237 to -2259 ft	DD 6043 ft TVD 5780 ft EL. -3822 ft but MAJOR LOST CIRC. ZONE WHILE DRILLING W/ MUD, AT: DD 4900 ft TVD 4166 ft EL. -2186 ft ... SUSPECT THIS WOULD HAVE BEEN A STEAM ENTRY IF THE DRILLING FLUID HAD BEEN AIR.	"	4" - dia. core

Geysers Core Samples

STORED AT ESRI AS OF 04/15/95

MLM-3

DESCRIPTION
BY M.K. TWICHELL
(AMINOIL USA)
1981

MLM No. 3 Core Description

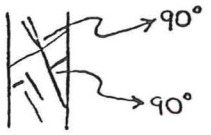
On Saturday, October 20, 1979, twenty-two feet of lithic graywacke was cored in the MLM No. 3 well. The cored interval was from 4330 feet to 4352 feet measured depth. All twenty-two feet of the core was recovered although a true measurement is not possible due to the highly fragmented nature of some of the core samples.

Tray #1 (Top of core - cored interval 4330'-4332' 6")

The entire length of the pieces filling tray #1 is 30". The top 4" is argillite with intercalated graywacke, then 24" of graywacke, then 2" of argillite.

Argillite (4330' to 4330' 4") - dark gray to black; phyllitic; thinly laminated to intercalated with med. to dark gray, very fine grained graywacke. The argillite and graywacke are disrupted by milky white pods and veinlets of milky quartz, calcite, and trace amounts of pyrite and pyrrhotite (?). These pods are confined to the argillite and appear like they have been "injected" into the argillite and graywacke, surrounding pods and stringers of the rock. Although rock and vein material are jumbled together, a crude planar orientation of the pods can be noted. This plane is approx. 50° to the axial plane of the core. The vein minerals are milky quartz, calcite, sulfides (pyrite and pyrrhotite) and trace amounts of chlorite. Sequence of mineral deposition seems to be milky quartz, then calcite with sulfides, and chlorite either last or at the same time as the calcite.

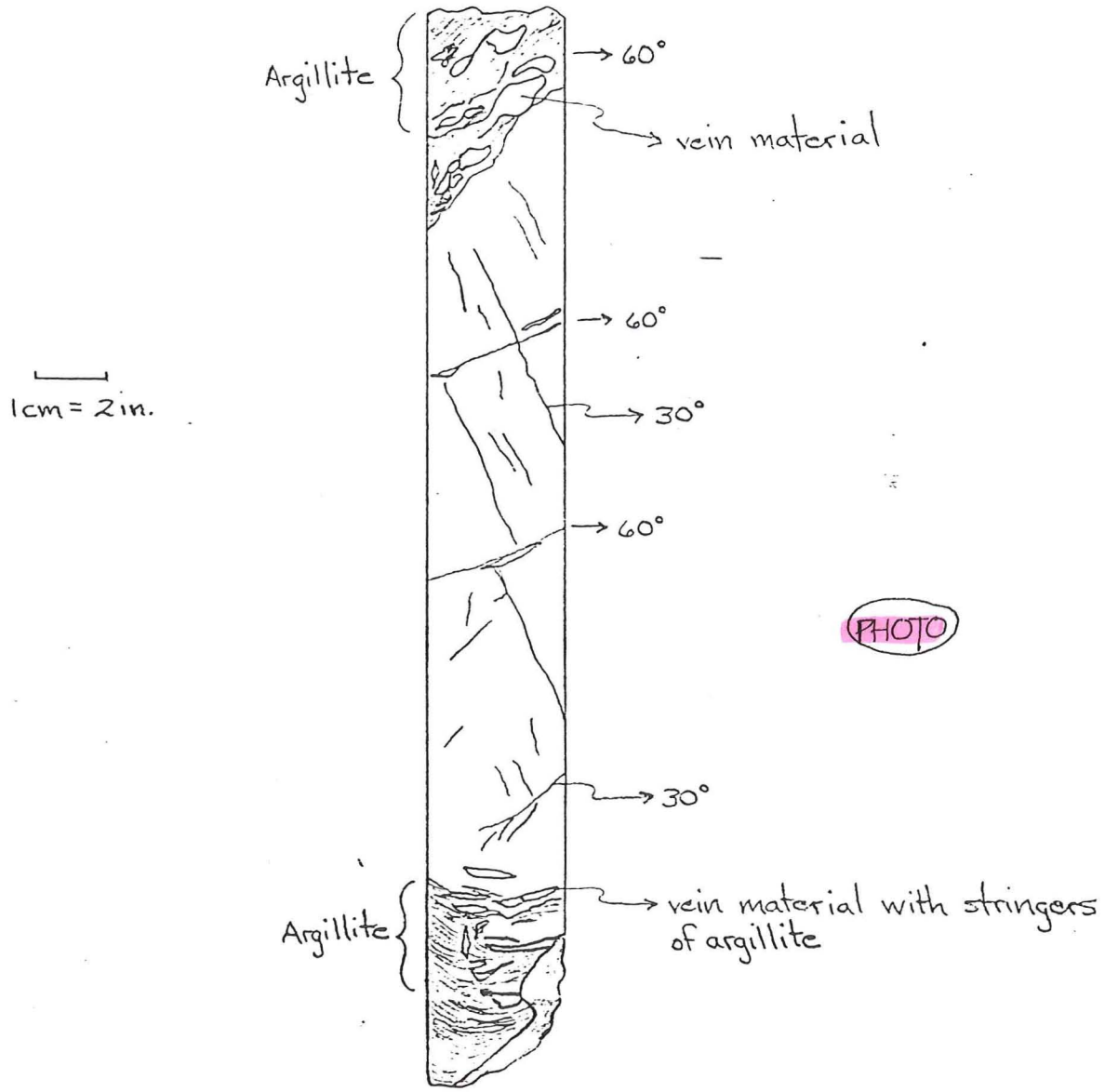
Graywacke (4330' 4" to 4332' 4") - med. to dark gray; very fine to fine grained; fairly well sorted lithic graywacke; composition questionable because of fine size. Graywacke is finely laminated with darker, more argillaceous laminations in with the graywacke. The laminations are deformed so that no through going foliation is evident. Circular patterns, broad folds, crenulations, microfaulting, and cataclastic stringers of argillite are all evident. Milky white veinlets and veins of both quartz and calcite cut through the core piece at what, at first, appears to be random orientation. However, three directions seem to predominate. The largest "veins", filled with milky quartz, calcite, chlorite, and sulfides trend at 60° to the axial plane of the core. They are not true veins but fractures with vein material in most parts of the fracture and stretched out argillaceous graywacke defining the plane where there is no vein material. Maximum width of these "veins" where filled is 6 mm. The next most prominent veinlets trend 30° to the axial plane of the core. Most are calcite with sulfides although quartz is also present. Only one of these veinlets cuts the vein filled fracture trending at 60°, the others either stop or are offset by these vein filled fractures. Width of these veinlets ranges from microscopic to 2 mm. These veinlets fall into two sets which trend perpendicular to one another.



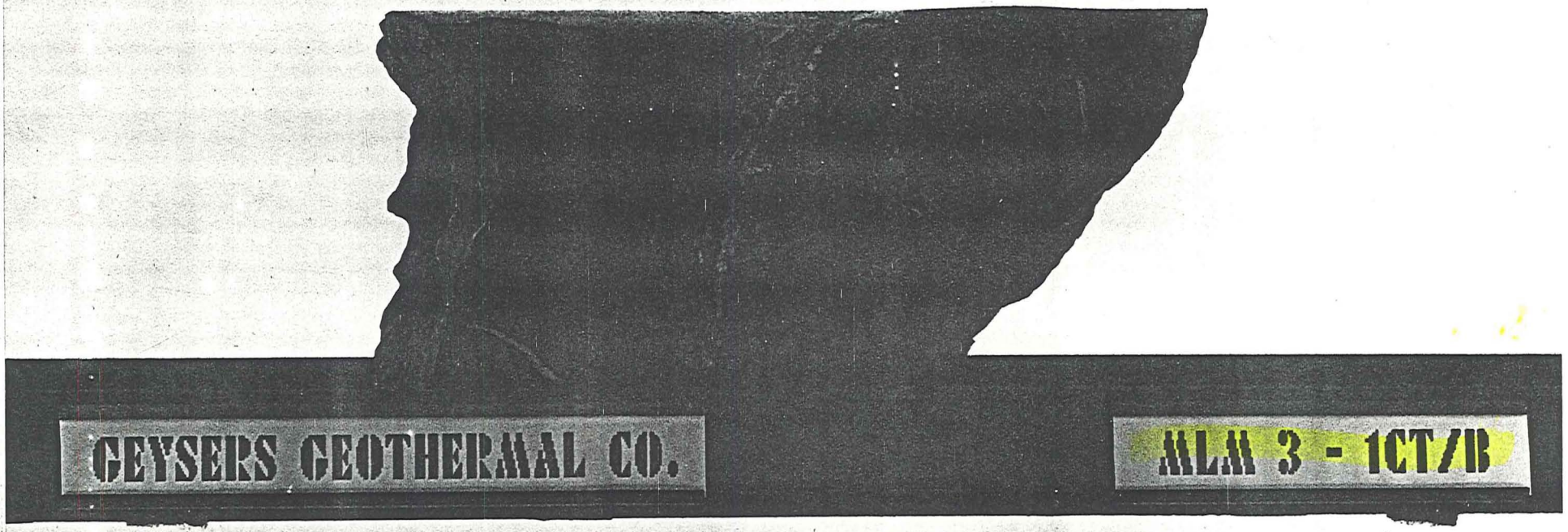
The least prominent set trends nearly parallel to the axial plane of the core and are short, discontinuous stringers of quartz, calcite, and sulfides. Most have more sulfide content than the other two vein/fractures described above. Width of these stringers ranges from microscopic to 2 mm.

MLM-3

Argillite (4332' 4" to 4332' 6") - dark gray to black; phyllitic; intercalated with med. to dark gray; very fine grained graywacke. Very few mineral stringers in this argillite section. Good example of a flame structure was noted with argillite squeezed up into the overlying graywacke.



PHOTO


GEYSERS GEOTHERMAL CO.
ALA 3 - 1CT/B

Tray #2 (Cored interval 4332' 6" to 4335')

The entire length of the pieces filling tray #2 is approximately 30". The top is a continuation of the argillite at the bottom of tray #1. Approximate length is 3". Below this is 3" of thinly laminated graywacke and argillite, then 24" of graywacke.

Argillite (4332' 6" to 4332' 9") - same as above only argillite is thinly laminated with the laminations disrupted by quartz, calcite, sulfides, chlorite filled stringers and veinlets. This vein material intermingles with stringers of argillite forming a plane trending 60°-70° to the axial plane of the core.

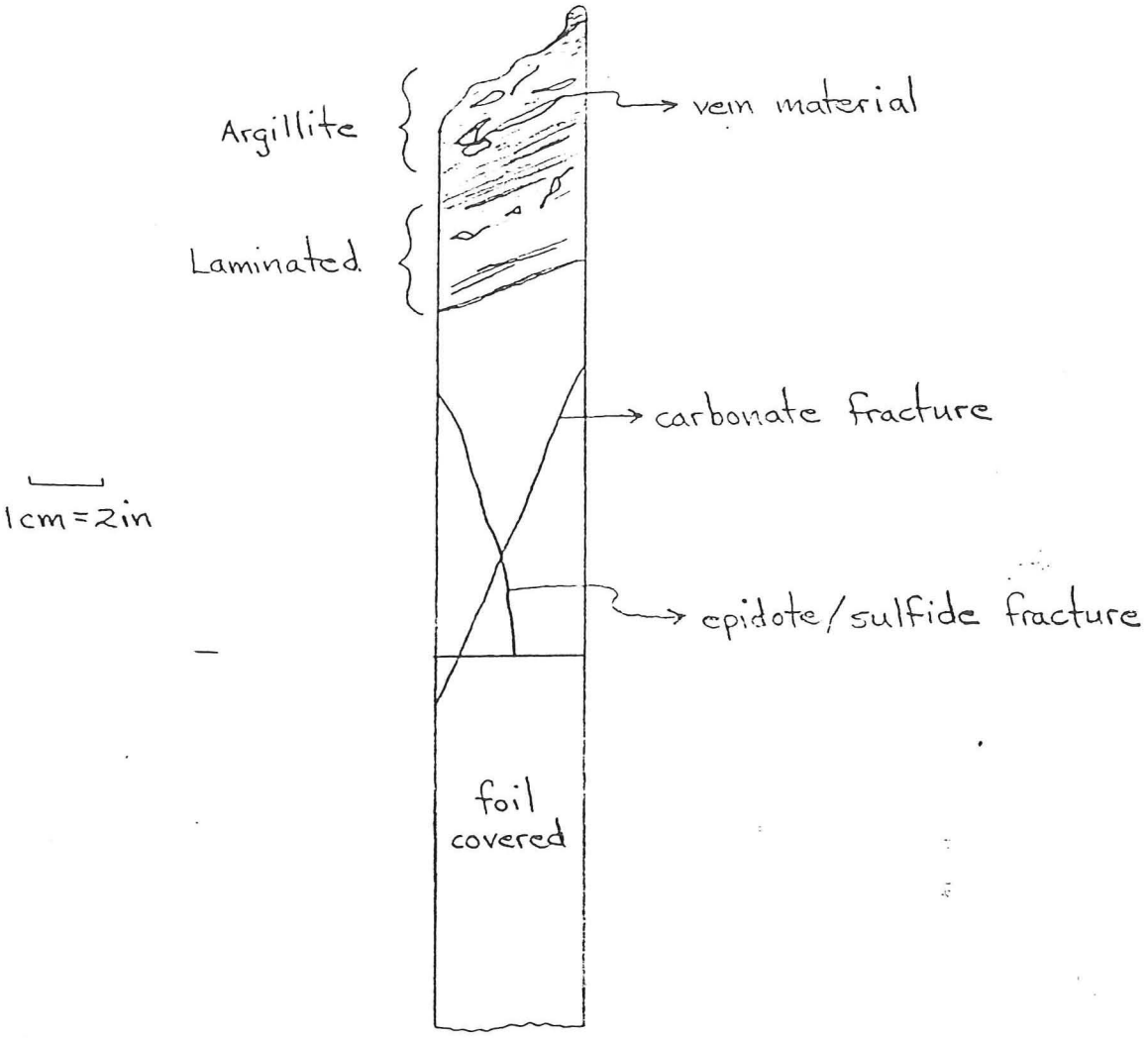
Laminated graywacke and argillite (4332' 9" to 4333') - microscopic to 2 mm thick black bands of argillite are intercalated with med. gray, very fined grained graywacke. The laminations are mostly planar although the upper argillite laminations are convolute to crenulated. The average planar orientation of the laminations is 60° to the axial plane of the core. Minor amounts of mineral filled stringers cut across the laminations.

Graywacke (4333'-4335') - will be describing the first 14" of graywacke, the remaining 10" is wrapped in tinfoil awaiting the fluid saturation test and will not be logged in at this time. The upper 10" of graywacke is med. gray, fine to med. grained, poorly sorted lithic graywacke composed of quartz, feldspar, and black mafic and lithic clasts; no clayey matrix is visible between the clasts. The lower portion is slightly more lithic than the upper portion with blocky to elongate clasts of argillite 1 mm to 5 mm in longest dimension. The lower 4" of graywacke is light gray, med. grained, poorly sorted lithic graywacke composed of quartz, feldspar, and black lithic and mafic clasts; no clayey matrix is visible between the clasts. The graywacke contains argillite clasts 1 mm to 2 mm in size. The graywacke exhibits some cataclastic texture. The graywacke pieces are cut by a series of fractures that have minerals precipitated on the fractured surfaces. The fractures fall into two groups:

1. Fractures with calcite only.
2. Fractures with quartz, calcite, epidote, sulfides, and sphene?

There are two fractures present in the graywacke that have calcite mineralization only (group 1). Their orientations are 10° and 20° to the axial plane of the core. These calcite filled fractures are cross cut by fractures of group 2. There are many group 2 fractures present in this 14" graywacke section. The most prominent fractures of this group trend at 10°, 20°, and 60° to the axial plane of the core. The largest, continuous fracture, 2 mm in width, trending 10° to the axial plane of the core, cross cuts the other fractures. This fracture contains quartz, calcite, epidote, pyrrhotite, and sphene. Most of the other fractures have quartz, calcite, pyrrhotite, and epidote although there are fractures that do not contain epidote. The order in which the minerals precipitated out seems to be quartz, epidote, and calcite with pyrrhotite and sphene. There are several examples where the widest portion of the fracture houses quartz on the outer margins, then epidote, with calcite and sulfides

filling the center. This same fracture may then narrow with only quartz precipitated in it.



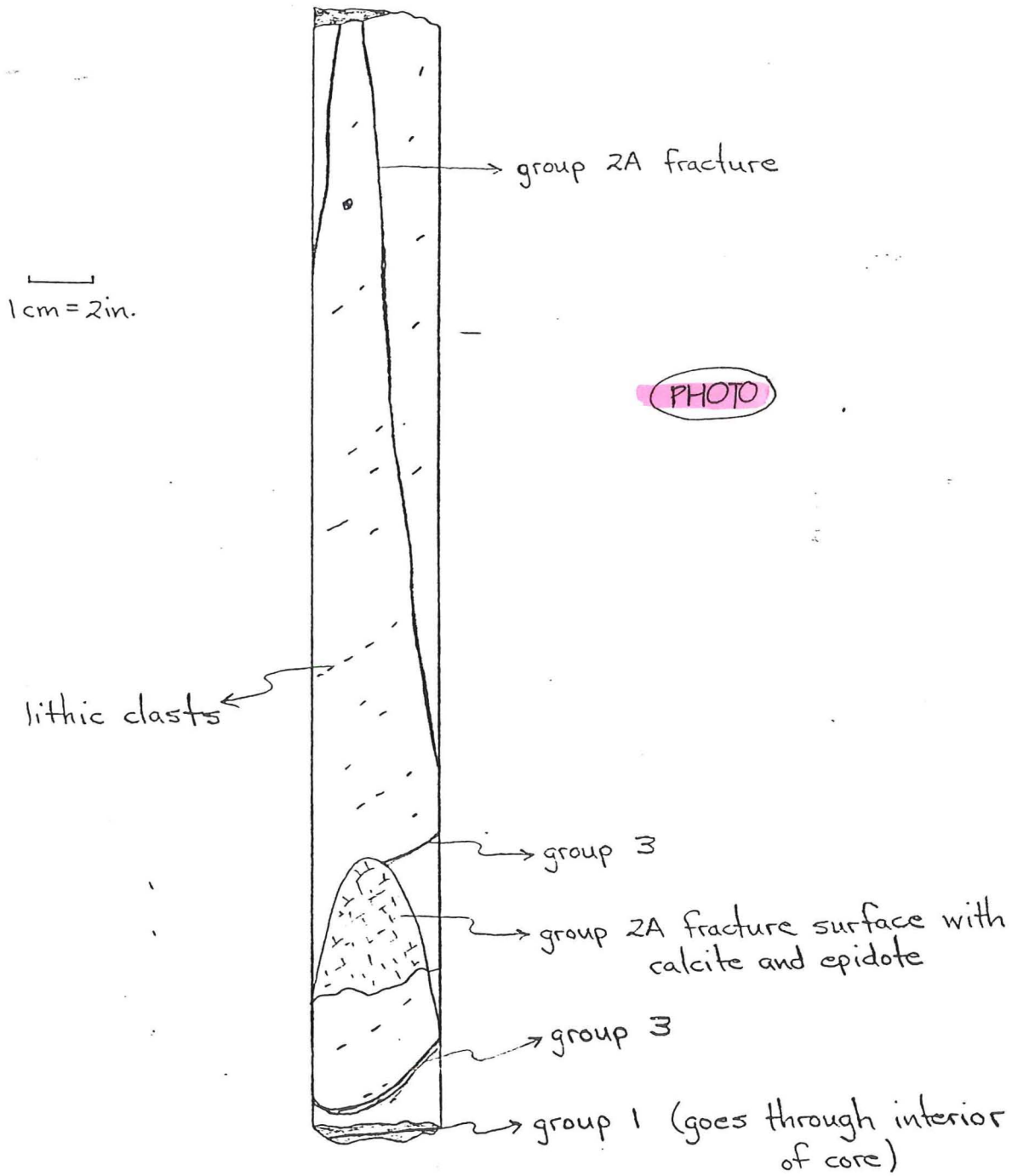
Tray #3 (Cored interval - 4335' to 4337' 10")

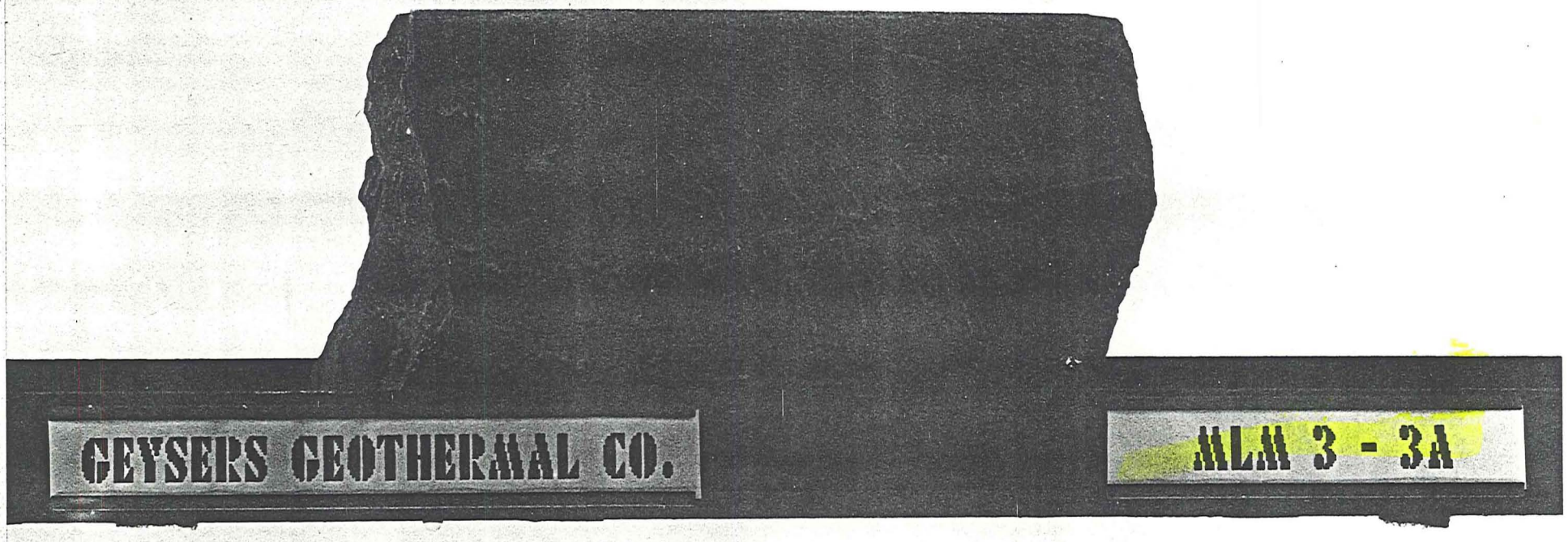
The entire length of the pieces filling tray #3 is 34". The pieces are all lithic graywacke.

The graywacke is light gray, med. to coarse grained, poorly sorted lithic graywacke composed of quartz, feldspar, variable lithic clasts, some mafic clasts, and minor epidote clasts; the most prominent lithic clasts are argillite clasts that range from 1 mm to 5 mm although a few argillite inclusions range up to 1-1/2 cm in longest dimension. The graywacke has a cataclastic texture with grain boundaries still fairly distinct. No clayey matrix is visible. The elongate lithic clasts impart a poorly developed foliation that trends at 50° to the axial plane of the core.

Two main fractures cut the graywacke pieces in tray #3. There are also other smaller fractures present. The nature of fracturing seems to fall into two categories: Those with minerals present in the fractures and those that are defined by pulverized graywacke (cataclasis of rock along the fracture plane). The latter will be denoted as group 3 fractures (groups 1 and 2 defined on page 3).

Group 3 fractures (cataclastic origin) are denoted by thin ($\leq$1 mm), dark gray bands that, under the hand lens, appear to be fine grained, pulverized graywacke. These trend at 40° to the axial plane of the core. They are cross cut by the mineral filled fractures.




GEYSERS GEOTHERMAL CO.
MLM 3 - 3A

MKT p6-of 11

MLH-3

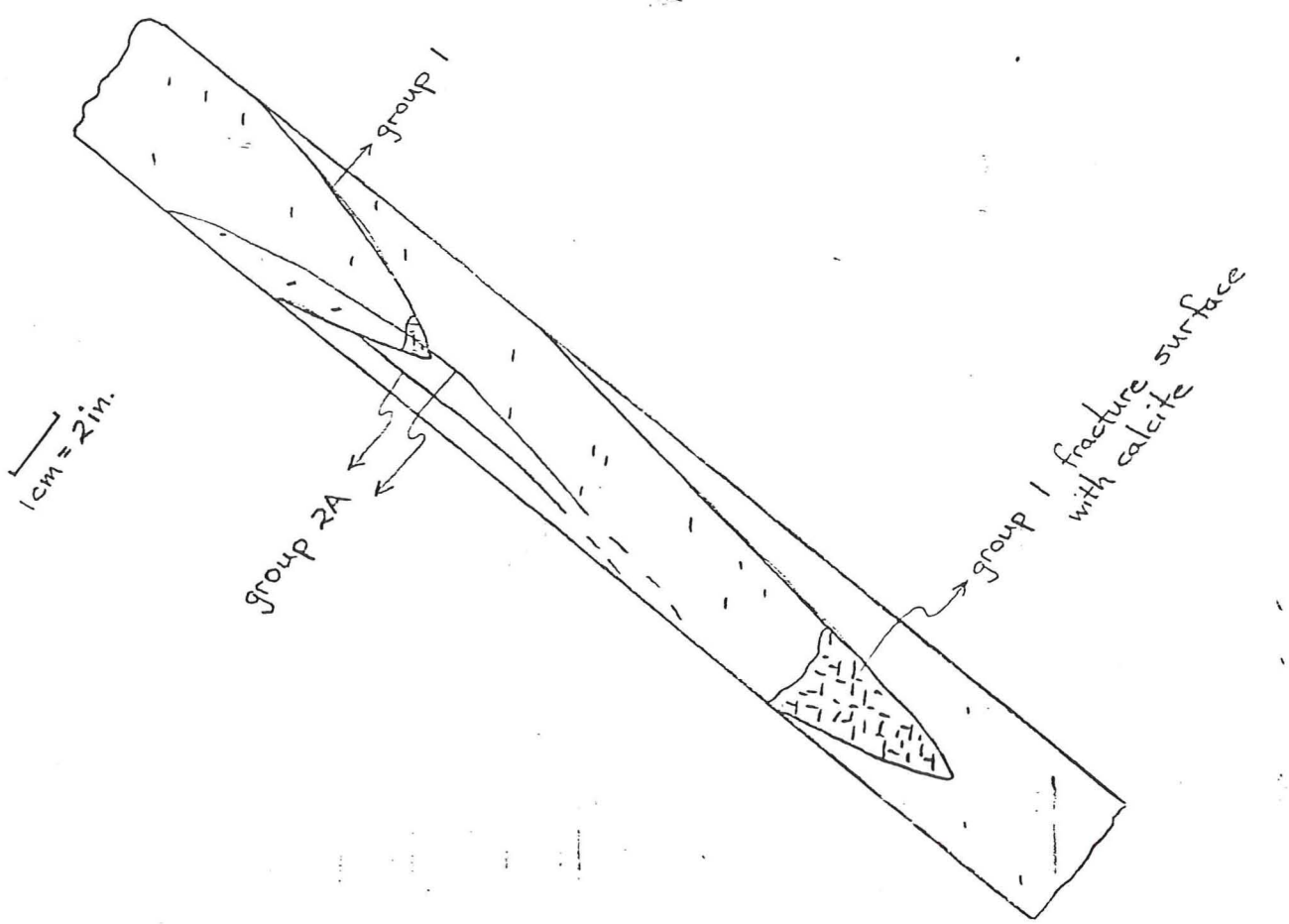
The mineral filled fractures are like group 2 fractures (see page 3). The largest of these is 4 mm in width, the smallest ones are less than 1 mm in width. However, the mineral content is different in this group of fractures than in group 2. The minerals present are quartz (first to occur and sometimes crystalline in the largest fracture), epidote, calcite, minor biotite, and only trace occurrences of sulfide and sphene. This fracture mineral content will be known as group 2A. Group 2A cross cuts both group 1 and group 3 fractures. Orientations of the two largest group 2A fractures are 10° and 20° to the axial plane of the core.

Tray #4 (Cored interval 4337' 10" to 4340' 7")

The entire length of the pieces filling tray #4 is 33". The pieces are all lithic graywacke.

The description for the graywacke is the same as that given for the graywacke in tray #3.

The three main fractures cutting this section of graywacke are group 1 fractures. A small amount of biotite seems to be associated with the calcite in these fractures. Two small group 2A fractures cut one of the group 1 fractures. The group 2A fractures are mostly 1 mm wide but do have vuggy areas between 2 mm and 3 mm in width. These vugs are partially filled with calcite. Orientations of the group 1 (calcite) fractures are parallel, 10° and 20° to the axial plane of the core.



MLM-3

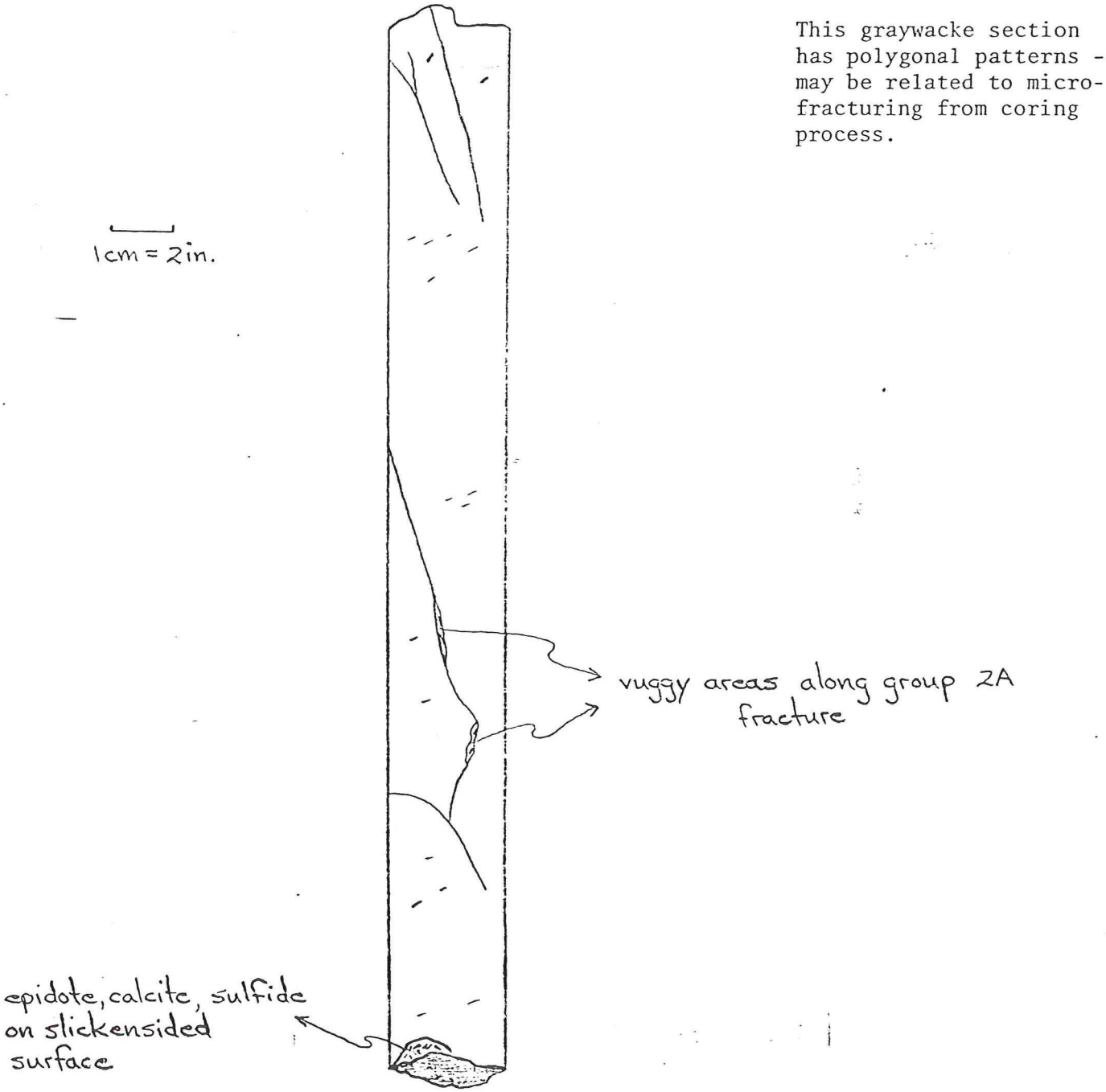
MKT p7-8 11

Tray #5 (Cored interval 4340' 7" to 4343' 5")

The entire length of the pieces filling tray #5 is 34". The pieces are all lithic graywacke.

The description for the graywacke is the same as that given for the graywacke in tray #3.

This section of graywacke is not fractured to any appreciable extent. The fractures that are present are of group 2A and are somewhat vuggy (see description for tray #4). The orientation of the largest group 2A fracture is 20° to the axial plane of the core.

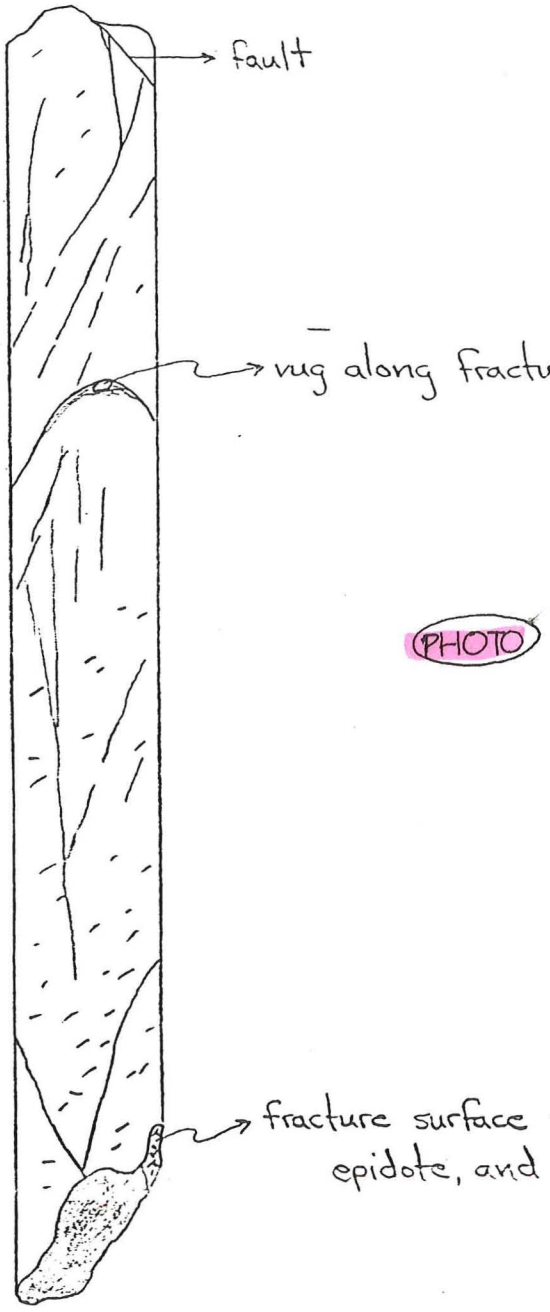


Tray #6 (Cored interval 4343' 5" to 4346' 2")

This section of graywacke is in one piece and is approximately 33" long. It is all lithic graywacke with the last 16" having more elongate argillite inclusion than above.

The description for the graywacke is the same as that given for the graywacke in tray #3. More elongate, 1 mm to 5 mm in length, argillite inclusions impart a foliation trending 50° to the axial plane of the core. These are more prominent in the bottom 16" of the core piece.

This section of graywacke has numerous small fractures most of which have vuggy areas at random intervals along their length. The vugs may be as much as 2 cm in length along the fracture and up to 7 mm in width. The rest of the mineral



1cm = 2in.

PHOTO


GEYSERS GEOTHERMAL CO.
ALA 3 - GB

filled fracture may only be 1 mm to 2 mm in width. The mineral content of these fractures resembles that of group 2 except that there is much less sulfide content, and what there is seems to be pyrite and sphal erite (?). The vugs also reveal the degree of crystallinity of the various minerals. Euhedral crystals of quartz grow out from the quartz lined margins of the vugs. Usually the crystals are concentrated on one side of the vug, but no pattern (top versus bottom) stays consistent for the vugs along the same fracture. Next, epidote, usually finely crystalline, occurs in proximity to the quartz line rim but not the quartz crystals. Crystalline calcite, with finely granular sphalerite (?) and trace amounts of pyrite, partially fill the vugs. Mainly quartz or quartz and epidote are found in the narrow portions of the fracture. The quartz crystals mentioned above are approximately 1 mm in length.

Of interest is that the fracture at the top of the piece is really a small fault as the minerals mentioned above were precipitated along a slickensided surface. This surface is dark gray, phyllitic, and striated where not covered by the minerals. Its orientation is 40° to the axial plane of the core. Most of the other fractures trend between 10° and 30° to the axial plane of the core. The fault also cross cuts the other fractures.

Tray #7 (Cored interval 4346' 2" to 4348' 6")

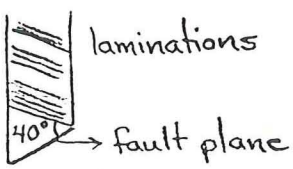
The entire length of the pieces filling tray #7 is 28". The first 6" is coarse lithic graywacke, then there are 9" of thinly laminated graywacke and argillite followed by 13" of lithic graywacke.

The first 6" of lithic graywacke is the same as the bottom 16" of graywacke in tray #6. The fractures in this piece are the same as those described for tray #6.

The next 9" is thinly laminated graywacke and argillite. The graywacke is med to dark gray, med. to very fine grained. It contains bands of dark gray to black, phyllitic argillite that gives it the thinly laminated structure. The laminations are contorted by crenulations, microfaults (high angle and thrust variety), and a number of warps and convolute structures due to loading. The orientation of the laminations is 60° to the axial plane of the core. Only a small number of mineral filled fractures are present in this section. These are of two types: 1) The quartz, calcite, pyrite, chlorite filled fracture parallel to the laminations and interfingering with them and 2) The high angle (20° to the axial plane of the core) extremely narrow (≤1/2 mm in width) quartz, calcite, sulfide fracture that is found in the graywacke below this section. A fracture plane with calcite along its surface cuts through the argillite at the top of the laminated sequence. This fracture trends 60° to the axial plane of the core (same as the laminations).

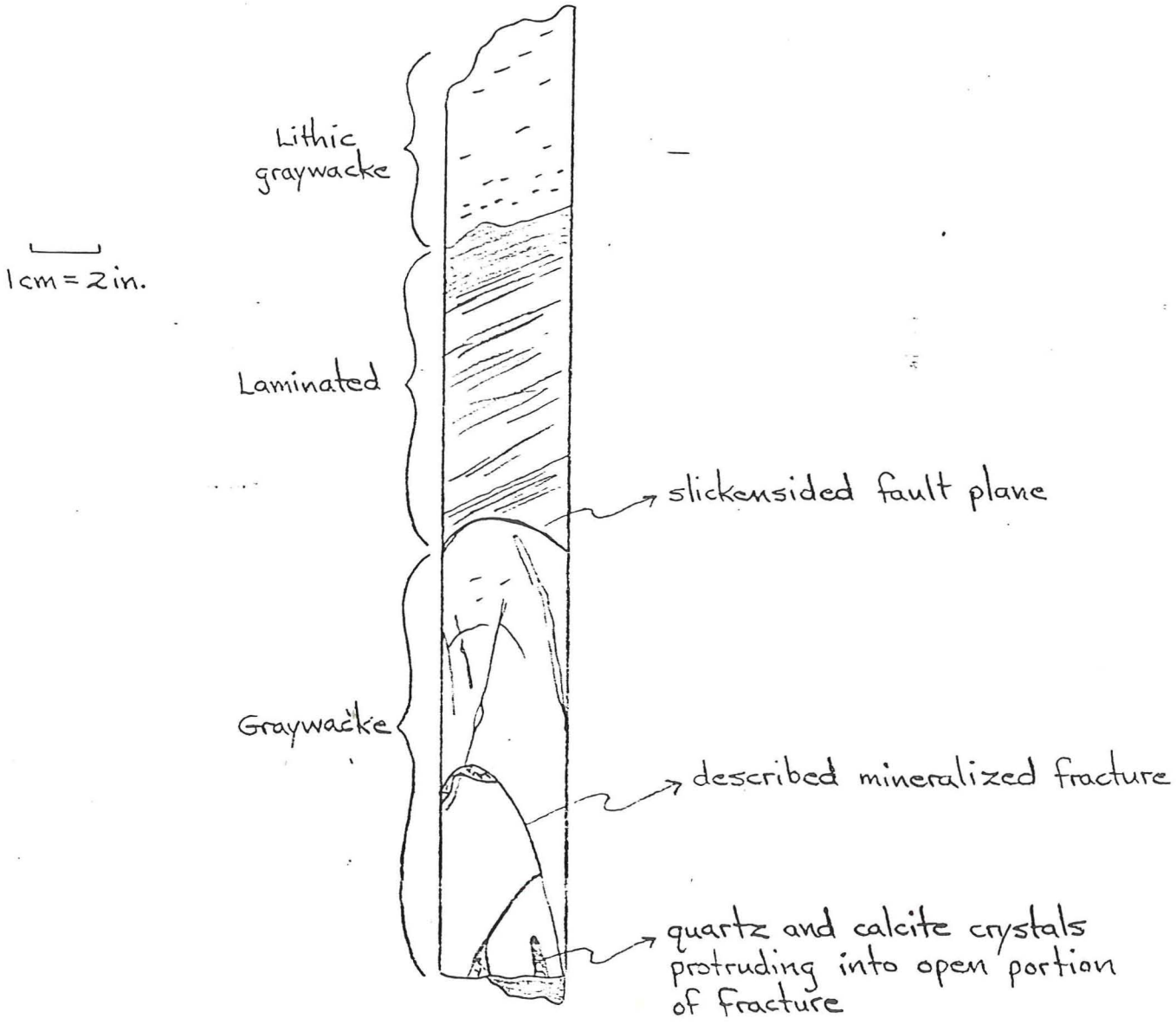
The 13" of graywacke is similar to that described for tray #3 except it has a green cast and increased cataclasis.

A fault plane, trending 60° to the axial plane of the core, is present in the upper part of the graywacke. The fault plane is slickensided. This plane is not oriented the same as the plane of the laminations but intersects it at approximately 40°. The rock on either side of the fault is pulverized, altered with partial chloritization taking place, and both calcite and quartz precipitated in the fault gouge. The fault plane is approximately 1 cm to 1-1/2 cm wide in the graywacke but where it butts up against the



argillite/graywacke section, no altered rock can be found.

There are four main mineralized fractures in the graywacke below the fault plant. Much of the length of these fractures is partially open with euhedral crystals of quartz and calcite protruding into the open space. The open portion is as much as 4 mm wide on the largest fracture with the fracture itself, from margin to margin, being only 5 mm wide. One of the fractures broke along its plane exposing the mineralized portion within. The sides exposed have a profusion of euhedral crystals of quartz, epidote, axinite, and calcite along with white, earthy masses of alunite (?) precipitated among the crystals. Trace amounts of euhedral sphalerite and galena are present along with anhedral pyrite and pyrrhotite embedded in the alunite (?). It appears that quartz precipitated first, followed by epidote and/or axinite, then calcite forming planar crystals around the above crystals, with alunite (?) and the sulfides forming last. This whole intergrown crystalline array is housed in a fracture that is only 1-1/2 mm in width. The fracture itself trends at 30° to the axial plane of the core. The other fractures in this graywacke section trend between near vertical to 30° to the axial plane of the core.



MLM-3

MKT pll of 11

Tray #8 (Cored interval 4348' 6" to 4351' 2")

The entire length of the two pieces filling tray #8 is 32". The pieces are all lithic graywacke with the top 6" having a few large (5 mm) lithic inclusions, the middle 17" having quite a few lithic inclusions, and the bottom 9" having abundant lithic inclusions.

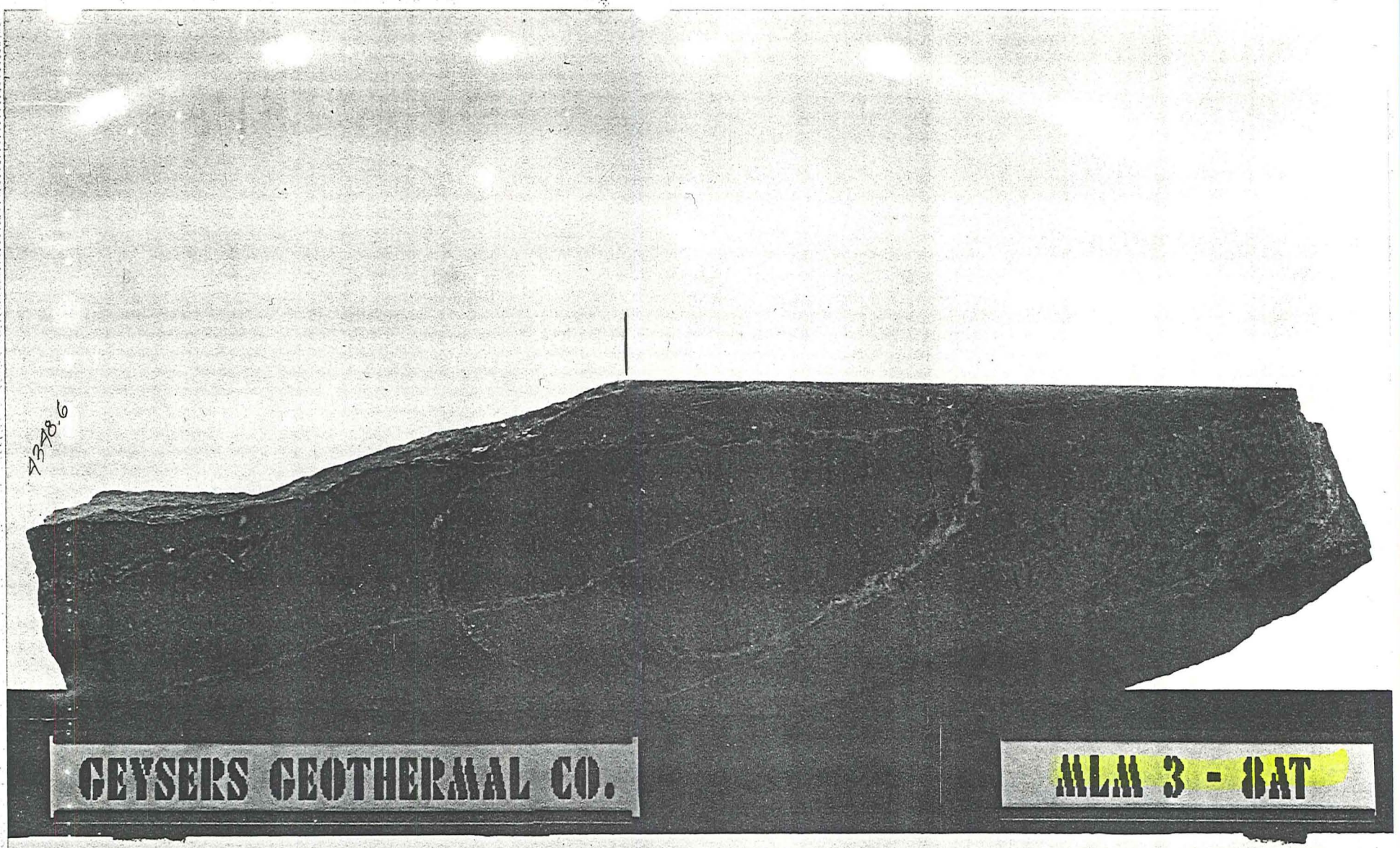
The upper 6" of lithic graywacke is the same as that described for tray #7. It has a greenish cast and cataclastic texture as well as same feldspar alteration and chloritization. Microscopic vugs contain epidote.

The middle 17" of lithic graywacke has quite a number of large (5 mm), lithic inclusions. Most of these are elongate argillite clasts. There are also rounded to subangular clasts of light green greenstone, milky to greyish quartz, and white, soft clayey clasts which may once have been chert (?) or some other lithic inclusion but which have been selectively altered to some clayey mineral (?). Microscopic quartz veinlets are present in these clasts. The graywacke is as described above.

The bottom 9" of lithic graywacke contains a large number of lithic inclusions as described above. Some of the "inclusions" are really quartz and epidote filled vugs. These minerals are usually massive, not crystalline as they are in the fractures.

Several fractures containing crystalline quartz, epidote, calcite, axinite, sphalerite, pyrite, and alunite (?) cross cut this section of graywacke. Most of these trend from near vertical to 30° to the axial plane of the core. Several vugs up to 9 mm in width and of variable length are present along the fractures. A major difference seen along these fractures versus the other fractures in the core pieces above is that the graywacke surrounding the fractures has been selectively dissolved forming small vugs in the altered rock along the fractures. Some of the vugs are partially filled with minerals, but most have no mineral content. Since the vugs are only microscopic to 2 mm diameter in size, the fractures appear to have "spongy" margins. Due to the presence of epidote and chlorite, these margins are greener in color than the surrounding graywacke.

PHOTO – NO DRAWING


4348.6
GEYSERS GEOTHERMAL CO.
ALA 3 - 8AT

04/30/86

CORE LABORATORIES, INC.
Special Core Analysis

File SCAL-308-86032

EFFECTIVE PERMEABILITY TO OIL

Geysers Geothermal Company — Wells As Noted

Well I.D.	Sample Number	Porosity, percent	Permeability to Air, millidarcys	Effective Overburden Pressure, psi	Specific Permeability to Water, millidarcys	Permeability Ratio, water/air
Barrows 2	2	4.6	0.48	6800	0.027	0.056
CA 958-3A	4	1.4	0.089	2860	0.0015	0.017
CA 1862-4	7	2.6	0.28	5210	*	-
CA 1862-17	10H**	0.9	0.10	8140	0.0017	0.017
MLM 3 (OAT)	(14)	9.1	1.8	5190	0.040	0.022

*Effectively impermeable with 5210 psi effective confining pressure and 100 psi injection pressure

**1-inch diameter core plug

04/30/86

CORE LABORATORIES, INC.
Special Core Analysis

File SCAL-308-86032

PERMEABILITY TO AIR AND POROSITY

Geysers Geothermal Company — Wells As Noted

Well Identification	Sample Number	Permeability to Air, millidarcys	Porosity, percent
Barrows 2	2	0.48	4.6
CA 958-3A	4	0.089	1.4
CA 1862-4	7	0.28	2.6
CA 1862-17	10H*	0.10	0.9
MLM 3 (BAT)	(14)	1.8	9.1

*1-inch diameter core plug

GEYSERS GEOTHERMAL COMPANY
MISC. WELLS

DATE : 3-26-86
FORMATION :
DRLG. FLUID :
LOCATION :

FILE NO. : 32020-15092
API WELL NO. :
LABORATORY : MIDLAND, TEXAS

FULL DIAMETER ANALYSIS - SUMMATION OF FLUIDS

SAMPLE NUMBER	DEPTH FEET	PERM MAXIMUM	PERM 90 DEG	PERM VERTICAL	FLD POR	OIL% POR	WTR% POR	GRAIN DEN M	
1	BARROWS 2 3T/B	0.64	<0.01	11.	3.0	0.0	8.3	2.68	
2	BARROWS 2 4T/B	0.30	0.26	0.70	4.7	0.0	8.3	2.71	
3	CA-958-3A 1CT/B	0.44	0.39	<0.01	1.3	0.0	22.2	2.72	
4	CA-958-3A 2BT/B	0.18	0.13	0.11	1.3	0.0	22.2	2.72	
5	CA-958-3A 5AT	0.12	0.07	0.38	0.5	0.0	50.0	2.70	
6	CA-958-6	0.56	0.39	1.6	1.9	0.0	62.5	2.71	
7	CA-1862-4 1BT/B	3.3	0.85	VF	1.9	0.0	46.0	2.76	VERTICALLY FRACTURED
8	CA-1862-4 1CT/B	0.30	0.25	0.35	1.9	0.0	43.5	2.76	
9	CA-1862-17 FT/B	0.30	0.21	0.41	1.2	0.0	40.0	2.67	
* 10	CA-1862-17G	0.12		0.01	1.6	0.0	75.0	2.66	
11	MLM-3 1CT/B	<0.01	<0.01	<0.01	2.2	0.0	87.5	2.72	
12	MLM-3 3A	<0.01	<0.01	<0.01	1.7	0.0	33.3	2.69	
13	MLM-3 6B	<0.01	<0.01	0.06	2.8	0.0	14.6	2.69	
(14)	MLM-3 8AT	6.9	0.22	2.3	9.4	0.0	14.9	2.78	

* INDICATES PLUG PERMEABILITY

CORE LABORATORIES, INC.

Petroleum Reservoir Engineering

DALLAS, TEXAS

GEYSERS GEOTHERMAL COMPANY
MISC. WELLS

DATE : 3-26-86
FORMATION :
DRLG. FLUID :
LOCATION :

FILE NO. : 32020-15092
API WELL NO. :
LABORATORY : MIDLAND, TEXAS

FULL DIAMETER ANALYSIS

SAMPLE NUMBER	DEPTH FEET	PERM MAXIMUM	PERM 90 DEG	PERM VERTICAL	HE FOR	OIL% FOR	WTR% FOR	GRAIN DEN M	
1	BARROWS 2 3T/B	0.64	<0.01	11.	3.0	0.0	91.7	2.68	
2	BARROWS 2 4T/B	0.30	0.26	0.70	5.5	0.0	85.7	2.74	
3	CA-958-3A 1CT/B	0.44	0.39	<0.01	1.4	0.0	90.0	2.72	
4	CA-958-3A 2BT/B	0.18	0.13	0.11	1.4	0.0	90.0	2.72	
5	CA-958-3A 5AT	0.12	0.07	0.38	0.9	0.0	57.1	2.71	
6	CA-958-6	0.56	0.39	1.6	2.6	0.0	72.7	2.73	
7	CA-1862-4 1BT/B	3.3	0.85	VF	2.1	0.0	92.5	2.77	VERTICALLY FRACTURED
8	CA-1862-4 1CT/B	0.30	0.25	0.35	2.4	0.0	79.3	2.77	
9	CA-1862-17 FT/B	0.30	0.21	0.41	1.7	0.0	85.7	2.68	
* 10	CA-1862-17G	0.12		0.01	1.8	0.0	66.3	2.66	
11	MLM-3 1CT/B	<0.01	<0.01	<0.01	2.5	0.0	88.9	2.72	
12	MLM-3 3A	<0.01	<0.01	<0.01	2.7	0.0	60.0	2.72	
13	MLM-3 6B	<0.01	<0.01	0.06	3.5	0.0	80.4	2.71	
14	MLM-3 8AT	6.9	0.22	2.3	9.5	0.0	97.9	2.79	

* INDICATES PLUG PERMEABILITY

2.93 avg.

2.92 w/o 9.5

GEYSERS GEOTHERMAL COMPANY
3\26\86
32020-15092

SAMPLE NUMBER	WELL NAME & NUMBER	PORE VOLUME BY SUMMNATION OF FLUIDS (cc)	PORE VOLUME BY HELIUM INJECTION (cc)	WATER LOSS (gm)	INJECTED SATURATION (gm)	GRAIN DENSITY BY SUMMNATION OF FLUIDS (gm/cc)	GRAIN DENSITY BY HELIUM INJECTION (gm/cc)	BULK DENSITY (gm/cc)	BULK VOLUME BY CALIPER (cc)	BULK VOLUME BY ARCHIMEDES (cc)
1	Barrows 3T/B	12.00	12.00	1.00	11.00	2.68	2.65	2.63	402.774	398.00
2	Barrows 4T/B	24.00	28.00	2.00	22.00	2.71	2.72	2.63	509.755	507.00
3	CA-958-3A 1CT/B	9.00	10.00	2.00	7.00	2.72	2.70	2.70	719.630	714.00
4	CA-958-3A 2BT/B	9.00	10.00	2.00	7.00	2.72	2.71	2.70	716.518	713.00
5	CA-958-3A 5AT	4.00	7.00	2.00	2.00	2.70	2.70	2.69	763.022	759.00
6	CA-958-6	8.00	11.00	5.00	3.00	2.71	2.73	2.68	417.485	416.00
7	CA-1862-4 1BT/B	37.00	40.00	17.00	20.00	2.76	2.77	2.73	1937.778	1936.00
8	CA-1862-4 1CT/B	23.00	29.00	10.00	13.00	2.76	2.76	2.72	1212.895	1207.00
9	CA-1862-17 FT/B	5.00	7.00	2.00	3.00	2.67	2.68	2.65		410.00
10	CA-1862-17G	8.00	9.05	4.00	4.00	2.66	2.66	2.63		503.00
11	MLM-3 1CT/B	8.00	9.00	7.00	1.00	2.72	2.70	2.68	365.819	363.00
12	MLM-3 3A	15.00	25.00	5.00	10.00	2.69	2.70	2.65	910.715	904.00
13	MLM-3 6B	41.00	51.00	6.00	35.00	2.69	2.71	2.64	1451.641	1452.00
14	MLM-3 8AT	47.00	48.00	7.00	40.00	2.78	2.76	2.61	505.180	500.00

2.67 avg.

WELL: MLM 3
LOCATION: 1800920E 401726N
SURFACE ELEVATION: 1980.
CASING SHOE: 4300.
FLOWRATE (KLBS/HR): 30.

COMMENTS: ORIGINALLY MLM 3 RD. PLUGGED BACK AND REDRILLED BECAUSE NONCOMMERCIAL. DATA IN WELL FILES UNDER BARROWS 3. NAME CHANGE DUE TO B.H.LOCATION.

Barrows-3 originally called MLM-3 RD

M.D.	T.V.D	N(-S)	E(-W)	COMP. INC	
0.	0.	0.	0.	0.	
200.	200.	6.	1.	-100.	
400.	400.	14.	6.	-100.	
600.	599.	23.	15.	-100.	
800.	798.	33.	26.	-100.	
1000.	997.	44.	41.	-100.	
1114.	1110.	51.	51.	0.	
1200.	1196.	54.	61.	-100.	
1400.	1395.	64.	85.	-100.	
1600.	1593.	78.	111.	-100.	
1800.	1790.	97.	139.	-100.	
2000.	1986.	120.	169.	-100.	
2029.	2014.	124.	173.	0.	
2200.	2180.	150.	205.	-100.	
2400.	2374.	185.	242.	-100.	
2600.	2566.	222.	278.	-100.	
2800.	2759.	263.	314.	-100.	
3000.	2950.	307.	350.	-100.	
3022.	2971.	312.	354.	0.	
3200.	3142.	353.	385.	-100.	
3400.	3334.	402.	420.	-100.	
3600.	3523.	456.	454.	-100.	
3800.	3711.	515.	488.	-100.	
4000.	3897.	578.	520.	-100.	
4014.	3910.	583.	522.	0.	
4200.	4076.	662.	549.	-100.	
4300.	4166.	704.	564.	-10.	⇒ LCZ
4400.	4257.	744.	579.	-100.	
4600.	4438.	822.	609.	-100.	
4800.	4620.	898.	638.	-100.	
5000.	4804.	970.	668.	-100.	
5021.	4823.	977.	671.	0.	
5200.	4989.	1036.	703.	-100.	
5400.	5175.	1100.	736.	-100.	
5600.	5362.	1162.	766.	-100.	
5800.	5550.	1223.	793.	-100.	
6000.	5739.	1282.	818.	-100.	
6038.	5775.	1293.	822.	0.	
6043.	5780.	1294.	823.	10.	
6200.	5932.	1331.	833.	-100.	
6400.	6126.	1381.	848.	-100.	
6600.	6318.	1433.	863.	-100.	
6800.	6509.	1489.	879.	-100.	
7000.	6700.	1547.	896.	-100.	
7067.	6763.	1568.	902.	0.	
7200.	6892.	1608.	909.	-100.	
7400.	7083.	1671.	922.	-100.	
7600.	7271.	1738.	940.	-100.	
7800.	7456.	1809.	962.	-100.	
8000.	7638.	1885.	989.	-100.	
8162.	7783.	1950.	1015.	0.	
8200.	7817.	1965.	1021.	-100.	
8400.	7993.	2050.	1058.	-100.	
8600.	8167.	2139.	1099.	-100.	
8800.	8338.	2232.	1145.	-100.	
8885.	8410.	2273.	1167.	0.	

OPEN HOLE DESCRIPTION

SIZE (IN)	**** INTERVAL ****** TOP	BOTTOM
8.75	4300.	7918.
8.50	7918.	8885.

Sample Depth or Depth Interval	Sample Type (e.g. full-dia. core, rubble, etc.)	Purpose of Sampling (e.g. for fluid-inclusion study	Sampler (Investigator) and Institution	Date Sampled	Date of Sample Return
① 8526.0 – 8526.35′ (2598.6 – 2598.7 m)	½-CORE	Φ, k MEAS.	G. BODVARSSON, LBL	08/09/91	
② 8534.9 – 8535.2 (2601.3 – 2601.4 m)	〃	ADSORPTION STUDIES	S. SHANG STANFORD UNIV.	06/09/92	
③ 8537.0 – 8537.3′ (2602.0 – 2602.1 m)	〃	〃	〃	06/17/92	
④ 8528.8 – 8529.0′ (2599.4 – 2599.5 m)	〃	THERMAL-CONDUCTIVITY MEAS.	C. WILLIAMS, USGS MENLO PARK	07/01/92	
⑤ 8529.6 – 8530.0′ (2599.7 – 2599.8 m)	〃	〃	〃	〃	
★ 5B → 8526.35-8526.6′ (2598.7-2598.8 m)	〃	X-RAY CT SCANNING	B. BONNER, LLL	09/02/92	
⑥ 8528.2 – 8528.5′ (2599.3 – 2599.4 m)	〃	Φ, k MEAS.	P. PERSOFF, LBL	12/29/92	
⑦ 8528.5 – 8528.8′ (2599.4 – 2599.5 m)	〃	〃	〃	〃	
⑧ 8530.9 – 8531.5′ (2600.1 – 2600.3 m)	〃	〃	〃	〃	
⑨ 8532.7 – 8533.1′ (2600.6 – 2600.8 m)	〃	〃	〃	〃	
⑩ 8533.1 – 8533.4′ (2600.8 – 2600.9 m)	〃	〃	〃	〃	
⑪ 8536.0 – 8536.8′ (2601.6 – 2601.9 m)	〃	〃	〃	〃	
⑫ 8526.6 – 8526.9′ (2598.8 – 2598.9 m)	〃	SONIC VELOCITY MEAS.	G. BOITNOTT, NEW ENGLAND RESEARCH	03/01/94	
⑬ 8529 – 8529.3′ (2599.5 – 2599.6 m)	〃	〃	〃	〃	
⑭ 8531.5 – 8531.8′ (2600.3 – 2600.4 m)	〃	〃	〃	〃	
⑮ 8531.8 – 8532′ (2600.4 m)	〃	〃	〃	〃	

Core Sample Record

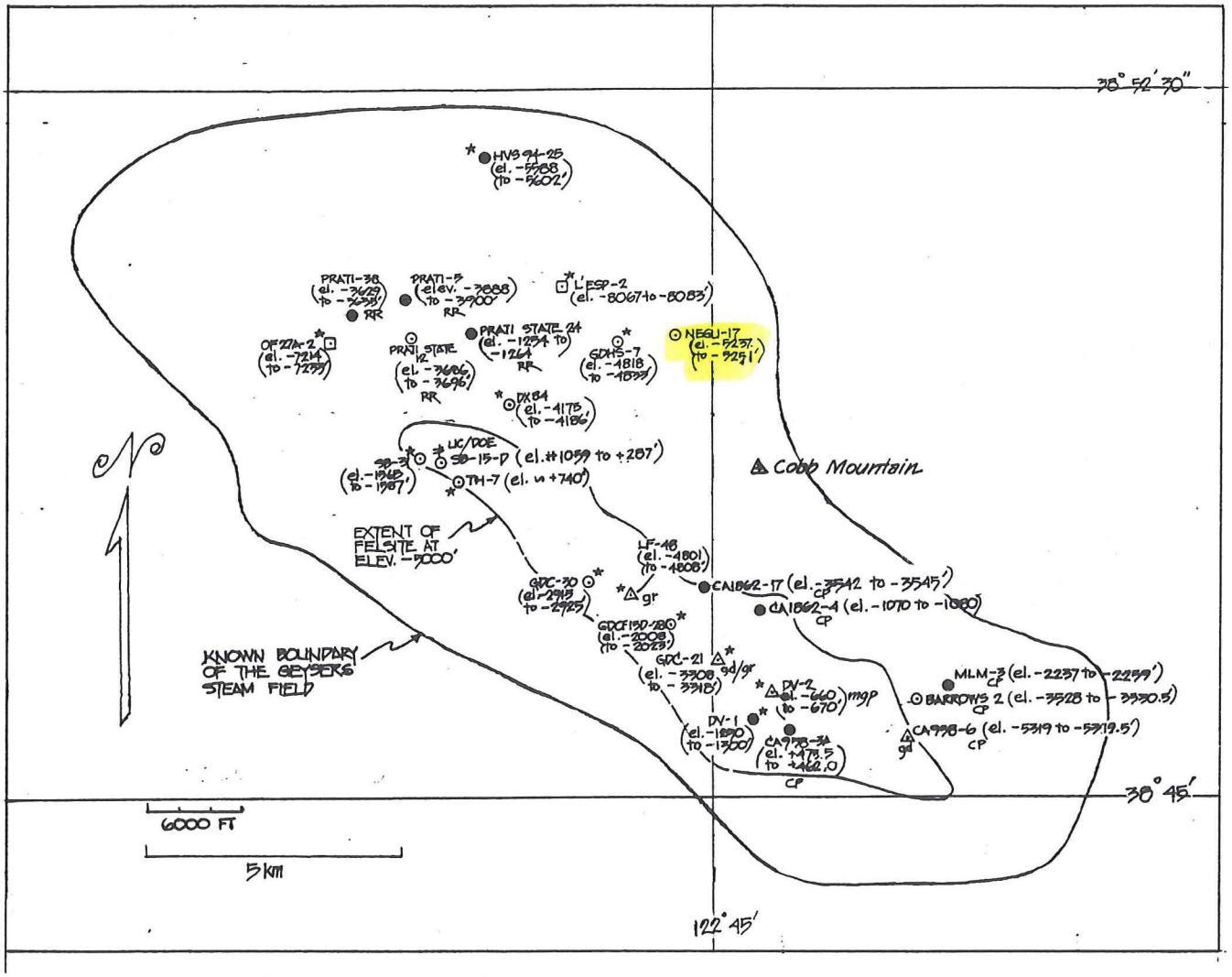
Well or Borehole NEGU-17 (GEYSERS, CA) Core Depth Interval 8526-8540′ (2598.6 – 2602.9 m)

Sample Depth or Depth Interval	Sample Type (e.g. full-dia. core, rubble, etc.)	Purpose of Sampling (e.g. for fluid-inclusion study	Sampler (Investigator) and Institution	Date Sampled	Date of Sample Return
(16) 8533.6 – 8533.9' (2600.9 – 2601.0m)	1/2 CORE	SONIC-VELOCITY MEAS	G. BOITNOTT, NEW ENGLAND RESEARCH	03/01/94	
(17) 8535.7 – 8536.0' (2601.6 m)	"	"	"	"	
(18) 8530 – 8530.5' (2599.8 – 2600.0 m)	RUBBLE	ADSORPTION MEAS.	R. MESMER H. HOLMES OAK RIDGE NATL. LAB	10/25/94	
(19) 8534.5 – 8534.7' (2601.2 – 2601.3 m)	RUBBLE	"	C. SATIK STANFORD UNIV.	11/17/94	

Core Sample Record

Well or Borehole NEGU-17 (GEYSERS, CA) Core Depth Interval 8526 – 8540' (2598.6 – 2602.9 m)

NEGU-17



CORE LOCATIONS AND ROCK TYPES

ABOVE FIRST STEAM ENTRY

● GRAYWACKE

BELOW FIRST STEAM ENTRY

"normal" steam reservoir
- ⊙ GRAYWACKE
- △ "FELSITE."
  - mgp = microgranite porphyry
  - sparsely porphyritic: gd/gr = hybrid granite/granodiorite; gd = granodiorite; gr = granite

"high-temp." steam reservoir
- ⊡ HORNFELSIC GRAYWACKE

* continuous core from above and below first steam entry.

* Unocal proprietary cores

UC – other Unocal cores
RR – Russian River Energy
CP – Calpine
DOE – Dept. of Energy/Geothermal Div.

Location at core depth/elev. — well designation

MLM-3 (el. -2237 to -2259') — Core elevation interval

LOCATION MAP — CORES FROM THE GEYSERS STEAM FIELD

Well Name / Company / Well Elev. (at ground level)	Core Location (Top of Core)	Core Depth or Depth Interval — Drilled Depth (DD) / True Vertical Depth (TVD)	Core Elevation or Elevation Interval	First Steam Entry in Well — Drilled Depth (DD) / True Vertical Depth (TVD) / Elevation (EL.)	Rock Type	Comments
NEGU-17 / Unocal / purchased by DOE/GD for $50K / EL. ?	1250 ft N, 200 ft W of SE cor. sec. 5, T11N, R8W, (MDBM) Lake Co., Calif. (approx. loc.— scaled fr. 1:264,000 map in Gunderson, 1990)	DD 8526-8540 ft (14 ft) / TVD unknown	-5237 to -5251 ft	ND but characterized as within steam reservoir by Gunderson (1990)	graywacke	½ of 4" dia. core, sawn longitudinally / poor core recovery / highly fragmented & milled / heavily sampled
SB15-D / DOE/Geothermal Division & Unocal / EL. 1880 ft	340 ft N, 830 ft E of SW cor. Sec 12, T11N, R9W, (MDBM) Sonoma Co., Calif.	DD 825-1602 ft (777 ft) / TVD 821 - 1593 ft (772 ft)	+1059 to +287 ft	DD 1369 ft / TVD 1360 ft / EL. 520 ft	graywacke and interbedded argillite	3" full-dia. core; 100% recovery / ~5% sampled
PRATI-5 / GEO/CCOC/RREC / EL. 2554 ft	1210 ft N, 560 ft E of SW cor. sec. 36, T12N, R. 9W (MDBM) Sonoma Co., Calif.	DD 6495-6507 ft / TVD 6442-6454 ft	-3888 to -3900 ft	DD 6935 ft / TVD 6875 ft / EL. -4321 ft	"	4" full-dia. core
PRATI-29 / CCOC/RREC	No documentation received with core				graywacke	
PRATI-38 / GEO/CCOC/RREC / EL. 1901 ft	50 ft S, 2430 ft E of NW cor., sec 2, T11N, R9W (MDBM) Sonoma Co., Calif.	DD 5554-5560 ft / TVD 5530-5536 ft	-3629 to -3635 ft	DD 6110 ft / TVD 6076 ft / EL -4175 ft	"	4" full-dia. core

Geysers Core Samples

STORED AT ESRI AS OF 04/15/95

NEGU-17

fr. HULEN, J.B., NIELSON, D.L., & MARTIN, W., 1992 — GEOTH. RESOUR. COUNC., TRANS. V. 16, P. 167-174

NEGU-17

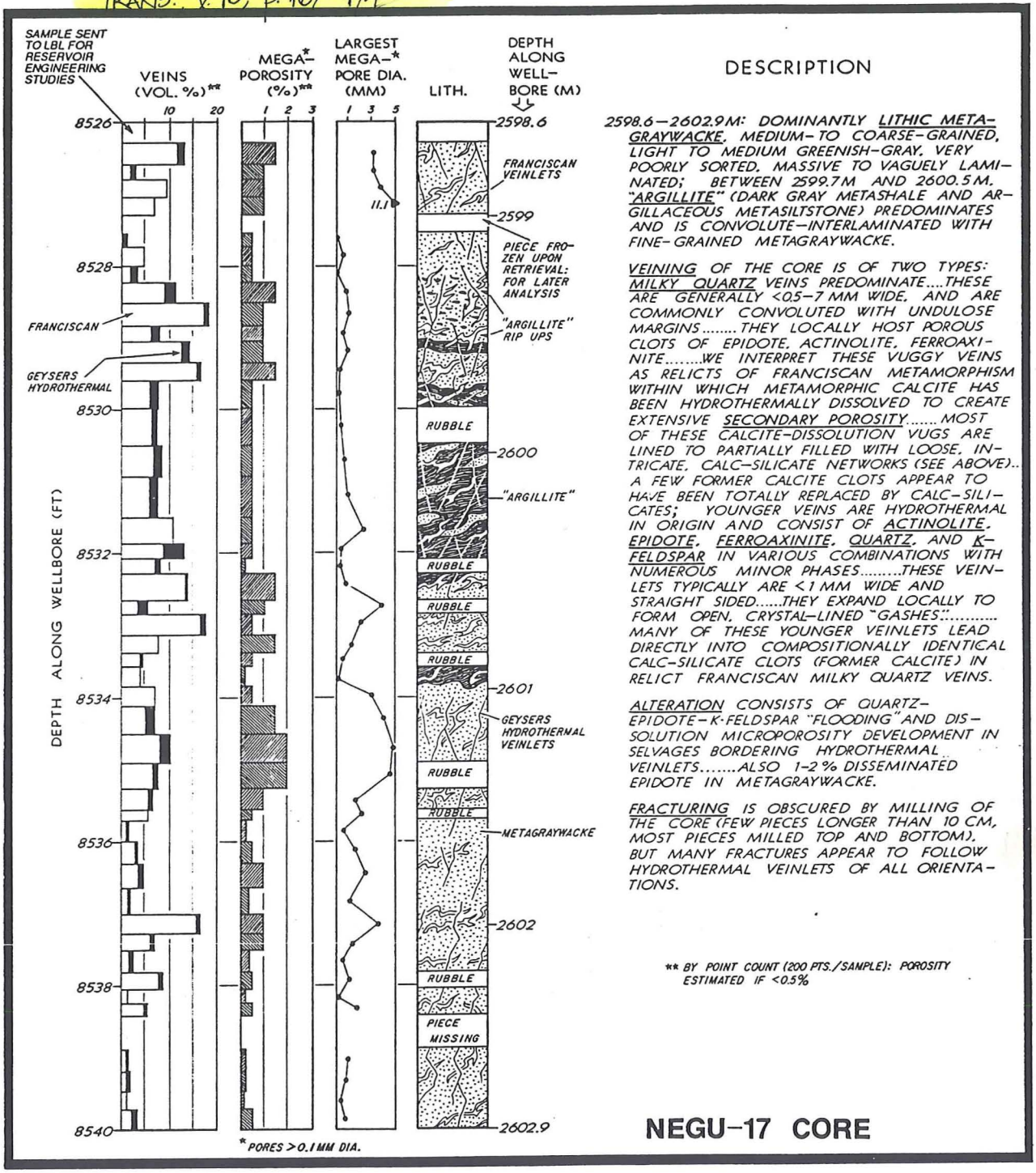


Figure 2. Lithology, vein mineralization, and porosity log for Geysers steam-reservoir core representing the depth interval 2598.6-2602.9 m in Unocal well NEGU-17. Please refer to Figure 1 for location.

GEOTH. RESOUR. COUNC. TRANS., V. 15, p. 167-174

NEGU-17

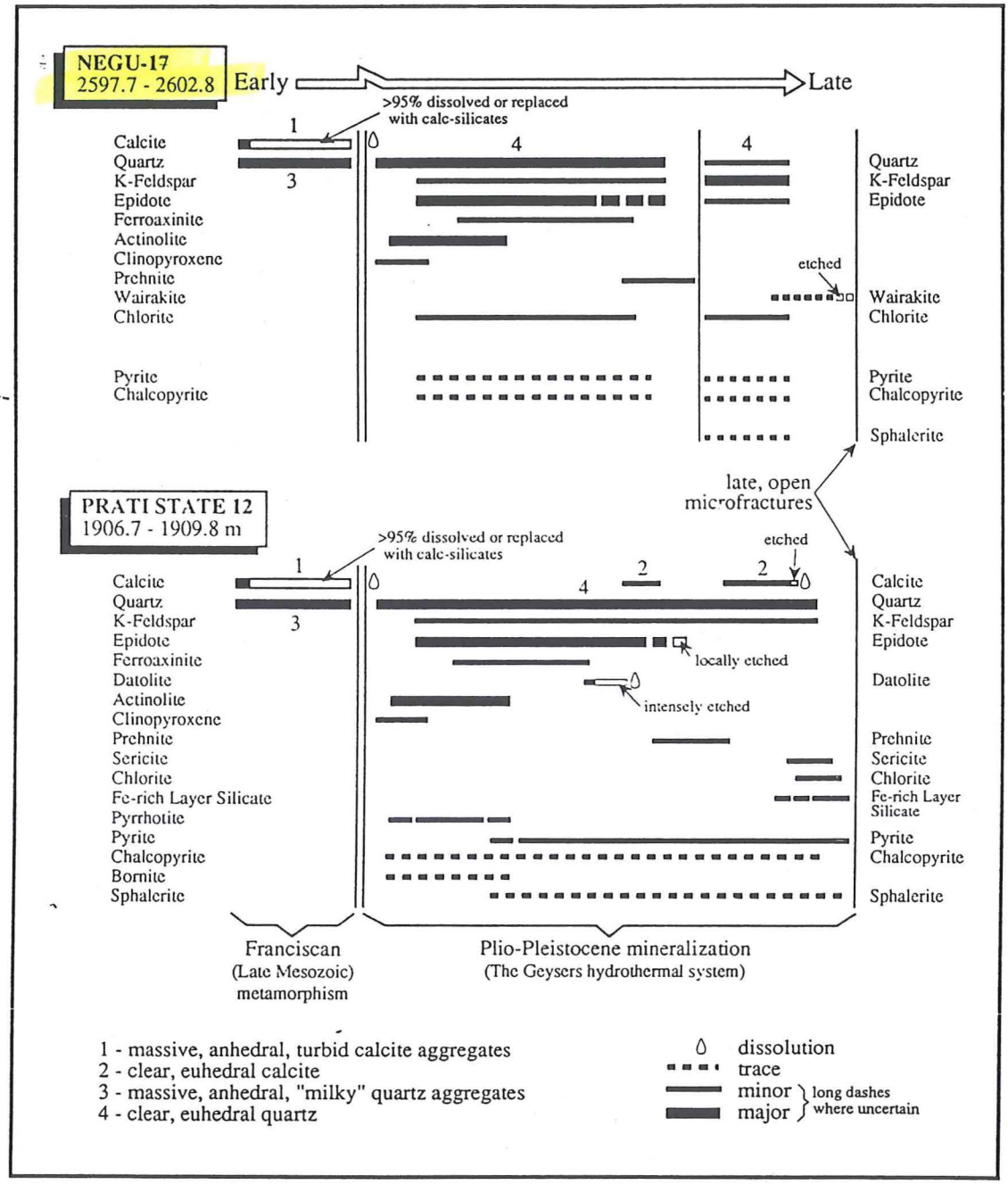


Figure 7. Interpreted vein-mineral paragenesis for steam-reservoir cores from wells NEGU-17 and Prati State 12. For locations of these wells please refer to Figure 1.

Lawrence Berkeley Laboratory
1 Cyclotron Road Berkeley, California 94720
(415) 486-4000 • FTS 451-4000

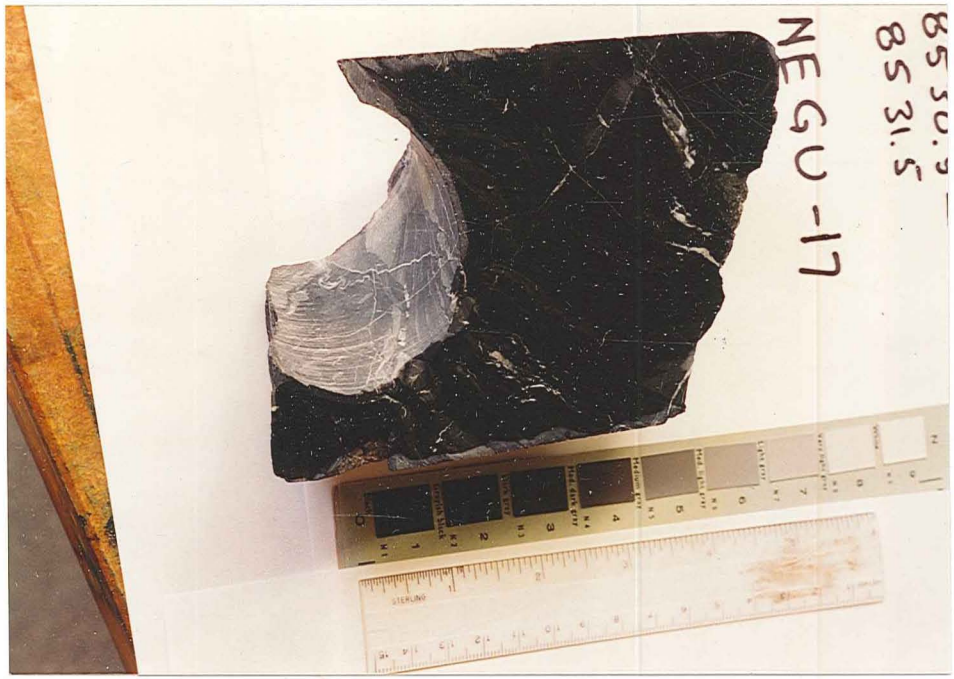
2/1/93

Dear Jeff:

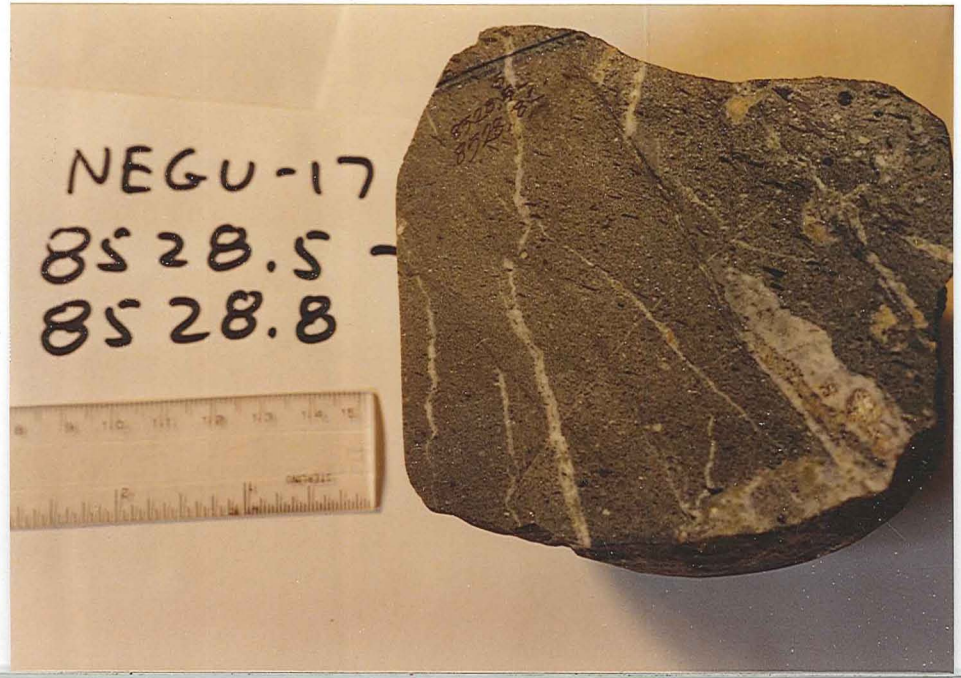
Here are pictures of the pieces of NEGU-17 core you sent me. All photographs were taken dry except the one of piece 8530.9 – 8531.5' by itself. Orange tint at the bottom of photograph of all 6 pieces is an artifact of lighting. We have not cut the pieces yet, so if you want better photographs, call me and tell me.

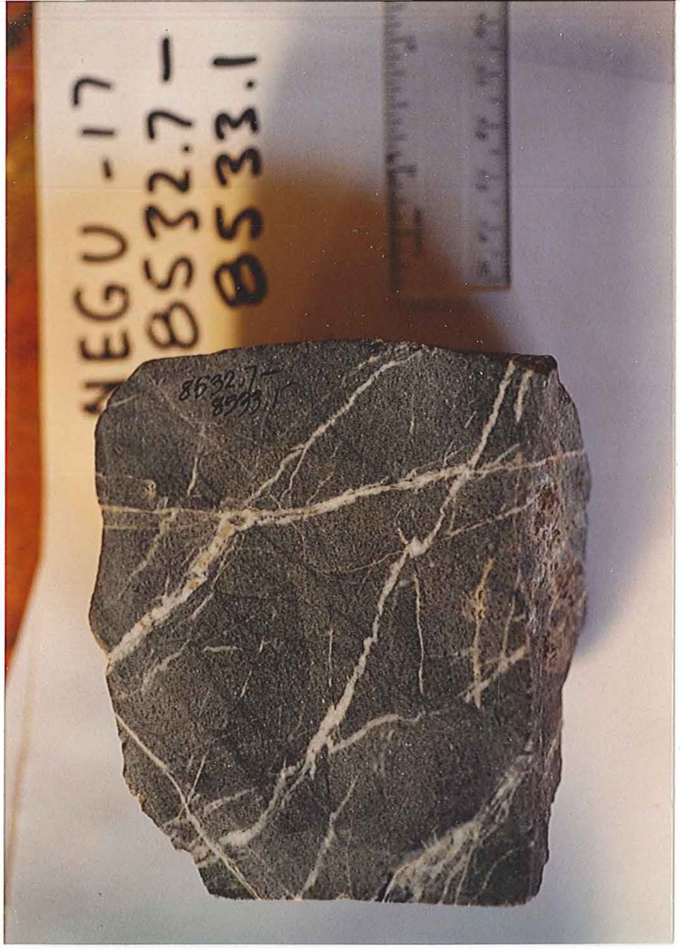
Sincerely,

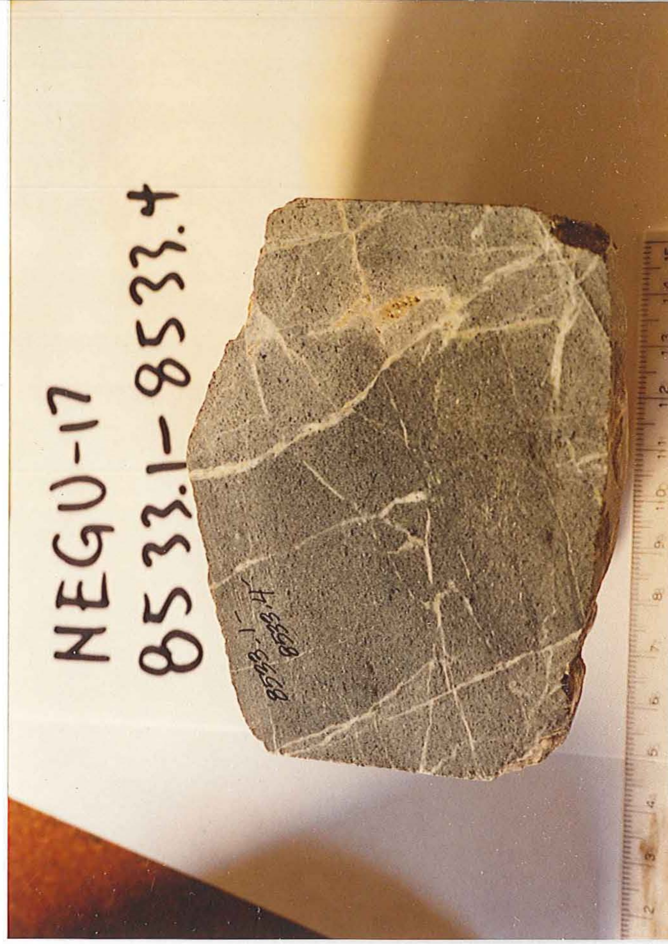
Peter Persoff.

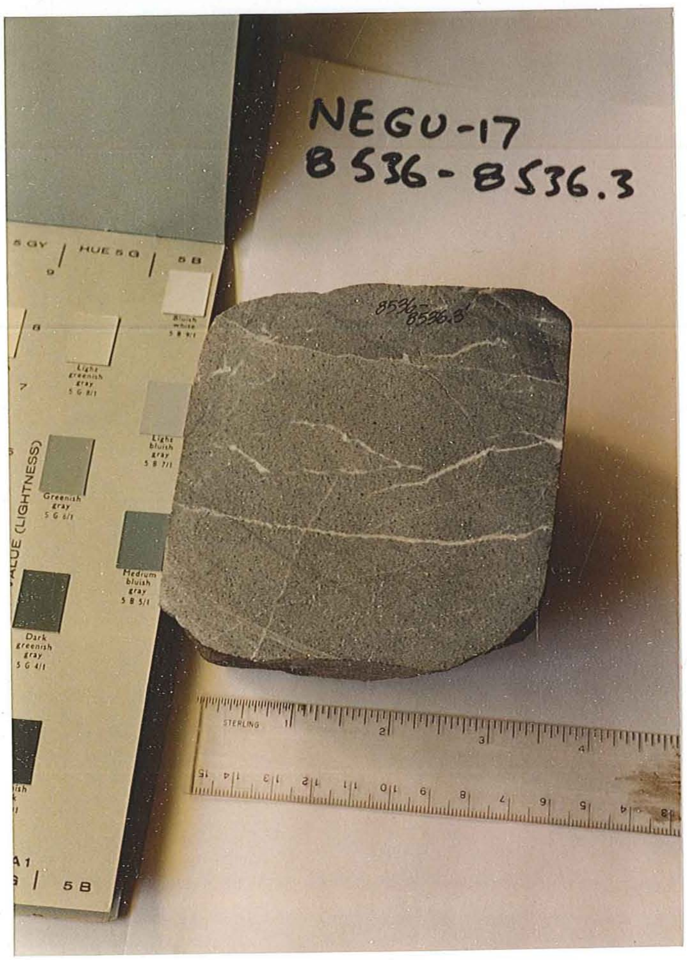

NEGU-17
8531.5


NEGU-17
8528.2 —
8528.5


NEGU-17
8528.5 -
8528.8


NEGU-17
8532.7-
8533.1


NEGU-17
8533.1-8533.4


NEGU-17
8536-8536.3
STERLING

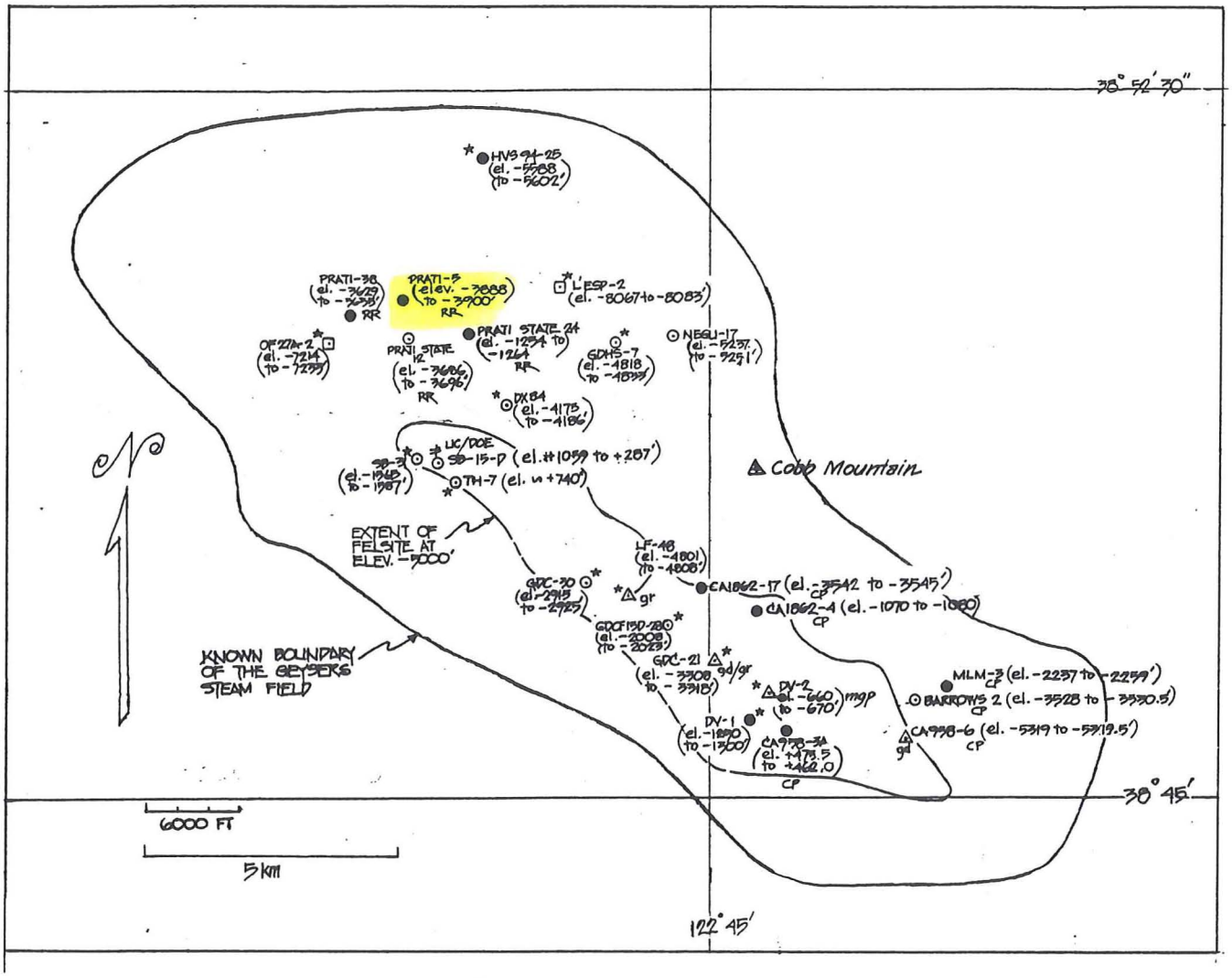
PRATI 5

Sample Depth or Depth Interval	Sample Type (e.g. full-dia. core, rubble, etc.)	Purpose of Sampling (e.g. for fluid-inclusion study	Sampler (Investigator) and Institution	Date Sampled	Date of Sample Return
(1) 6504–6507' (1982.3–1983.2 m)	NUMEROUS SCATTERED RUBBLE PCS.	SULFIDE ANALYSIS	M. McKIBBEN UNIV. of CALIF. RIVERSIDE	05/07/90	
(2) 6497–6495.7' (1979.6–1979.8 m)	WHOLE-CORE	THERMAL CONDUCTIVITY MEAS.	C. WILLIAMS, USGS MENLO PK.	07/01/92	
(3) 6497' (1980.2 m)	PARTIAL CORE	ADSORPTION MEAS.	C. SATIK, STANFORD UNIV.	04/06/95	
(4) 6503' (1982 m)	〃	〃	〃	〃	
(5) 6506' (1982.9 m)	〃	〃	〃	04/06/95	

Core Sample Record

Well or Borehole PRATI 5 (NW GEYSERS) Core Depth Interval 6495–6507' (1979.6–1983.2')

PRATI 5



CORE LOCATIONS AND ROCK TYPES

ABOVE FIRST STEAM ENTRY

● GRAYWACKE

BELOW FIRST STEAM ENTRY

"normal" steam reservoir
- ⊙ GRAYWACKE
- △ "FELSITE"
  - mgp = microgranite porphyry
  - sparsely porphyritic: gd/gr = hybrid granite/granodiorite; gd = granodiorite; gr = granite

"high-temp." steam reservoir
- ⊡ HORNFELSIC GRAYWACKE

\# Continuous core from above and below first steam entry.

* Unocal Proprietary cores

UC – other Unocal cores
RR – Russian River Energy
CP – Calpine
DOE – Dept. of Energy/Geothermal Div.

Location at core depth/elev. — well designation

○ MLM-3 (el. -2237 to -2299') — core elevation interval

LOCATION MAP — CORES FROM THE GEYSERS STEAM FIELD

Well Name / Company / Well Elev. (at ground level)	Core Location (Top of Core)	Core Depth or Depth Interval — Drilled Depth (DD) / True Vertical Depth (TVD)	Core Elevation or Elevation Interval	First Steam Entry in Well — Drilled Depth (DD) / True Vertical Depth (TVD) / Elevation (EL.)	Rock Type	Comments
NEGU-17 / Unocal / purchased by DOE/GD for $50K / EL. ?	1250 ft N, 200 ft W of SE cor. sec. 5, T11N, R8W, (MDBM) Lake Co., Calif. (approx. loc.— scaled fr. 1:264,000 map in Gunderson, 1990)	DD 8526-8540 ft (14 ft) / TVD unknown	-5237 to -5251 ft	ND, but characterized as within steam reservoir by Gunderson (1990)	graywacke	½ of 4" dia. core, sawn longitudinally / poor core recovery / highly fragmented & milled / heavily sampled
SB15-D / DOE/Geothermal Division & Unocal / EL. 1880 ft	340 ft N, 830 ft E of SW cor. Sec 12, T11N, R9W, (MDBM) Sonoma Co., Calif.	DD 825-1602 ft (777 ft) / TVD 821 - 1593 ft (772 ft)	+1059 to +287 ft	DD 1369 ft / TVD 1360 ft / EL. 520 ft	graywacke and interbedded argillite	3" full-dia. core; 100% recovery / ~50% sampled
PRATI-5 / GEO/CCOC/RREC / EL. 2554 ft	1210 ft N, 560 ft E of SW cor. sec. 36, T12N, R. 9W (MDBM) Sonoma Co., Calif.	DD 6495-6507 ft / TVD 6442-6454 ft	-3888 to -3900 ft	DD 6935 ft / TVD 6875 ft / EL. -4321 ft	"	4" full-dia. core
PRATI-29 / CCOC/RREC	No documentation received with core				graywacke	
PRATI-38 / GEO/CCOC/RREC / EL. 1901 ft	50 ft S, 2430 ft E of NW cor., sec 2, T11N, R9W (MDBM) Sonoma Co., Calif.	DD 5554-5560 ft / TVD 5530-5536 ft	-3629 to -3635 ft	DD 6110 ft / TVD 6076 ft / EL -4175 ft	"	4" full-dia. core

Geysers Core Samples

STORED AT ESRI AS OF 04/15/95

PRATI-5

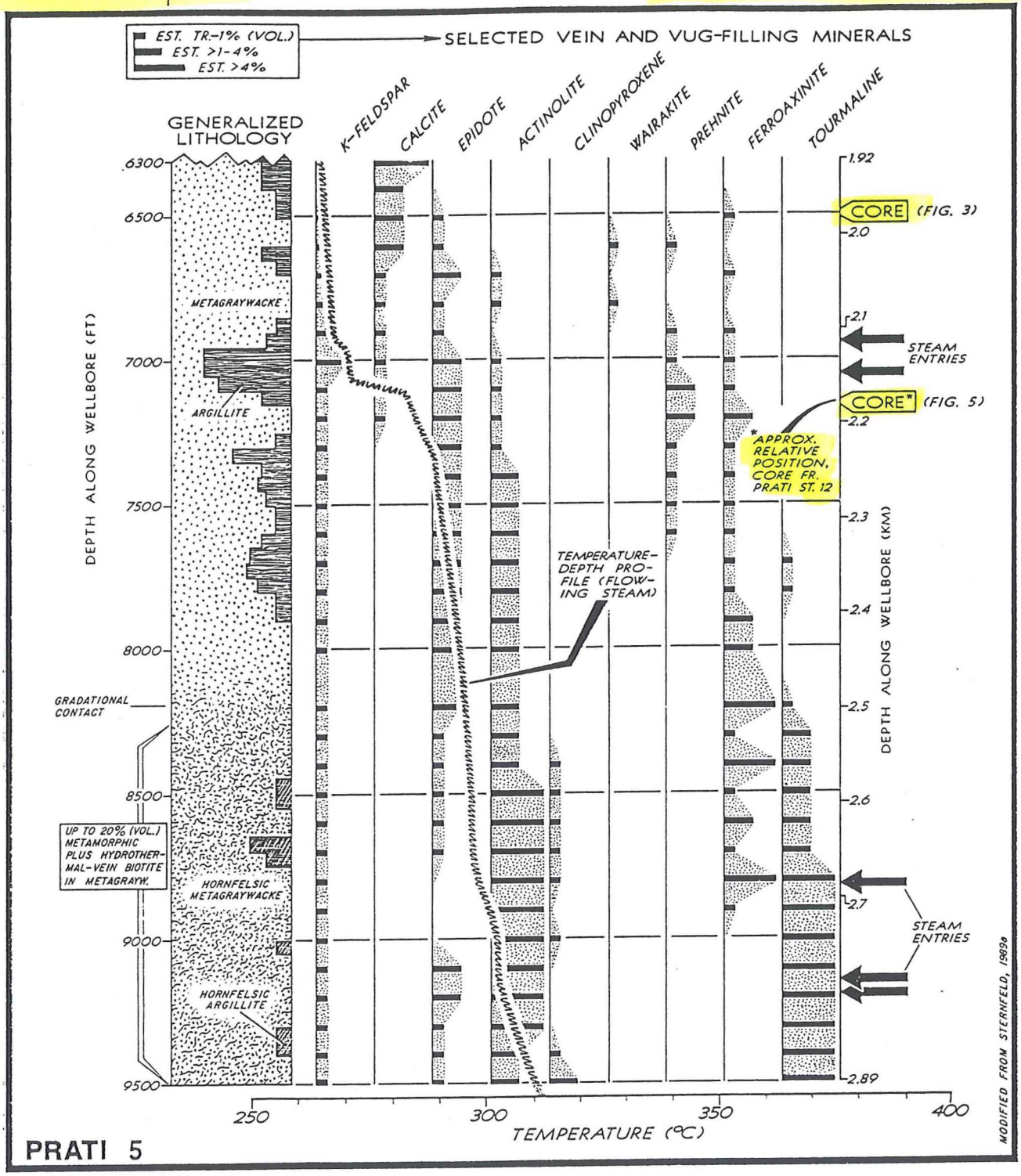


Figure 2. Generalized lithologic, vein mineralization, and flowing-steam temperature profile for the lower portion of Northwest Geysers geothermal well Prati 5 (see Fig. 1 for location), showing positions of caprock and steam-reservoir cores examined in detail for this study. Relative position of reservoir core from well Prati State 12 is approximate and based on depth of the core in that well below the top of pervasive vein epidote mineralization.

PRATI-5

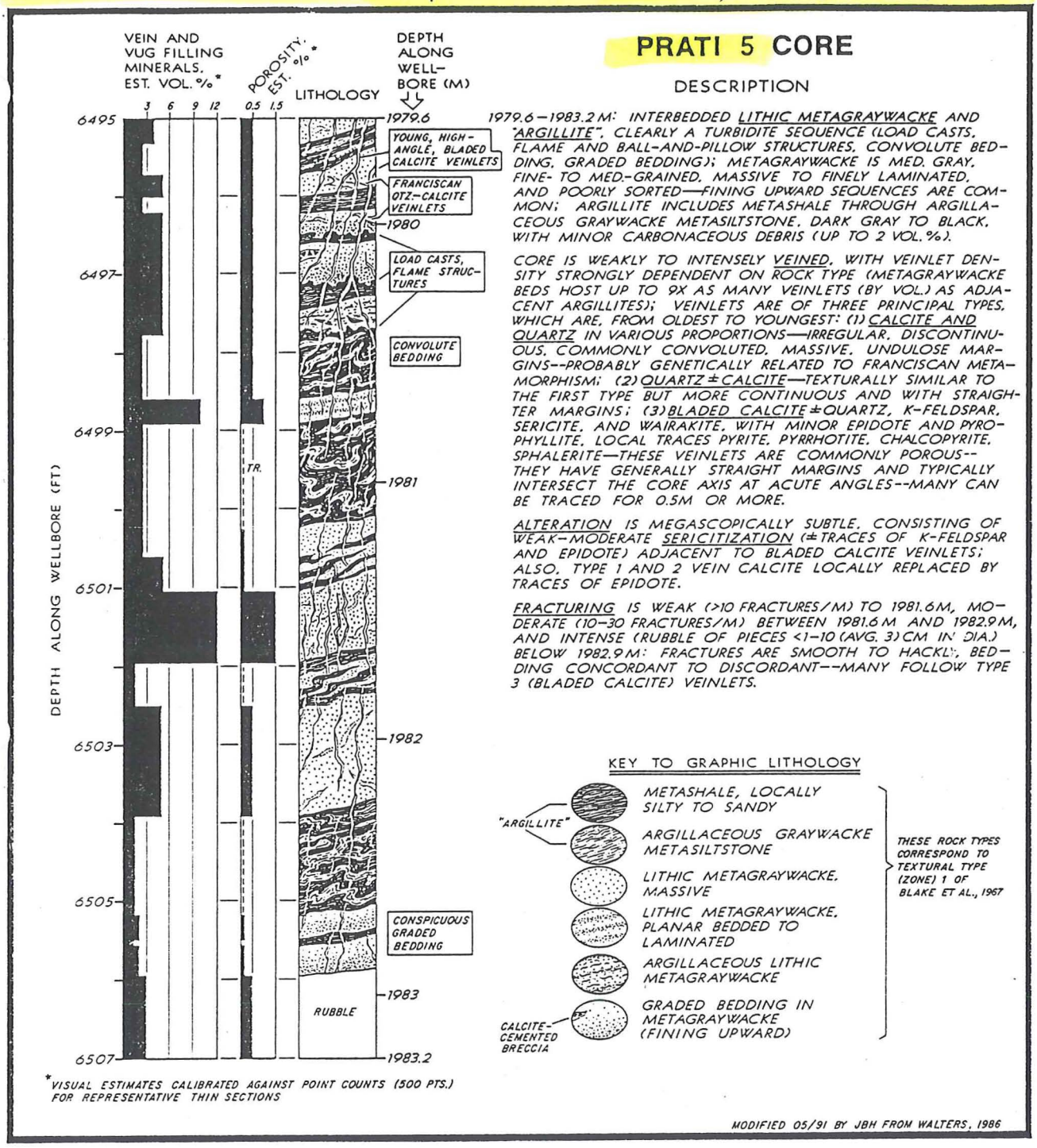


Figure 3. Detailed lithologic, vein mineralization, and estimated porosity log for caprock core from a measured depth of 1979.6-1983.2 m in Northwest Geysers geothermal well Prati 5 (see also Fig. 2). Porosity values are visual estimates calibrated against point counts for representative thin sections impregnated with fluorescent epoxy.

BY MARK WALTERS
G.E.O. OPERATOR CORP.
1986

Report
on
Prati 5
Oriented Core: 6495'-6507' M.D.

Abstract

An oriented core was cut from depths of 6495' to 6507' during the drilling of Prati 5. Approximately 95% of the cored interval was recovered. The rock is texturally unmetamorphosed "Type 1 graywacke" consisting of thin-bedded turbidites of graywacke sandstone and argillite. The bedding dips 16-21° northeast and strikes N19-35°W, and shows clear evidence that the stratigraphic section has not been overturned. Several generations of fracturing and vein filling are observed from cross-cutting relationships. The veins dip steeply, most being within 15° of vertical.

General

An oriented core was cut during the drilling of Prati 5 between 6495' and 6507' M.D. on March 1, 1986. The coring contractor was Norton Christensen, Inc., Bakersfield, CA. Eastman Whipstock provided orientation surveys of the inner core barrel.

The core was taken below the shoe (6487' M.D.) of the 11-3/4" casing while drilling with mud. Once coring was complete, the drilling circulation medium was changed to air in preparation for penetrating the steam reservoir. The steam reservoir was encountered at 6935' M.D., or 428' below the core.

The core is 4" diameter. From 6495' to 6504', almost 100% of the core was recovered and many pieces were usable for orientation. Within this interval there are good Hugel orientation groves on the core which allow for the three dimensional orientation of stratigraphic and structural features. The orientation groves are essentially straight, showing little rotation of the core barrel.

The core from 6504' to 6507' is badly broken and generally lacks Hugel orientation groves. Approximately 80% was recovered from this interval.

Cores from the Prati 5 well were re-oriented to their original position in respect to the earth's magnetic field allowing dip and strike measurements to be made directly. A goniometer specially manufactured for core re-orientation and a Brunton compass were used. (Plate 2).

Thin sections were made from selected portions of the core for petrographic examination. These were made to examine vein mineralogy and lithologic detail.

Photographs were made as a permanent record of the core's appearance. One annotated photograph (Plate 1) is attached to this report.

Although the information from the core presented herein may be detailed and unambiguous, it is necessary to remember the core measurements come from an interval of rock less than 10 feet long. Comparison of the data from this core to subsequent ones will determine if the data are typical of a rock unit which is thousands of feet thick.

Lithology and Stratigraphy

The core is entirely Franciscan Assemblage graywacke sandstone and argillite. Approximately 50% of the lithology is graywacke and 50% argillite. The argillite ranges from a black, partially metamorphosed shale with slickensided partings to dark brown, laminated siltstone, and is interbedded as discrete lenses between the graywacke beds.

Some of the graywacke intervals are recognizable as relatively thin, turbidite beds which grade upward from medium grained (0.50-0.25mm) to very fine grained (less than 0.125mm) sandstone. Visible laminations are present in the finer-grained portions of a few of these beds, with most appearing massive. Thickness of the graywacke intervals ranges from 1-1/2 inches to 1-1/2 feet.

The graywacke units often grade into laminated siltstone and black shaley argillite. The siltstone and argillite commonly have features associated with soft sediment deformation including load structures, flame structures and convoluted bedding planes. These fine grained rocks represent the upper flow regime of the turbidite facies and the interturbidite facies deposited either

by pelagic sedimentation or low density turbidity current deposition. Ripple marks, which are used in the Bouma turbidite model to punctuate the interturbidite and turbidite facies, were not observed in the core.

Petrographic examination of the thin sections shows the rock to be a texturally undeformed, "Type 1" graywacke. Scattered phengite-lawsonite mineral grains throughout the core are characteristic of low temperature-high pressure Franciscan metamorphism. The framework grains of the graywacke are angular to subangular, very poorly to poorly sorted and consist primarily of quartz and feldspar. The grains are sufficiently arranged in some portions of the core to give the graywacke a laminated appearance, especially when viewed with a petrographic microscope. (When the laminated graywacke is silicified, it often has the appearance of "Type 2" graywacke when viewed only as chips under a binocular microscope.) Generally, the finer grained the graywacke is, the more apparent bedding laminations are.

The provenance of the graywacke in the core was a volcanic terrane. Volcanic rock clasts altered to greenschist facies minerals are present throughout the coarser grained portions of the thin sections. Organic material is limited to bits of carbonized plant stems(?) and unidentified "organic trash".

Stratigraphic Dip and Strike

Bedding of some graywacke and argillite beds is sufficiently defined to allow measurement of dip and strike (Plate 2). The measured dips range from 16^{o} to 21^{o} northeast; the strikes from N19^{o}W to N35^{o}W. Load casts and the upward-grading grain-size reduction from these are evidence that the stratigraphic section has not been overturned.

Secondary Mineralization

Secondary minerals are mostly confined to vein fillings of fractures and comprise approximately 1% the total core. The veins are mostly (99±%) bladed calcite and quartz with disseminated rare traces of pyrite, galena, chalcopyrite, marcasite, and sphalerite; listed here in order of declining abundance. These

sulfides are generally identifiable only at high magnification (30-40x) using a binocular microscope. Galena and chalcopyrite occur together spatially and marcasite occurs as overgrowths on pyrite.

At least three periods of vein mineralization are present. The oldest veins are very thin (0.1mm±), barren quartz veins whose grains appear "moth eaten" and show undulatory extinction when viewed with polarized light. These veins are thought to be associated with Franciscan metamorphism. A second and much younger-appearing generation of quartz veining, thought to be associated with hydrothermal activity, is present and is associated with traces of feldspar, epidote, sulfides, and perhaps actinolite. A third generation of veining is present as calcite which partly consumed and fills voids in the quartz-feldspar-epidote-sulfide veins. The calcite may be seen filling the center of the hydrothermal quartz veins. Because calcite is more abundant and covers the quartz on the veins walls, quartz is generally not visible in the core unless a petrographic microscope is used.

All veins present in the thin sections were examined for the presence of recent, mineral assemblages known to be associated with the steam reservoir, including axinite-prehnite. None were observed. Because the most recent veining is calcite and because the calcite superseded the quartz-feldspar-epidote-sulfide mineralization, it is concluded that the secondary mineralization in the core is peripheral to the present hydrothermal system.

Other secondary minerals are associated with the alteration of graywacke. These include pumpellyite and sericite which commonly occur as partial replacements in plagioclase clasts. Although the graywacke appears relatively "fresh" at low magnification, at magnifications of x100, or greater, the graywacke is pervasively and mildly altered.

Fracturing

The rock encountered by the coring has been moderately to intensely fractured at different times as evidenced by the cross-cutting nature and offsets seen in the veins. Fracture orientation (referenced to the core axis) dips from 45° to vertical. Discrete fractures range from hairline width (0.1mm) to 2.0mm; gash vein filling in brecciated areas is as much as 10mm.

The dip and strike of prominent vein-filled fracture sets was measured using a goniometer. There are at least three fracture sets: N30-40°E 75-89°W; N30-35°W 55-75°E; and N50-65°E 55-70°W. The observed veins dip steeply; the most common being within 15° of vertical.

Apparently, unveined fractures are also present although they are usually difficult to measure because they are poorly defined. Those noted were also dip steeply. The lack of horizontally to shallowly (less than 20°) dipping fractures or veins is conspicuous.

During petrographic examination it was observed that some veins have been re-fractured; apparently because they are lines of weakness. It was observed that unfractured calcite grains fill quartz veins in which the individual quartz grains are clearly offset. It was also observed that tiny open fractures also exist down the center of some late-stage calcite veins. The origin of the open fractures is unknown - they may be due to geologic processes or the mechanical processes of cutting core and making thin sections. In any case, open fractures do develop along pre-existing veins.

Although it is difficult to determine the existence of open fractures in core because fractures are where the core will break, the core is broken into pronounced vertical slabs between 6505' to 6507'. These may be interpreted either as open fractures or strain orientation that existed prior to drilling. The ends of each of these rock slabs are also broken in such a manner as to suggest that there are very small fractures or a strain orientation parallel to the long axis of the slabs.

It is readily observable from the core that the graywacke units fracture more readily than the argillite units. Although the larger veins transect both graywacke and argillite units, many of the smaller veins seen in the graywacke truncate at the contacts with argillite. A particular good example was observed at 6498'-8" where very thin calcite veins in a 1-1/2"-thick unit of graywacke truncate on both the upper and lower contacts against argillite. This is annotated on Plate 1.

Microscopic fractures (0.01mm±) exist throughout the core. These are seen as tiny dark lines that offset grains and beds but in turn are offset by hydrothermal veins. They appear to filled with opaque to dark brown, clayey material (gouge?). These fractures are interpreted as pre-existing to the hydrothermal veins and therefore are probably not related to the geothermal reservoir.

MAW:bk
GE86-129.maw

LITHOLOGY LOG

6495'-0" to 6495'-3": Massive, fine-grained graywacke sandstone.

6495'-3" to 6495'-5": Intercalated argillite and very fine-grained graywacke sandstone showing soft sediment deformation.

6495'-5" to 6495'-11": Massive graywacke sandstone.

6495'-11" to 6496'-4": Intercalated argillite with load casts and flame structures, and very fine-grained graywacke sandstone with ripped-up clasts.

6496'-4" to 6496'-7": Medium-grained graywacke sandstone grading upwards to fine-grained graywacke sandstone.

6496'-7" to 6496'-8": Argillite showing soft sediment deformation.

6496'-8" to 6497'-2": Coarse-grained, massive graywacke sandstone grading upward to very fine-grained, laminated sandstone. Locally brecciated with calcite-filled gash veins.

6497'-2" to 6497'-3": Argillite.

6497'-3" to 6497'-8": Very fine-grained, massive graywacke sandstone with ripped-up argillite clasts.

6497'-8" to 6498'-8": Interbedded siltstone and argillite showing soft sediment deformation.

6498'-8" to 6498'-10": Laminated, fine to very fine-grained graywacke sandstone.

6498'-10" to 6501'-0": Siltstone-argillite interval showing soft sediment deformation with occasional massive, medium-grained graywacke sandstone lenses.

6501'-0" to 6502'-0": Intensely veined, massive to weakly laminated graywacke sandstone.

6502'-0" to 6502'-6": Deformed argillite interbedded with very fine-grained graywacke sandstone containing ripped-up clasts.

6502'-6" to 6503'-11": Fine-grained, massive graywacke sandstone.

6503'-11" to 6505'-2": Laminated siltstone interbedded with argillite showing soft sediment deformation.

6505'-2" to 6505'-5": Medium-grained graywacke sandstone grading upwards to very fine-grained sandstone. Core is broken into flat, vertically-oriented slabs.

6505'-5" to 6505'-6": Argillite. Part of core is lost.

6505'-6" to 6505'-11": Medium-grained graywacke sandstone grading upwards to very fine-grained sandstone and siltstone.

6505'-11" to 6507': The core is too broken to describe the location of the various argillite and graywacke sandstone units.

MAW:bk
GE86-129.maw

PRATI 5

6495'

Brecciated zone with Calcite Filling

Load Cast

Flame Structure

Steeply dipping fracture with Calcite Filling

6498'-6"

6498'-6"

Interval of Soft Sediment Deformation

Thin Bedded Turbidites

Graywacke Sandstone bed with Intensive Calcite veining

6502'

Veining is Preferentially located in Graywacke units

Ripped-up Clast

6502'

6506'

Plate 1

PLATE 2
GONIOMETER FOR RE-ORIENTING 4" CORE FROM PRATI 5

*** G E O pratt5 DIRECTIONAL WELL SURVEY ***

p. 1 of 3

Vertical section calculated in plane of proposal
Direction : S 75 E

** 1**

Date: 03/24/86

MEASURED DEPTH feet	DRIFT ANGLE deg. min	DRIFT DIRECTION deg	COURSE LENGTH feet	TRUE VERT. DEPTH feet	RECTANGULAR COORDINATES feet		SEC-TION feet	DOGLEG SEVERITY dg/100ft
0	0 0	0	0	0.00	0.00	0.00	0.00	0.00
140	0 30	s 52w	140	140.00	0.38S	0.48W	-0.37	0.36
255	1 30	s 48w	115	254.98	1.67S	2.02W	-1.52	0.87
339	1 30	s 44w	84	338.95	3.19S	3.60W	-2.65	0.13
460	1 45	s 44w	121	459.90	5.66S	5.98W	-4.31	0.21
584	1 45	s 24w	124	583.85	8.80S	8.10W	-5.55	0.49
739	2 0	s 17w	155	738.76	13.55S	9.88W	-6.03	0.22
896	2 0	s 24w	157	895.67	18.68S	11.80W	-6.56	0.15
1052	2 30	s 23w	156	1051.55	24.30S	14.24W	-7.46	0.32
1207	2 30	s 32w	155	1206.40	30.30S	17.36W	-8.93	0.25
1354	3 15	s 29w	147	1353.21	36.65S	21.10W	-10.90	0.52
1508	3 15	s 27w	154	1506.97	44.36S	25.20W	-12.86	0.07
1663	3 45	s 26w	155	1661.68	52.83S	29.42W	-14.75	0.32
1819	4 0	s 24w	156	1817.32	62.38S	33.88W	-16.58	0.18
1976	5 15	s 32w	157	1973.81	73.56S	39.82W	-19.43	0.89
2102	5 30	s 33w	126	2099.26	83.51S	46.16W	-22.98	0.21
2257	5 45	s 35w	155	2253.51	96.11S	54.66W	-27.92	0.21
2365	6 15	s 31w	108	2360.92	105.58S	60.81W	-31.41	0.60
2479	6 30	s 31w	114	2474.21	116.43S	67.33W	-34.90	0.22
2514	7 0	s 33w	35	2508.97	119.92S	69.51W	-36.10	1.58
2542	7 0	s 29w	28	2536.76	122.84S	71.27W	-37.04	1.74
2573	7 0	s 25w	31	2567.53	126.21S	72.98W	-37.83	1.57
2604	7 0	s 24w	31	2598.30	129.65S	74.55W	-38.45	0.40
2635	6 15	s 18w	31	2629.09	132.98S	75.83W	-38.83	3.29
2672	5 45	s 16w	37	2665.89	136.68S	76.96W	-38.96	1.47
2703	5 15	s 9w	31	2696.75	139.58S	77.60W	-38.83	2.70
2734	5 0	s 0w	31	2727.62	142.34S	77.82W	-38.33	2.71
2765	5 15	s 11e	31	2758.50	145.10S	77.55W	-37.36	3.27
2797	5 0	s 23e	32	2790.37	147.83S	76.72W	-35.84	3.43
2828	4 30	s 26e	31	2821.26	150.17S	75.65W	-34.21	1.80
2858	4 0	s 33e	30	2851.18	152.11S	74.56W	-32.65	2.40
2889	3 45	s 41e	31	2882.11	153.78S	73.30W	-31.00	1.92
2913	4 0	s 52e	24	2906.06	154.89S	72.12W	-29.57	3.26
2944	4 0	s 61e	31	2936.98	156.09S	70.32W	-27.52	2.02
2975	4 15	s 69e	31	2967.90	157.03S	68.30W	-25.33	2.02
3006	4 45	s 78e	31	2998.81	157.72S	65.97W	-22.90	2.79
3055	4 30	n 77e	49	3047.65	157.69S	62.01W	-19.09	4.11
3086	4 30	n 70e	31	3078.55	157.00S	59.68W	-17.02	1.77
3148	4 30	n 63e	62	3140.36	155.06S	55.22W	-13.21	0.88
3191	4 30	n 80e	43	3183.23	153.99S	52.02W	-10.40	3.09

CONFIDENTIAL

MEASURED DEPTH feet	DRIFT ANGLE deg.	min	DRIFT DIRECTION deg	COURSE LENGTH feet	TRUE VERT. DEPTH feet	RECTANGULAR COORDINATES feet		SEC-TION feet	DOGLEG SEVERITY dg/100ft
3222	4	45	n 74e	31	3214.13	153.42S	49.59W	-8.19	1.75
3253	5	0	n 82e	31	3245.01	152.88S	47.01W	-5.84	2.33
3284	5	45	n 80e	31	3275.88	152.42S	44.14W	-3.19	2.49
3338	6	45	n 78e	54	3329.56	151.30S	38.37W	2.10	1.90
3398	7	0	n 82e	60	3389.12	150.05S	31.30W	8.61	0.90
3461	7	15	n 84e	63	3451.64	149.10S	23.54W	15.85	0.56
3555	8	15	n 86e	94	3544.78	148.00S	10.91W	27.76	1.10
3627	8	0	n 88e	72	3616.06	147.46S	0.75W	37.44	0.53
3721	7	45	n 87e	94	3709.17	146.90S	12.11E	49.72	0.30
3814	7	15	n 88e	93	3801.37	146.37S	24.24E	61.30	0.56
3927	8	15	n 84e	113	3913.34	145.31S	39.44E	75.71	1.01
4018	9	15	n 85e	91	4003.28	143.98S	53.22E	88.67	1.11
4110	11	0	n 81e	92	4093.85	142.01S	69.28E	103.67	2.05
4183	10	45	n 87e	73	4165.54	140.57S	82.97E	116.53	1.59
4276	10	0	n 87e	93	4257.02	139.69S	99.70E	132.46	0.81
4368	9	45	n 90e	92	4347.66	139.28S	115.47E	147.58	0.62
4461	9	0	n 87e	93	4439.41	138.89S	130.61E	162.11	0.96
4549	9	0	n 86e	88	4526.33	138.04S	144.36E	175.17	0.18
4641	9	45	n 85e	92	4617.10	136.87S	159.30E	189.29	0.83
4733	10	0	n 85e	92	4707.74	135.49S	175.01E	204.12	0.27
825	10	0	n 85e	92	4798.34	134.10S	190.93E	219.13	0.00
+918	10	0	n 86e	93	4889.93	132.83S	207.03E	234.35	0.19
4982	10	45	n 86e	64	4952.88	132.03S	218.53E	245.25	1.17
5075	11	0	n 85e	93	5044.21	130.65S	236.02E	261.79	0.34
5169	11	45	n 84e	94	5136.36	128.88S	254.47E	279.16	0.83
5276	11	45	n 84e	107	5241.12	126.60S	276.14E	299.50	0.00
5370	11	0	n 85e	94	5333.28	124.82S	294.60E	316.86	0.83
5460	10	15	n 83e	90	5421.73	123.09S	311.10E	332.36	0.93
5522	9	45	n 80e	62	5482.79	121.50S	321.75E	342.23	1.16
5645	10	0	n 76e	123	5603.97	117.11S	342.38E	361.02	0.59
5771	10	30	n 73e	126	5727.96	111.12S	363.99E	380.34	0.58
5926	10	15	n 68e	155	5880.42	101.80S	390.30E	403.35	0.60
6109	8	45	n 66e	183	6060.91	90.00S	418.10E	427.15	0.84
6202	8	30	n 64e	93	6152.86	84.11S	430.74E	437.83	0.42
6324	9	30	n 61e	122	6273.36	75.29S	447.67E	451.90	0.91
6480	10	45	n 59e	156	6426.93	61.58S	471.42E	471.30	0.83
6548	10	0	n 65e	68	6493.82	55.83S	482.23E	480.25	1.93
6613	9	0	n 90e	65	6557.93	53.51S	492.71E	489.77	6.48
6742	10	45	s 80e	129	6685.02	55.44S	514.75E	511.55	1.89
6901	10	15	s 82e	159	6841.35	59.97S	543.36E	540.37	0.39

PRATT-5, p. 3 of 3

Date: 03/24/86

MEASURED DEPTH feet	DRIFT ANGLE deg.	min	DRIFT DIRECTION deg	COURSE LENGTH feet	TRUE VERT. DEPTH feet	RECTANGULAR COORDINATES feet		SEC-TION feet	DOGLEG SEVERITY dg/100ft
059	9	45	s 88e	158	6996.95	62.36S	570.70E	567.39	0.73
7154	9	0	s 86e	95	7090.68	63.17S	586.15E	582.53	0.86
7316	9	45	n 86e	162	7250.52	63.17S	612.54E	608.02	0.93
7474	9	45	n 78e	158	7406.24	59.45S	639.04E	632.65	0.86
7632	10	45	n 68e	158	7561.72	51.23S	665.92E	656.49	1.29
7760	17	30	n 68e	128	7685.85	39.53S	694.89E	681.44	5.27
7824	21	0	n 68e	64	7746.27	31.62S	714.45E	698.29	5.47
7886	21	0	n 68e	62	7804.15	23.30S	735.05E	716.03	0.00
7951	21	0	n 68e	65	7864.83	14.57S	756.65E	734.63	0.00
8043	21	15	n 68e	92	7950.65	2.15S	787.39E	761.09	0.27
8136	21	15	n 69e	93	8037.33	10.20N	818.75E	788.22	0.39
8228	21	30	n 66e	92	8123.00	23.03N	849.73E	814.82	1.22
8387	21	0	n 63e	159	8271.19	47.84N	901.74E	858.64	0.75
8481	21	30	n 62e	94	8358.80	63.57N	931.96E	883.76	0.66
8670	20	0	n 62e	189	8535.54	05.01N	991.09E	932.73	0.79
8794	19	30	n 60e	124	8652.24	115.33N	1027.74E	962.87	0.68
8855	18	45	n 59e	61	8709.88	125.47N	1044.96E	976.88	1.34
8980	17	30	n 53e	125	8828.67	147.21N	1077.19E	1002.39	1.80
9100	16	30	n 50e	120	8943.43	169.05N	1104.65E	1023.26	1.11
9206	17	0	n 52e	106	9044.93	188.28N	1128.39E	1041.21	0.72
9500	17	0	n 52e	294	9326.09	241.20N	1196.13E	1092.94	0.00

Closure distance : 1220.20 feet.
angle : N 78 deg 35 min E

**** E N D O F R E P O R T ****

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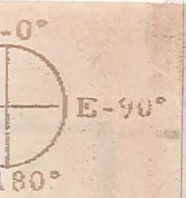
EASTMAN WHIPSTOCK, I

REPORT OF *Corex* CORE ORIE

ORIENTING LUG



ANGULAR DISTANCE
OF REFERENCE GROOVE
FROM ORIENTING LUG 0°

MAGNETIC
DECLINATION ____°

COMPANY GEO. OPERATOR

WELL NAME PRATT # NO. 5 CORE NO. 1 DEPTH 6497-6505

FIELD SONOMA STATE CA. DATE RUN 3/2/86 JOB NO. 0121

CORING DATA

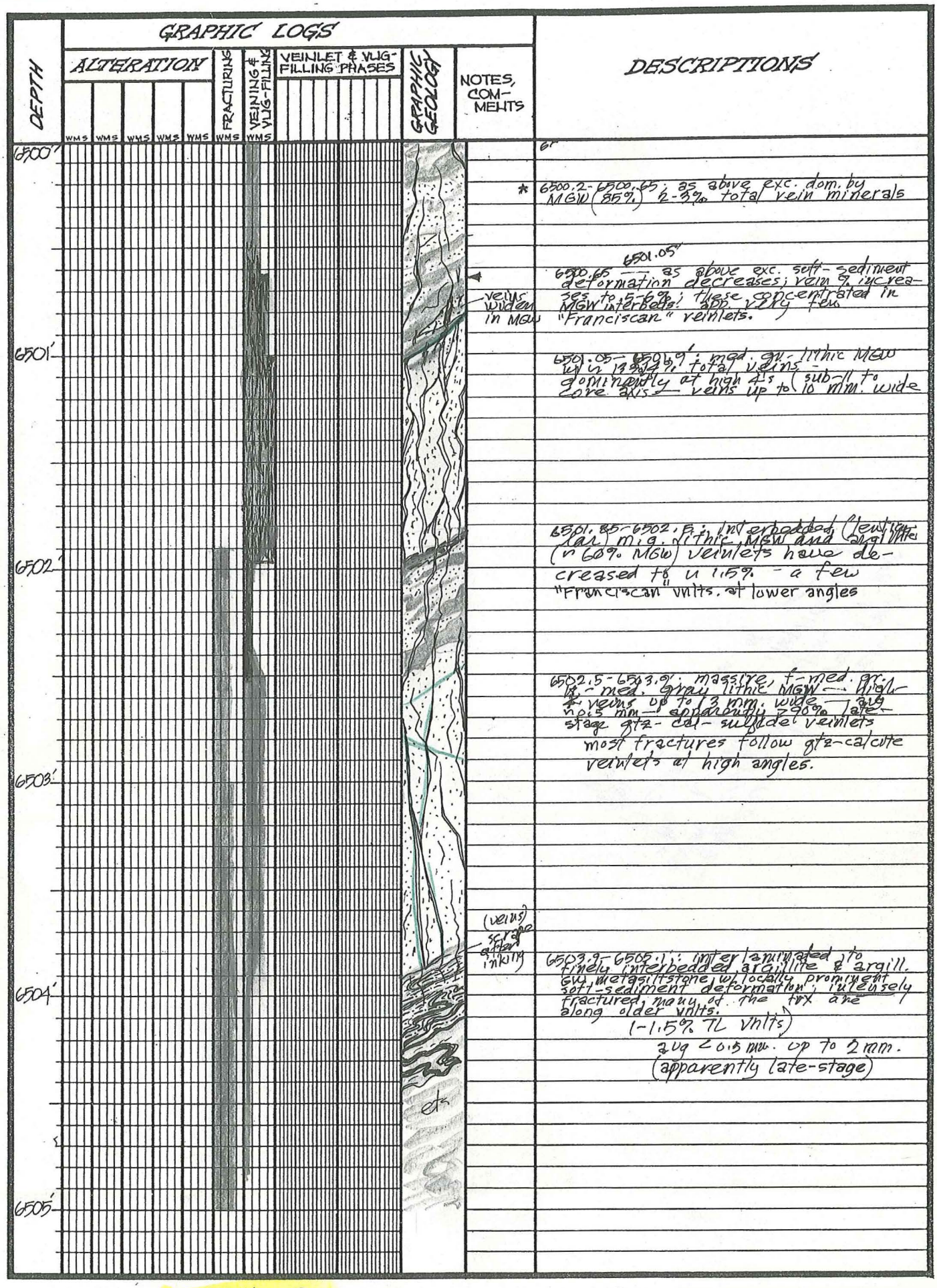
Station Number	PICTURE NUMBER	DEPTH	DRIFT ANGLE	DRIFT DIRECTION	ORIENTING LUG DIRECTION	ORIENTING LUG AZIMUTH	REFERENCE GROOVE DIRECTION TRUE	REFERENCE GROOVE AZIMUTH	REFERENCE GROOVE DIRECTION
TIE IN	GIVEN:	6480	10 45	N59E					
1	32	6497	10 45	N59E			10 °R		N69E
2	49	6499	10 45	N59E			15 °R		N74E
3	70	6501	11°	N59E			22 °R		N81E
4	88	6505	11°	N59E			30° R		N89E

Remarks:

D-966

SUBJECT TO DECISION OF SCOPE OF SERVICE AGREEMENT

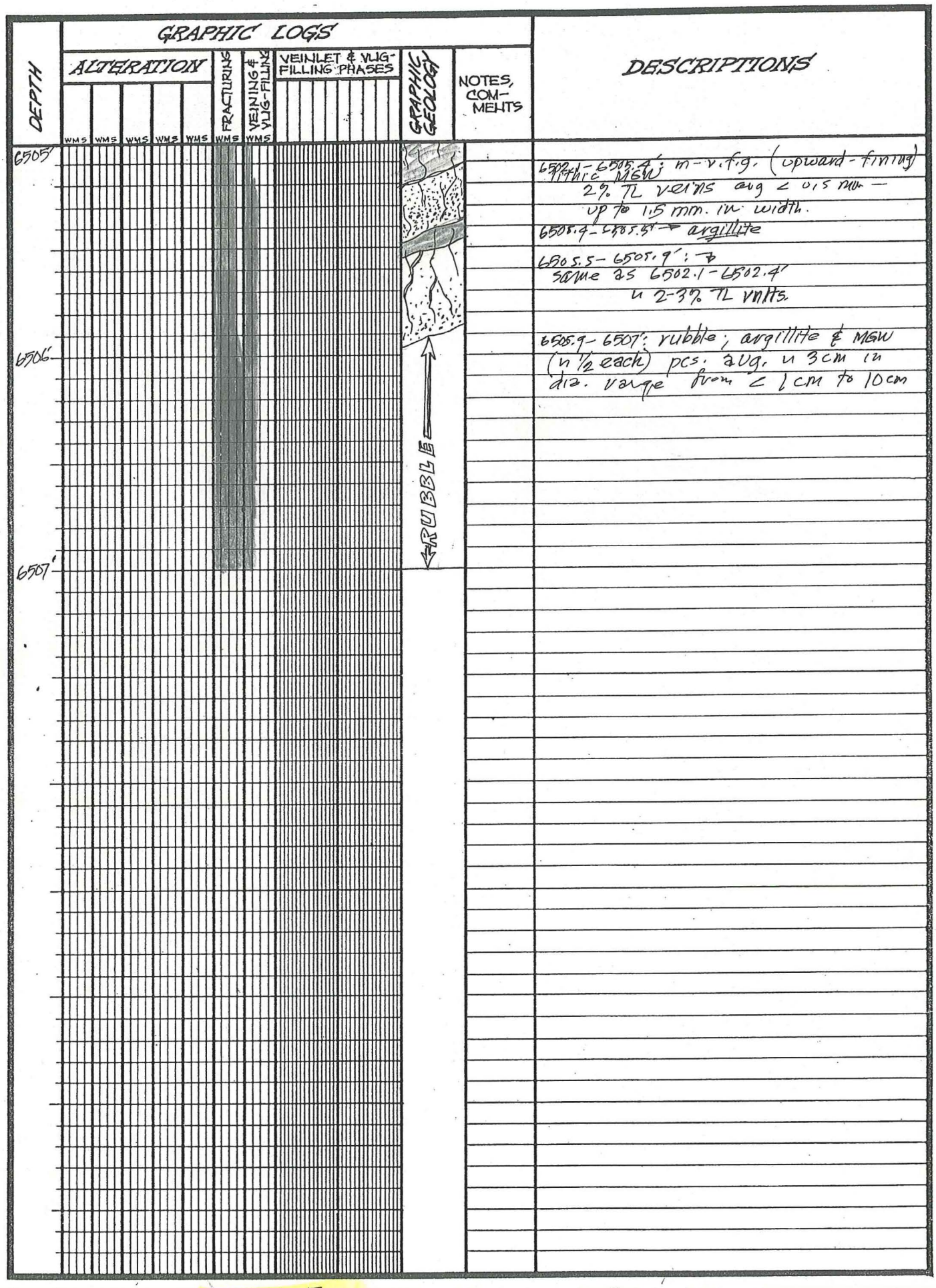
XEROX TELECOPIER 295 ; MAR 03 '86 15:57 EASTMAN WHIPSTOCK 3- 2-86; 3:54 PM; 805 658 1480 P.1



DRILL HOLE PRATT-5

LOCATION NW GEYSERS

LOGGED BY J. HULEN



DRILL HOLE PRATI-5

LOCATION NW GEYSERS

LOGGED BY J. HULEN

05/04/91

WELL SUMMARY

CCPA NO. 1 PRATI-29 ST1

True Vertical Depth Plot

WELL NAME	CCPA No. 1 PRATI 29 ST1
SPUD DATE	6/23/93
COMPLETION DATE	8/25/93
TD (MEASURED)	10,022'
TD (TRUE VERTICAL)	9,425'
LOCATION	~~825' S, 50' E~~ of NW CRNR Sec 36, T12N, R8W, MBDM
ELEVATION	3223' + 30' KB
RIG TEST	79,600#/HR, 137psig, 358 deg F, 4" Orifice

747.98, 6.,
92.73 W.

Gwke
Siltstone
Argillite
Clay
Chert
Greenstone
Serpentine

MINERALS
Q Quartz
C Calcite
P Pyrite
E Epidote
R Pyrrhotite
N Prehnite
X Axinite
T Tourmaline
B Unident Mnrl

Rare
Trace
Minor
Common
Abundant

Well Course - Plan View
Scale: 1" = 1500'

N

TD

200 ROP 0

Well Course - Elevation View
S38.50W
Scale: 1" = 1500'

0
1000
2000
3000
4000
5000
6000
7000
8000
9000
10000

247' MD & TVD: 20" Casing

Surface - 530' MD: Grenstone/Chert Complex.
530'- 1310' MD: Graywacke; lt-dk gry, loc grn/gry, fine grained, massive, with minor Siltstone and Argillite.

1310'- 2580' MD: Melange; Clay, Graywacke, Chert, Greenstone, Serpentine, Siltstone, Argillite.

2651' MD, 2646' TVD: 13 3/8" Casing

26 Cmt Plugs
f/2654'- 4800' MD
2649'- 4756' TVD

2580'- 6350' MD: Graywacke; lt-med gry, loc lt-med grn, crs-fn gr, pred fn gr, gd gr bndrs, mass, w/depth weak fol & com slicks, pred detrital frags of qtz, felds & argil, tr chert, biotite & volc frags.

Steam Entries:

MD	TVD	*P/T Increase
8072'	7743'	11/12
8093'	7761'	14/4
8179'	7834'	70/44
8945'	8491'	3/0
9006'	8545'	3/0
9015'	8553'	6/0
9107'	8632'	7/0

*P = psi, T = deg F

6502' MD, 6342' VD: 9 5/8" Casing

Start Air Drlg @
6513' MD, 6353' TVD

6350'?- 6850' MD: Melange; Graywacke, Argillite, Siltstone, Serpentine, Greenstone.

6850' MD - T.D.: Graywacke; v lt-lt gry-loc wht, lt gry/grn, gr bndrs good to

8445'-8455' MD, 8062'-8070' TVD: Core

fair to loc indistinct. Siltstone: dk gry-blk, frm-hd, v fnly sndy-clayey.

9900' MD -T.D.: Weak hornfelsic matrix.

Lost Circ:--- Steam Entry: ——

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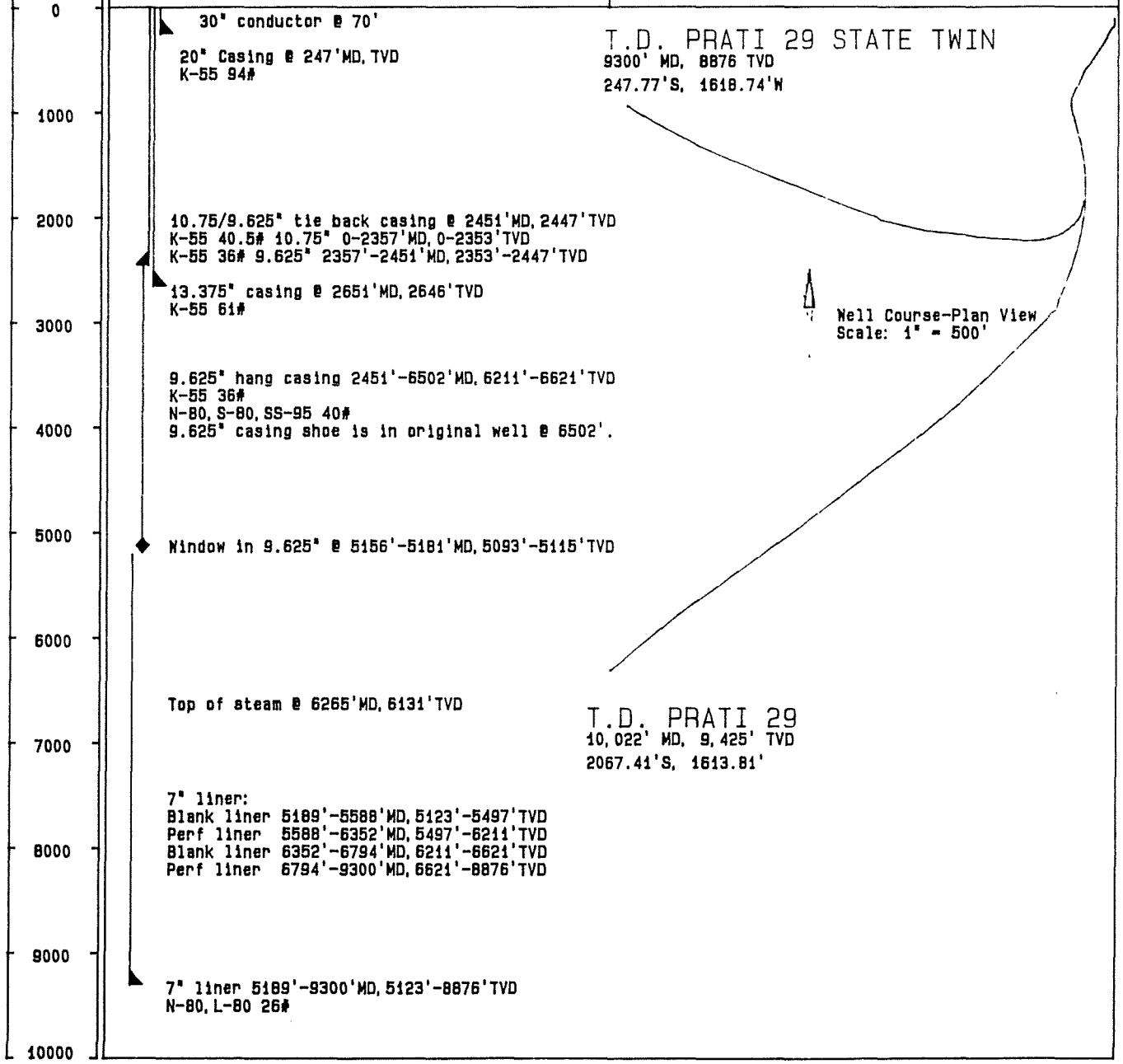
DRILLING SUMMARY

CCPA NO. 1 PRATI-29 STATE TWIN

Measured Depth Plot

Scale 1 : 18000

WELL NAME	CCPA P-29 STATE TWIN	RIG TESTS:
SPUD DATE	3/15/94	2.5" ORIFICE, 5/15/94
COMPLETION DATE	5/15/94	Flow = 28.5 KPH
TD (MEASURED)	9,300'	Temp = 288 deg F
TD (TRUE VERTICAL)	8,876'	Pressure = 128 psig
LOCATION	748'S, 93'W of NW CRNR Sec 36, T12N, R9W, MDBM	2.0" ORIFICE, 5/16/94
		Flow = 22.9 KPH
ELEVATION	3223' + 30' KB	Temp = 256 deg F
	Note: State Lease Line @ 5840' M.D.	Pressure = 169 psig



5/20/94
LD

CONFIDENTIAL

DRILLING SUMMARY

CCPA NO. 1 PRATI-29 STATE TWIN

Well History Abstract

Scale 1 : 18000

WELL NAME	CCPA P-29 STATE TWIN	RIG TESTS:
SPUD DATE	3/15/94	2.5" ORIFICE, 5/15/94
COMPLETION DATE	5/15/94	Flow = 28.5 KPH
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		Flow = 22.9 KPH
ELEVATION	3223' + 30' KB	Temp = 256 deg F
	Note: State Lease Line @ 5840' M.D.	Pressure = 169 psig

March 15,94	Rig up Nabors rig 58 over CCPA NO 1 Prati 29 Sidetrack 1.
March 16-22	Fish in Prati 29 Sidetrack 1 for lost wireline, no good.
March 23-27	Mill window f/ 5156'to 5167'for twin.
March 28-31	Drill 8.75" hole to 5383' w/ mud motor.
April 1-3	Drill to 5809', begin losing 20 to 30 bbls/hr mud.
April 4	Ream f/ 5152' to bottom, hang up in window.
April 5	RIH & try to work through window, no good.
April 6-10	Mill on window, probe for hole w/ bit, no good.
April 11	Fish for whipstock, whipstock found to be damaged.
April 12	Mill w/ junk mill f/ 5173' to 5190'.
April 13	Run wireline casing log, RIH w/ packer for whipstock.
April 14	RIH w/ new whipstock to 5181', lengthened window f/ 5167'-5181'.
April 15	RIH w/ taper mill to 5153', ream through window to 5285'
April 16-17	Rig to air, stage in w/ air to 3373', plugged bit, Stage in to 3848', plugged bit, ream and drill ahead to 5910'. Crossed into state lease @ 5840'MD with no steam.
April 18-22	Drill to 7477', first steam entry @ 6265' 9 psi & 87 deg F.
April 23-25	Drill to 8049'.
April 26	Mill f/ 5306' to 6872'.
April 27	Continue milling/reaming/pushing to bottom, work mill on bottom, POH, RIH w/ new bit #16, ream f/ 5617' to 5625', RIH to 5929'.
April 28	Ream to 5974', POH, RIH w/ taper and string mills, ream f/ 5961' to 6101', RIH, ream to 6954'.
April 29-30	RIH w/ NB#17 and slick DA, ream f/ 6954' to 6964', RIH to 7978', ream and c/o fill to bottom, drill f/ 8049' to 8365'.
May 1	Ream f/ 8022' to 8365', drill to 8637'.
May 2-3	Ream f/ 8146' to 8637', drill to 8899'.
May 4-7	Ream f/ 8400' to 8899', would not drill, RIH w/ bottom and string mills, mill on junk, POH, drill to 9200'.
May 8	Run caliper log, RIH w/ casing scraper to 2451', POH.
May 9	Set packer @ 2751', fill hole, pump sand plug, top sand plug @ 2686', run 10.75" tie back casing.
May 10	Complete tie back casing run, set 56 jts K-55 of 40.5# 10.75" casing to 2357' and 36# 9.625" f/ 2357' to 2451', cement in place.
May 11-12	RIH to 2570', c/o bridge f/ 2570' to 2615', RIH to 5979'.
May 13	Ream to bottom w/ tight spots f/ 5979' to 6434', 6550' to 6813', 9075' to 9200', drill to 9300'.
May 14-15	Run 7" blank and perforated liner f/ 5189' to 9300', test well.
May 16	Test well, tests witnessed by WHR, Inc. and State Lands Commission.

5/20/94
LD

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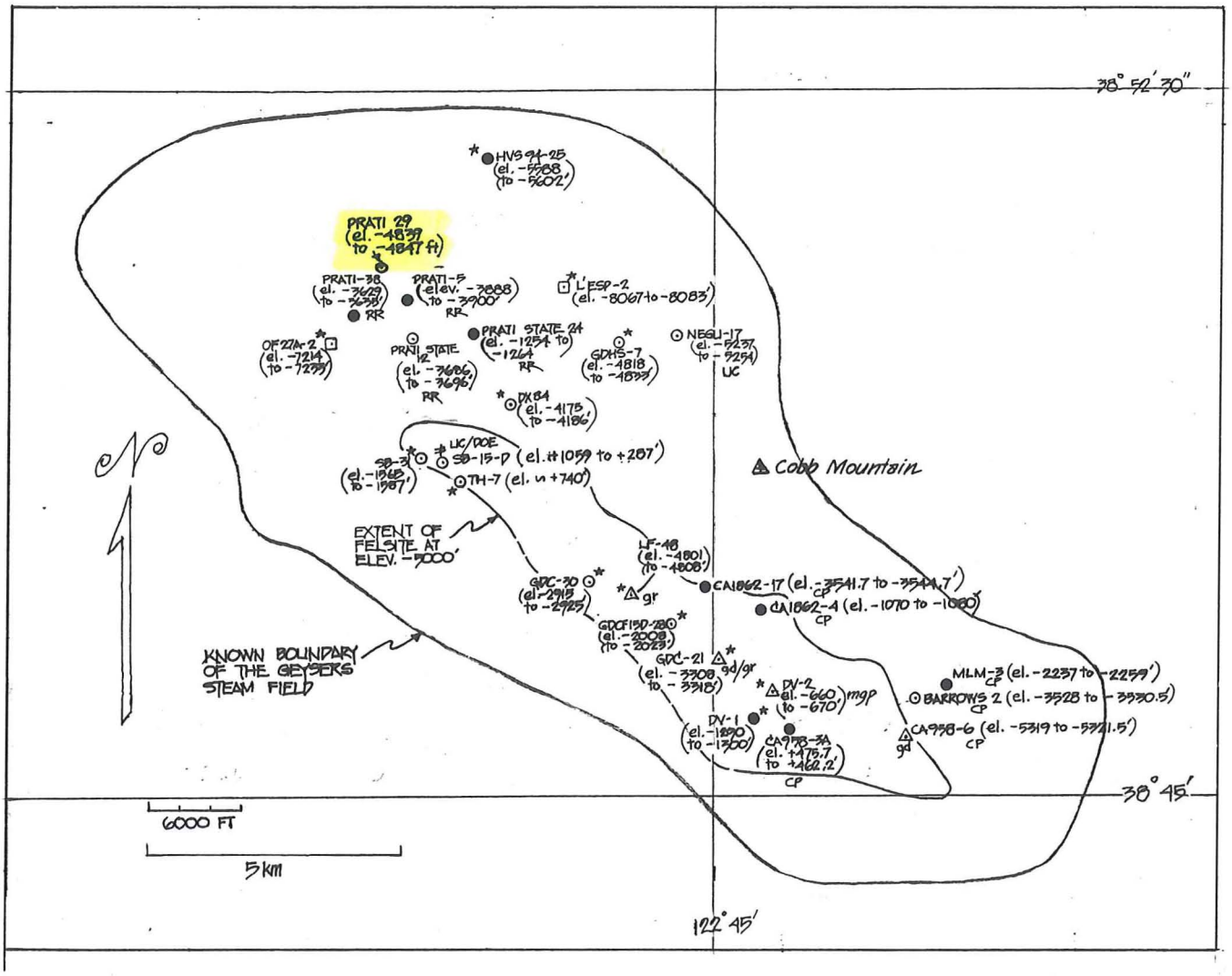
Sample Depth or Depth Interval	Sample Type (e.g. full-dia. core, rubble, etc.)	Purpose of Sampling (e.g. for fluid-inclusion study	Sampler (Investigator) and Institution	Date Sam-pled	Date of Sample Return
(1) 8448' (2574.8 m)	PARTIAL CORE	ADSORPTION STUDIES	C. SATIK STANFORD UNIV.		

Core Sample Record

Well or Borehole PRATI 29 Core Depth Interval _____



CORE LOCATIONS AND ROCK TYPES

ABOVE FIRST STEAM ENTRY

● GRAYWACKE

BELOW FIRST STEAM ENTRY

"normal" steam reservoir
- ⊙ GRAYWACKE
- △ "FELSITE"
  - mgp = microgranite porphyry
  - sparsely porphyritic: gd/gr = hybrid granite/granodiorite; gd = granodiorite; gr = granite

"high-temp." steam reservoir
- ⊡ HORNFELSIC GRAYWACKE

* Continuous core from above and below first steam entry.

* Unocal proprietary cores

UC – other Unocal cores
RR – Russian River Energy
CP – Calpine
DOE – Dept. of Energy/Geothermal Div.

Location at core depth/elev. — well designation

MLM-3 (el. -2237 to -2259') — core elevation interval

LOCATION MAP — CORES FROM THE GEYSERS STEAM FIELD

Well Name / Company / Well Elev. (at ground level)	Core Location (Top of Core)	Core Depth or Depth Interval — Drilled Depth (DD) / True Vertical Depth (TVD)	Core Elevation or Elevation Interval	First Steam Entry in Well — Drilled Depth (DD) / True Vertical Depth (TVD) / Elevation (EL.)	Rock Type	Comments
NEGU-17 / Unocal / purchased by DOE/GD for $50K / EL. ?	1250 ft N, 200 ft W of SE cor. sec. 5, T11N, R8W, (MDBM) Lake Co., Calif. (approx. loc.— scaled fr. 1:264,000 map in Gulnderson, 1990)	DD 8526-8540 ft (14 ft) / TVD unknown	-5237 to -5251 ft	ND but characterized as within steam reservoir by Gunderson (1990)	graywacke	½ of 4" dia. core, sawn longitudinally / poor core recovery / highly fragmented & milled / heavily sampled
SB15-D / DOE/Geothermal/Division & Unocal / EL. 1880 ft	340 ft N, 830 ft E of SW cor. sec 12, T11N, R9W, (MDBM) Sonoma Co., Calif.	DD 825-1602 ft (777 ft) / TVD 821 - 1593 ft (772 ft)	+1059 to +287 ft	DD 1369 ft / TVD 1360 ft / EL. 520 ft	graywacke and interbedded argillite	3" full-dia. core; 100% recovery / ~50% sampled
PRATI-5 / GEO/CCOC/RREC / EL. 2554 ft	1210 ft N, 560 ft E of SW cor. sec. 36, T12N, R. 9W (MDBM) Sonoma Co., Calif.	DD 6495-6507 ft / TVD 6442-6454 ft	-3888 to -3900 ft	DD 6935 ft / TVD 6875 ft / EL. -4321 ft	"	4" full-dia. core
PRATI-29 / CCOC/RREC / EL. 3223 ft	(approx.) 2448 S, 1243 ft W of NW cor, sec. 36 T12, R8W (MDBM) Sonoma Co., Calif.	DD 8445-8455 ft / TVD 8062-8070 ft	-4839 to -4847 ft	DD 8072 ft / TVD 7743 ft / EL. -4520 ft	graywacke	4" full-dia core — very poor core recovery
PRATI-38 / GEO/CCOC/RREC / EL. 1901 ft	50 ft S, 2430 ft E of NW cor., sec 2, T11N, R9W (MDBM) Sonoma Co., Calif.	DD 5554-5560 ft / TVD 5530-5536 ft	-3629 to -3635 ft	DD 6110 ft / TVD 6076 ft / EL -4175 ft	"	4" full-dia. core

Geysers Core Samples

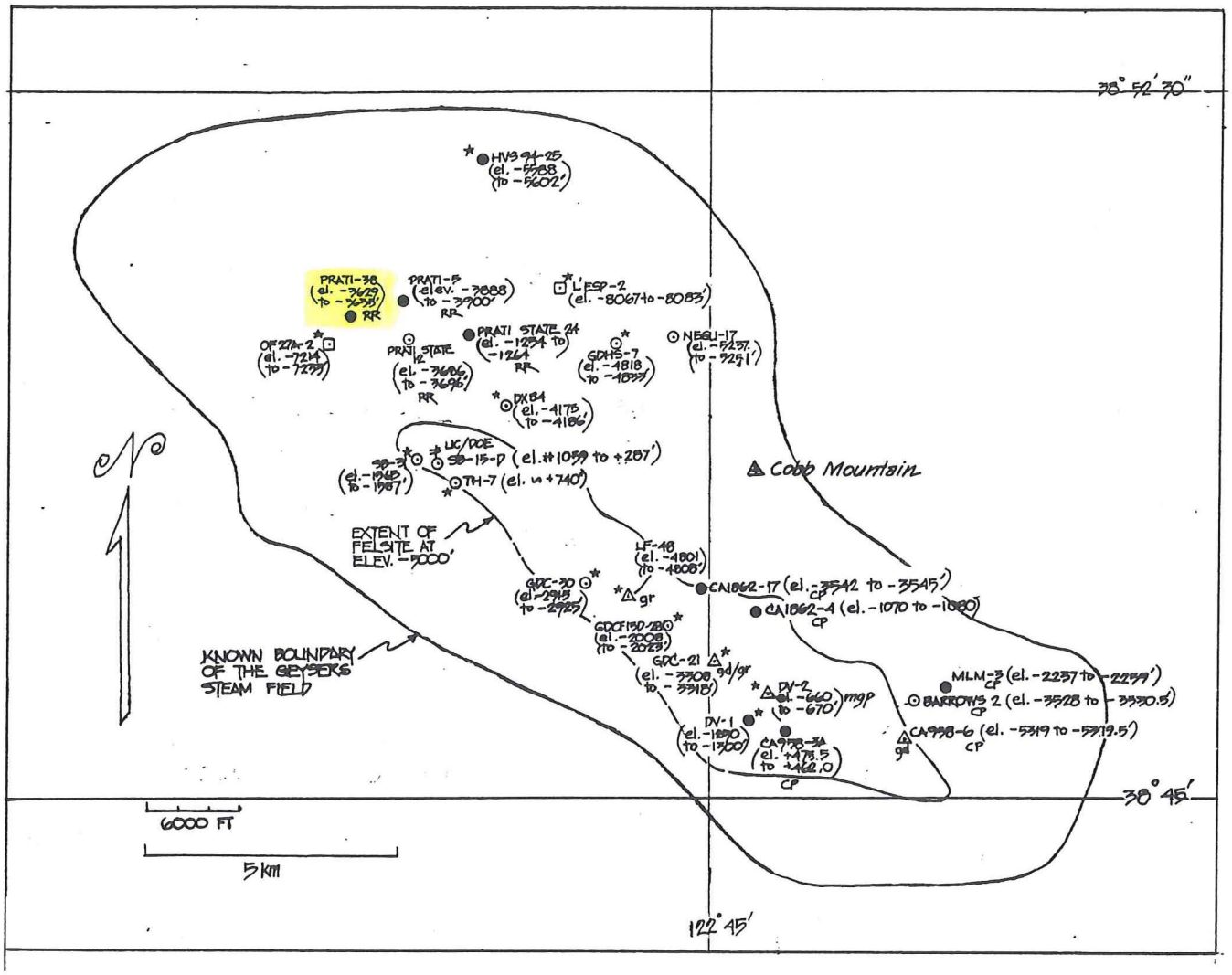
STORED AT ESRI AS OF 04/15/95

Sample Depth or Depth Interval	Sample Type (e.g. full-dia. core, rubble, etc.)	Purpose of Sampling (e.g. for fluid-inclusion study	Sampler (Investigator) and Institution	Date Sam-pled	Date of Sample Return
① 5556 – 5560' (1693.4 – 1694.6m)	NUMEROUS SCATTERED RUBBLE PCS.	SULFIDE ANALYSIS	M. McKIBBEN U. of CALIF. RIVERSIDE	05/07/90	
② 5554.7 – 5555.3' (1693 – 1693.2 m)	WHOLE CORE	THERMAL-CONDUCTIVITY MEAS.	C. WILLIAMS USGS MENLO PARK	07/01/92	

Core Sample Record

Well or Borehole PRATT 78 (NW GEYSERS) Core Depth Interval 5554 – 5560' (1692.8 – 1694.6 m)

PRATI 38



CORE LOCATIONS AND ROCK TYPES

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● GRAYWACKE

BELOW FIRST STEAM ENTRY

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- ⊙ GRAYWACKE
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"high-temp." steam reservoir
- ⊡ HORNFELSIC GRAYWACKE

\# Continuous core from above and below first steam entry.

* Unocal Proprietary cores

UC — other Unocal cores
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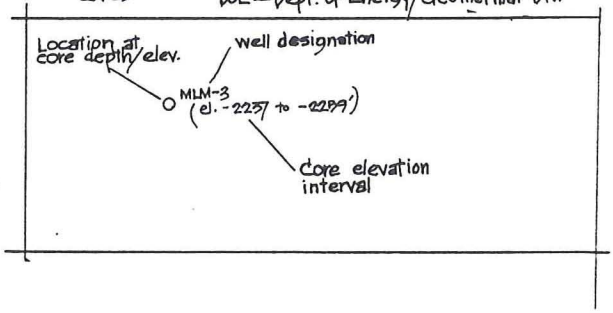


LOCATION MAP — CORES FROM THE GEYSERS STEAM FIELD

Well Name / Company / Well Elev. (at ground level)	Core Location (Top of Core)	Core Depth or Depth Interval — Drilled Depth (DD) / True Vertical Depth (TVD)	Core Elevation or Elevation Interval	First Steam Entry in Well — Drilled Depth (DD) / True Vertical Depth (TVD) / Elevation (EL.)	Rock Type	Comments
NEGU-17 / Unocal / purchased by DOE/GD for $50K / EL. ?	1250 ft N, 200 ft W of SE cor. sec. 5, T11N, R8W, (MDBM) Lake Co., Calif. (approx. loc.—scaled fr. 1:264,000 map in Gunderson, 1990)	DD 8726-8740 ft (14 ft) / TVD unknown	-5237 to -5251 ft	ND but characterized as within steam reservoir by Gunderson (1990)	graywacke	½ of 4" dia. core, sawn longitudinally / poor core recovery / highly fragmented & milled / heavily sampled
SB15-D / DOE/Geothermal/Division & Unocal / EL. 1880 ft	340 ft N, 830 ft E of SW cor. Sec 12, T11N, R9W, (MDBM) Sonoma Co., Calif.	DD 825-1602 ft (777 ft) / TVD 821 - 1593 ft (772 ft)	+1059 to +287 ft	DD 1369 ft / TVD 1360 ft / EL. 520 ft	graywacke and interbedded argillite	3" full-dia. core; 100% recovery / ~15% sampled
PRATI-5 / GEO/CCOC/RREC / EL. 2554 ft	1210 ft N, 560 ft E of SW cor. sec. 36, T12N, R. 9W (MDBM) Sonoma Co., Calif.	DD 6495-6507 ft / TVD 6442-6454 ft	-3888 to -3900 ft	DD 6935 ft / TVD 6875 ft / EL. -4321 ft	"	4" full-dia. core
PRATI-29 / CCOC/RREC	No documentation received with core				graywacke	
PRATI-38 / GEO/CCOC/RREC / EL. 1901 ft	50 ft S, 2430 ft E of NW cor., sec 2, T11N, R9W (MDBM) Sonoma Co., Calif.	DD 5554-5560 ft / TVD 5530-5536 ft	-3629 to -3635 ft	DD 6110 ft / TVD 6076 ft / EL -4175 ft	"	4" full-dia. core

Geysers Core Samples

STORED AT ESRI AS OF 04/15/95

PRATI-38

*** G E O prati38 DIRECTIONAL WELL SURVEY ***

Vertical section calculated in plane of proposal
Direction : S 25 E

** 1**

Date: 04/31/86

MEASURED DEPTH feet	DRIFT ANGLE deg.	min	DRIFT DIRECTION deg	COURSE LENGTH feet	TRUE VERT. DEPTH feet	RECTANGULAR COORDINATES feet		SECTION feet	DOGLEG SEVERITY dg/100ft
0	0	0	0	0	0.00	0.00	0.00	0.00	0.00
192	0	30	s 26e	192	192.00	0.75S	0.37E	0.84	0.26
250	0	45	s 15e	58	249.99	1.35S	0.59E	1.47	0.48
403	0	45	s 2e	153	402.98	3.33S	0.88E	3.39	0.11
555	0	15	n 57w	152	554.98	3.98S	0.27W	3.49	0.60
710	0	45	n 84w	155	709.97	3.53S	1.54W	2.54	0.35
863	0	30	s 3w	153	862.96	4.61S	2.81W	2.99	0.60
1020	0	45	n 37w	157	1019.95	5.11S	4.45W	2.75	0.75
1173	0	45	n 39w	153	1172.94	3.53S	5.68W	0.80	0.00
1329	0	45	n 39w	156	1328.93	1.95S	6.97W	-1.18	0.00
1485	1	0	n 34w	156	1484.91	0.03S	8.39W	-3.52	0.17
1640	1	0	n 33w	155	1639.88	2.22N	9.88W	-6.19	0.00
1794	1	0	n 90w	154	1793.86	3.51N	12.24W	-8.35	0.62
952	1	30	n 85w	158	1951.82	3.66N	15.69W	-9.94	0.32
107	1	45	s 88w	155	2106.76	3.77N	20.08W	-11.90	0.21
2264	1	30	s 66w	157	2263.70	2.77N	24.42W	-12.83	0.43
2426	2	0	s 64w	162	2425.62	0.68N	28.90W	-12.83	0.31
2574	2	45	s 64w	148	2573.49	2.01S	34.41W	-12.72	0.51
2729	3	15	s 67w	155	2728.28	5.37S	41.79W	-12.79	0.34
2882	3	30	s 72w	153	2881.02	8.53S	50.23W	-13.50	0.25
3036	4	0	s 83w	154	3034.69	10.71S	60.06W	-15.68	0.57
3161	4	15	s 76w	125	3159.36	12.35S	68.91W	-17.93	0.45
3226	4	15	s 60w	65	3224.18	14.15S	73.37W	-18.18	1.82
3258	4	15	s 45w	32	3256.10	15.59S	75.25W	-17.67	3.47
3289	4	0	s 30w	31	3287.02	17.36S	76.61W	-16.64	3.56
3321	4	45	s 17w	32	3318.92	19.60S	77.58W	-15.02	3.87
3351	4	45	s 8w	30	3348.82	22.03S	78.12W	-13.05	2.48
3383	4	45	s 6e	32	3380.71	24.68S	78.17W	-10.67	3.61
3414	5	0	s 20e	31	3411.60	27.24S	77.58W	-8.09	3.91
3445	5	30	s 29e	31	3442.47	29.83S	76.40W	-5.26	3.10
3522	5	45	s 46e	77	3519.10	35.81S	71.81W	2.11	2.18
3616	7	0	s 48e	94	3612.52	42.93S	64.17W	11.79	1.35
3710	7	30	s 48e	94	3705.76	50.87S	55.36W	22.71	0.53
3773	8	0	s 52e	63	3768.19	56.33S	48.85W	30.41	1.17
3834	8	15	s 51e	61	3828.58	61.70S	42.10W	38.12	0.47
3907	8	45	s 53e	73	3900.77	68.34S	33.60W	47.74	0.80
4036	8	0	s 51e	129	4028.40	79.91S	18.79W	64.48	0.62
4160	7	45	s 48e	124	4151.23	90.94S	5.87W	79.94	0.39
4254	7	45	s 46e	94	4244.37	99.59S	3.40E	91.69	0.29
4382	7	45	s 45e	128	4371.20	111.68S	15.71E	107.86	0.11

** 2**

Date: 04/31/86

MEASURED DEPTH feet	DRIFT ANGLE deg.	min	DRIFT DIRECTION deg	COURSE LENGTH feet	TRUE VERT. DEPTH feet	RECTANGULAR COORDINATES feet		SECTION feet	DOGLEG SEVERITY dg/100ft
4476	7	0	s 43e	94	4464.42	120.36S	24.09E	119.27	0.84
4587	7	45	s 41e	111	4574.51	130.95S	33.62E	132.89	0.71
4650	8	15	s 37e	63	4636.89	137.77S	39.14E	141.40	1.19
4757	8	30	s 35e	107	4742.75	150.38S	48.30E	156.70	0.36
4833	8	15	s 29e	76	4817.94	159.76S	54.17E	167.69	1.20
4967	8	30	s 27e	134	4950.51	177.00S	63.33E	187.18	0.29
5091	9	30	s 24e	124	5072.99	194.50S	71.68E	206.57	0.89
5151	9	0	s 28e	60	5132.20	203.17S	75.91E	216.22	1.36
5217	7	45	s 30e	66	5197.50	211.58S	80.57E	225.81	1.94
5248	8	12	s 31e	31	5228.20	215.29S	82.75E	230.09	1.52
5328	8	45	s 36e	80	5307.33	225.12S	89.26E	241.75	1.15
5389	9	15	s 36e	61	5367.58	232.84S	94.87E	251.12	0.82
5452	10	0	s 36e	63	5429.69	241.36S	101.06E	261.46	1.19
5647	10	30	s 34e	195	5621.58	269.78S	120.96E	295.63	0.31
5805	10	15	s 29e	158	5776.99	294.04S	135.83E	323.90	0.59
5932	11	0	s 29e	127	5901.82	314.52S	147.18E	347.26	0.59
6048	11	0	s 27e	116	6015.69	334.07S	157.58E	369.36	0.33
6207	11	45	s 17e	159	6171.56	363.14S	169.32E	400.68	1.33
6363	12	45	s 12e	156	6324.01	395.19S	177.61E	433.22	0.93
6521	12	15	s 9e	158	6478.27	428.81S	183.84E	466.33	0.52
6646	13	15	s 4e	125	6600.18	456.22S	186.97E	492.49	1.19
6804	14	0	s 3e	158	6753.74	493.37S	189.24E	527.12	0.50
6962	14	0	s 14w	158	6907.04	531.42S	185.57E	560.06	2.59
7121	16	0	s 16w	159	7060.63	571.17S	174.92E	591.58	1.30
7248	18	0	s 21w	127	7182.08	606.38S	163.14E	618.52	1.95
7348	18	0	s 23w	100	7277.18	635.04S	151.56E	639.59	0.62
7411	17	45	s 20w	63	7337.14	653.03S	144.48E	652.90	1.52
7506	17	45	s 22w	95	7427.62	680.07S	134.10E	673.02	0.64
7631	19	15	s 25w	125	7546.16	716.44S	118.28E	699.30	1.42
7663	19	30	s 25w	32	7576.35	726.06S	113.80E	706.13	0.79
7770	20	0	s 27w	107	7677.05	758.56S	97.95E	728.88	0.79
7880	21	15	s 27w	110	7780.00	793.08S	80.36E	752.74	1.14
8004	22	0	s 28w	124	7895.28	833.62S	59.25E	780.56	0.67
8159	22	0	s 30w	155	8038.99	884.40S	31.10E	814.68	0.48
8317	20	0	s 32w	158	8186.50	932.94S	1.94E	846.35	1.34
8718	20	0	s 32w	401	8563.31	1049.25S	70.74W	921.04	0.00

Closure distance : 1051.63 feet.
angle : S 3 deg 51 min W

**** E N D O F R E P O R T ****

CONFIDENTIAL

PRATI STATE 12

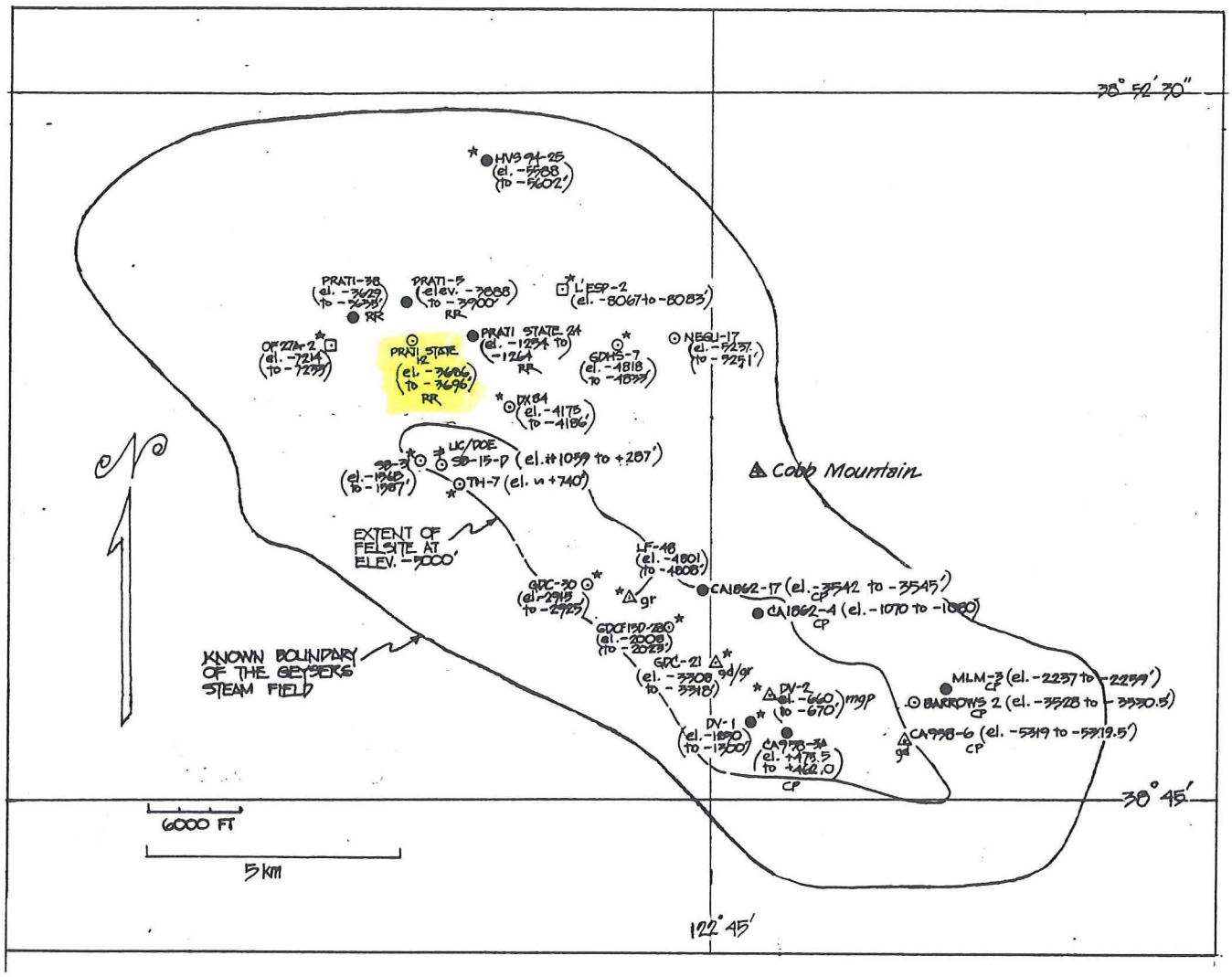
Sample Depth or Depth Interval	Sample Type (e.g. full-dia. core, rubble, etc.)	Purpose of Sampling (e.g. for fluid-inclusion study	Sampler (Investigator) and Institution	Date Sampled	Date of Sample Return
(1) 6662.5' (2030.6 m)	RUBBLE	SULFIDE ANALYSIS	M. McKIBBEN U. CALIF. RIVERSIDE	05/01/90	
(2) 6663' (2030.8 m)	"	"	"	"	
(3) 6256-6266' (1906.7-1909.8 m)	scattered rubble pcs.	"	"	"	
(4) 6260.25-6260.5' (1908-1908.1 m)	HALF-CORE	Φ, k MEAS.	G. BODVARSSON LBL	04/18/91	
(5) 6265.75-6266.0' (1909.7-1909.8 m)	WHOLE CORE	"	"	"	
(6) 6257-6257.4' (1907-1907.2 m)	" 2 pcs.	THERMAL CONDUCTIVITY MEAS.	C. WILLIAMS USGS MENLO PARK	07/01/92	
(7) 6260-6260.25' (1908 m)	"	"	"	"	
(8) 6261.7-6261.8' (1908.5 m)	WHOLE CORE	ADSORPTION MEAS.	R. MESMER H.F. HOLMES OAK RIDGE NAT'L. LAB	10/25/94	
(9) 6261.8-6261.9' (1909 m)	" ?	"	C. SATIK STANFORD UNIV.	11/17/94	
(10) 6256.8-6257 (1907 m)	PARTIAL CORE	"	C. SATIK "	04/06/95	
(11) 6264' (1909.2 m)	"	"	"	"	

Core Sample Record

J. Hulen

Well or Borehole PRATI STATE 12 NW GEYSERS Core Depth Interval 6256-6266' (1906.7-1909.8 m)

PRATI STATE 12



CORE LOCATIONS AND ROCK TYPES

ABOVE FIRST STEAM ENTRY

● GRAYWACKE

BELOW FIRST STEAM ENTRY

"normal" steam reservoir
- ⊙ GRAYWACKE
- △ "FELSITE."
  - mgp = microgranite porphyry
  - sparsely porphyritic: gd/gr = hybrid granite/granodiorite; gd = granodiorite; gr = granite

"high-temp." steam reservoir
- ⊡ HORNFELSIC GRAYWACKE

* Continuous core from above and below first steam entry.

* Unocal Proprietary cores

UC — other Unocal cores
RR — Russian River Energy
CP — Calpine
DOE — Dept. of Energy/Geothermal Div.

Location at core depth/elev. — well designation

○ MLM-3 (el. -2237 to -2259')

Core elevation interval

LOCATION MAP — CORES FROM THE GEYSERS STEAM FIELD

Well Name / Company / Well Elev. (at ground level)	Core Location (Top of Core)	Core Depth or Depth Interval — Drilled Depth (DD) / True Vertical Depth (TVD)	Core Elevation or Elevation Interval	First Steam Entry in Well — Drilled Depth (DD) / True Vertical Depth (TVD) / Elevation (EL.)	Rock Type	Comments
PRATI STATE 12 / GEO/CCOC/RREC / EL. 2435 ft	1280 ft S, 820 ft E of NW cor. sec 1, T11N, R9W (MDBM) Sonoma Co., Calif.	DD 6256-6266 ft / TVD 6121-6131 ft	-3686 to -3696 ft	DD 4778 ft / TVD 4718 ft / EL. -2283 ft	graywacke w/ minor argillite	4"-dia. core, most sawn in half longitudinally; poor core recovery; highly fragmented and milled; heavily sampled
PRATI STATE 24 / GEO/CCOC/RREC / EL. 2435 ft	∿1250 ft S, 390 ft W of NE cor. sec 1, T11N, R9W (MDBM) Sonoma Co., Calif.	DD 3983-3993 ft / TVD ∿3850-3860 ft*	(approx.) -1254 to -1264 ft *	DD 6070 ft * * →	graywacke and argillite	4"-dia. core * no drift survey received with core
CA958-3A / Aminoil/Calpine / EL. 2900 ft	850 ft N, 1700 ft E of SW cor. sec 34, T.11N, R8W (MDBM) Sonoma Co., Calif.	DD 2440.5-2454 ft / TVD 2424.5-2438 ft	+475.5 to +462.0 ft	DD 3770 ft / TVD 3711 ft / EL -811 ft	schistose graywacke	4"-dia. core some pcs. sawn in half longitudinally
CA958-6 / Aminoil/Calpine / EL. 2200 ft.	80 ft N, 830 ft W of SE cor. Sec. 35, T11N, R8W (MDBM) Lake Co., Calif.	DD 7842-7842.5 ft / TVD 7519-7519.5 ft	-5319.0 to -5319.5 ft	DD 5671 ft / TVD 5502 ft / EL -3302 ft	biotite-hornblende-orthopyroxene granodiorite, sparsely porphyritic	4"-dia core 1 pc. remaining, ∿ 1" long
CA1862-4 / Aminoil/Calpine / ELEV. 3373 ft	1150 ft S 700 ft W of NE cor. Sec 28 T11N, R8W (MDBM) Sonoma Co., Calif.	DD 4455-4465 ft / TVD 4443-4453 ft	-1070 to -1080 ft	DD 4530 ft / TVD 4517 ft / EL. -1144 ft	schistose graywacke	〃

Geysers Core Samples

STORED AT ESRI AS OF 04/15/95

PRATI STATE 12

GEOTH. RESOUR. COUNC., TRANS., V. 15, p. 11-18

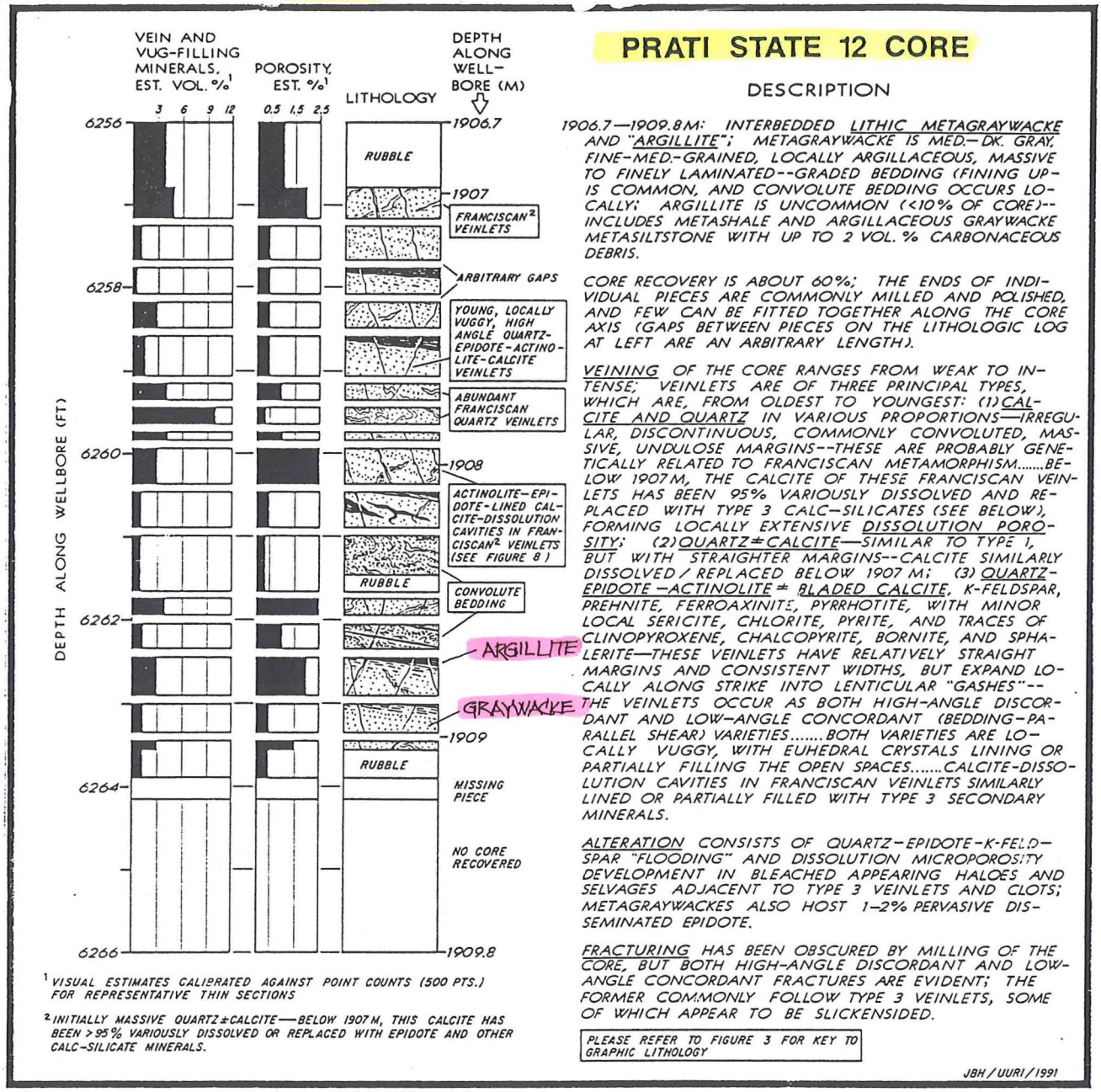


Figure 5. Detailed lithologic, vein mineralization, and estimated porosity log for steam-reservoir core from a depth of 1906.7-1909.8 m in Northwest Geysers geothermal well Prati State 12. Porosity values are visual estimates calibrated against point counts for representative thin sections impregnated with fluorescent epoxy.

could be adsorbed, and Economides and Miller (1985) believe that failure to take adsorption into account when modeling vapor-dominated systems could lead to reserve estimates an order of magnitude too low. We suggest that (1) the intricate, porous crystal networks in calcite-dissolution vugs and open veinlets in the Prati State 12 reservoir core would be particularly favorable for adsorption of liquid water because of their unusually high total surface areas; and (2) such adsorption should be given serious consideration in Northwest Geysers reservoir models and reserve estimates.

ACKNOWLEDGEMENTS

This research is being sponsored by the U.S. Department of Energy, Geothermal Division (contract no. DE/AC07/90ID12929); said support does not constitute a DOE endorsement of the views expressed in this paper. We are grateful to Coldwater Creek Operator Corporation for permission to publish. SEM photomicrographs are the work of Wes Martin, Salt Lake City. Bob Turner produced Figure 1; Dave Langton Figure 6, and Pam Sjostrom processed the manuscript.

4

BDDVG - 29, 25, 33, 5

GRAPHIC LOGS

DEPTH	ALTERATION (% vein / vein / Φ; WMS)	FRACTURING (WMS)	VEINING & VUG-FILLING (WMS)	VEINLET & VUG-FILLING PHASES	GRAPHIC GEOLOGY	NOTES, COMMENTS	DESCRIPTIONS
6256'							11 pcs. ranging from 3.8 cm to 7.5 cm maximum dimension. pcs. are pulled apart, smoothed w/ mud & the milling sub- to core axis
6257'						AI-AII	6256-56.8': LITHIC MGW, f-med. gr, mod. gray massive to very vaguely bedded, w/ bedding defined by metashale chips up to 6x1 mm. in X-section., cut by qtz. & qtz-cal vnlts. of 1st 2 generations. — earliest are undulose-margined, locally contorted, .015-.5 mm in diag. width, — sometimes w/ discontinuous, wall-rock septa; qtz is bull (white) — calcite is errat. dist. in clots along strike, and is transl-transparent; younger vnlts are banded-appearing, tend to occur at high-angles, straight margins, more uniform width, much more transparent — both qtz. & calcite — may have tr. epidote, sulfides — one of these is w/ vug 5x0.5 mm in X-section, lined w/ acicular epidote xls up to 0.3 mm. long → also PRISMATIC QTZ.
							← LAA: late veinlets in 40% of the rock, very vuggy (up to 12% Φ in these) — the vugs are invariably rich in calc-silicates, yellow-grn epidote & (locally) hair like actinolite w/ traces of sulfide — late veinlets range in thickness from <0.15 to 1.5 mm
						NO MATCH	← MGW, as above, rythmic graded bedding med. — fine gr. — sets 1-3 cm thick rip up presents some late qtz-sulfide veinlets parallel bedding.
							← DIAGONAL SLIX, POLISHING ON FRACTURE
							← argillite wispy, sheared / cuticular-appearing
						bedding	← interlam. avg. grw metasiltstone & arg to silty, f. gr. lithic MGW: — generally fining upward. VNLT avg. few & wispy
6258'							← f-med. gr. gen. fining upward.
						Fr. vein	
						rip-ups	← avg. w/ m-gr. lithic MGW rip-ups
							• at contact: undulose <0.5-4 mm. Fr; qtz-Vn w/ concordant vugs up to 10x2 mm 50% filled w/ ep., qtz.
							GW
						MILLED	← AA:
6259'						MILLED A22B	super abundant Franciscan veinlets — may actually include some calcite of Franciscan vintage. calcite — no young veins — no Φ
						A23b	← Med-crs. gr. lithic MGW
							Argillaceous lithic MGW, local soft-sed. defm
							BEST EXAMPLE YET OF HYDROTH. VEINLET CUTTING FR. VEIN W/ RESULTANT DISSOL. OF FR. CALCITE, INFILLING W/ VARIOUS CALC-SILICATES.
						Reverse	
						Reverse	A22C ?
6260'							
							A15a avg & GW
						frp	
						avg.	
						reverse GW metasilt.	
							F-MGR lithic GRW w/ upper bed. of avg. Grw metasiltstone & some arg. — some soft-sed. deformation and attc. mixing of rock types fracturedly
6261'							

DRILL HOLE PRATI-STATE 12 NOTES

LOCATION NW GEYSERS

LOGGED BY J. HULEN

MAY 5 & 6, '91

GRAPHIC LOGS

DEPTH	ALTERATION (WMS)	FRACTURING (WMS)	VEINING & VUG-FILLING (WMS)	VEINLET & VUG-FILLING PHASES	GRAPHIC GEOLOGY	NOTES, COMMENTS	DESCRIPTIONS
61							small shale grains common interbdd. arg. GRW. & CW, x prom. soft-sed. deformation; ss d.g.
						A28a, A28b	
						A29, as above	
					vugs	A30A	* massive to vaguely bedded m-gr. lithic MGW prominent dissolution vugs along Franciscan veinlets.
					arg. parting	A32A	interbedded arg. lithic MGW & non-arg. CW w/ prominent soft-sediment deformation. several thin (≤1 mm) bedding-parallel layers of quartz, bornite, sphalerite, pyrite, chalcopy.
62							
					~bed//		argillite grading downward into fgr. GW — A30A alteration & many excellent hydroth. veins. w/ vug ϕ
					ups down		
					form upside down		argillite fgr. grading downward into med.-gr arg. lithic MGW few good veinlets
63						A35	FGR lithic MGW — a few good vugs up to 15X6 mm
							rubble — q — hematitic q
							F-MG GW — F-M q. MGW
							✓ Badvarsson's
64							
65							

DRILL HOLE PRATI-STATE 12 NOTES

LOCATION NW GEYSERS

LOGGED BY J. HULEN

MAY 5 & 6, '91

GEOTH. RESOUR. COUNC., TRANS., V. 15, P. 167 - 174

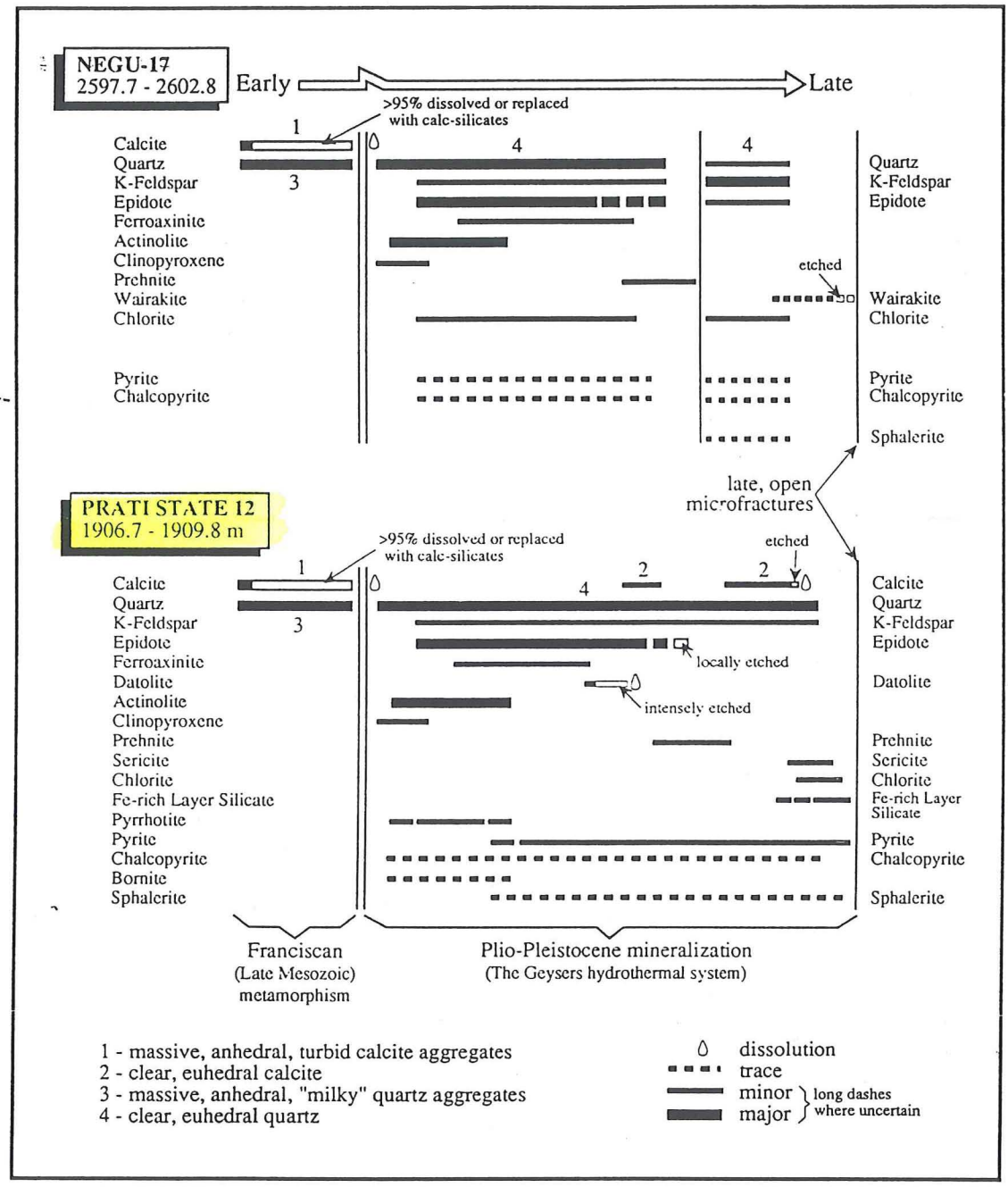


Figure 7. Interpreted vein-mineral paragenesis for steam-reservoir cores from wells NEGU-17 and Prati State 12. For locations of these wells please refer to Figure 1.

PRATI STATE 12

*** G E O pst-12 DIRECTIONAL WELL SURVEY ***

Vertical section calculated in plane of proposal
Direction : S 61 W

** 1**

Date: 08/20/87

MEASURED DEPTH feet	DRIFT ANGLE deg.	min	DRIFT DIRECTION deg	COURSE LENGTH feet	TRUE VERT. DEPTH feet	RECTANGULAR COORDINATES feet		SEC-TION feet	DOGLEG SEVERITY dg/100ft
0	0	0	0	0	0.00	0.00	0.00	0.00	0.00
281	0	30	n 48w	281	281.00	0.82N	0.91W	0.40	0.18
435	1	15	s 62e	154	434.98	2.75N	0.44E	-1.71	1.13
591	2	0	s 38e	156	590.92	0.10S	3.83E	-3.30	0.64
759	2	0	s 44e	168	758.81	4.52S	7.67E	-4.52	0.12
904	2	15	s 41e	145	903.71	8.49S	11.31E	-5.77	0.19
1061	2	15	s 29e	157	1060.59	13.53S	14.84E	-6.42	0.30
1218	3	0	s 21e	157	1217.43	20.05S	17.88E	-5.92	0.53
1376	3	30	s 22e	158	1375.17	28.39S	21.16E	-4.75	0.32
1528	4	15	s 26e	152	1526.83	37.77S	25.34E	-3.85	0.52
1683	4	45	s 17e	155	1681.35	49.08S	29.80E	-2.26	0.56
1906	4	15	s 14e	223	1903.66	65.94S	34.47E	1.82	0.25
2062	4	30	s 6e	156	2059.21	77.66S	36.54E	5.69	0.42
2219	4	30	s 3e	157	2215.72	89.94S	37.51E	10.80	0.15
2371	5	0	s 8e	152	2367.20	102.47S	38.71E	15.82	0.43
2527	5	15	s 4e	156	2522.58	116.33S	40.17E	21.27	0.28
2682	5	45	s 3w	155	2676.86	131.19S	40.30E	28.35	0.54
2839	6	15	s 6w	157	2833.00	147.55S	39.01E	37.41	0.38
2964	7	0	s 8w	125	2957.17	161.86S	37.25E	45.89	0.63
3013	7	0	s 12w	49	3005.80	167.74S	36.22E	49.65	1.00
3045	6	45	s 17w	32	3037.57	171.45S	35.26E	52.28	2.03
3075	6	45	s 24w	30	3067.37	174.75S	34.02E	54.97	2.74
3106	6	45	s 33w	31	3098.15	177.96S	32.28E	58.04	3.41
3136	6	45	s 42w	30	3127.94	180.75S	30.14E	61.27	3.52
3166	7	0	s 49w	30	3157.73	183.27S	27.58E	64.73	2.91
3197	7	30	s 57w	31	3188.48	185.63S	24.45E	68.61	3.63
3280	10	0	s 67w	83	3270.51	191.55S	13.30E	81.23	3.52
3374	12	45	s 64w	94	3362.67	199.24S	3.57W	99.71	2.99
3436	15	0	s 62w	62	3422.86	205.99S	16.81W	114.57	3.71
3469	14	30	s 66w	33	3454.77	209.67S	24.37W	122.96	3.44
3530	12	0	s 67w	61	3514.15	215.25S	37.19W	136.88	4.12
3604	11	0	s 55w	74	3586.66	222.40S	50.09W	151.63	3.50
3634	11	0	s 58w	30	3616.11	225.56S	54.86W	157.34	1.91
3695	12	15	s 65w	61	3675.86	231.43S	65.67W	169.63	3.09
3725	12	45	s 70w	30	3705.15	233.91S	71.67W	176.08	3.97
3757	13	0	s 76w	32	3736.34	236.00S	78.48W	183.06	4.25
3788	13	30	s 82w	31	3766.52	237.35S	85.46W	189.81	4.72
3865	16	0	s 84w	77	3840.98	239.74S	104.92W	207.99	3.31
4072	16	0	s 87w	207	4039.96	244.22S	161.80W	259.91	0.40
4196	16	0	s 87w	124	4159.16	246.01S	195.93W	290.63	0.00

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PRATI STATE 12

** 2**

Date: 08/20/87

MEASURED DEPTH feet	DRIFT ANGLE deg.	min	DRIFT DIRECTION deg	COURSE LENGTH feet	TRUE VERT. DEPTH feet	RECTANGULAR COORDINATES feet		SEC-TION feet	DOGLEG SEVERITY dg/100ft
4308	17	30	s 82w	112	4266.41	249.10S	228.06W	320.23	1.86
4397	17	0	s 82w	89	4351.40	252.77S	254.19W	344.87	0.56
4556	17	0	s 88w	159	4503.46	256.82S	300.50W	387.34	1.10
4713	16	30	s 86w	157	4653.79	259.19S	345.69W	428.01	0.49
4871	16	0	s 83w	158	4805.48	263.43S	389.70W	468.55	0.62
5032	16	30	s 82w	161	4960.05	269.31S	434.37W	510.47	0.36
5191	16	45	s 82w	159	5112.40	275.64S	479.41W	552.94	0.16
5358	17	0	s 81w	167	5272.21	282.81S	527.36W	598.35	0.23
5515	18	45	s 76w	157	5421.63	292.41S	574.58W	644.31	1.48
5610	18	45	s 75w	95	5511.59	300.06S	604.15W	673.87	0.34
5704	19	0	s 70w	94	5600.54	309.21S	633.15W	703.67	1.74
5790	18	45	s 70w	86	5681.91	318.72S	659.29W	731.15	0.29
5885	19	0	s 64w	95	5771.80	330.73S	687.58W	761.71	2.06
5978	19	0	s 64w	93	5859.74	344.00S	714.79W	791.95	0.00
6146	19	45	s 66w	168	6018.22	367.56S	765.31W	847.55	0.60
6216	19	45	s 67w	70	6084.11	376.99S	787.00W	871.09	0.48
6274	20	0	s 65w	58	6138.65	385.01S	805.01W	890.74	1.25
6432	20	0	s 62w	158	6287.12	409.12S	853.37W	944.72	0.65
6496	20	0	s 62w	64	6347.26	419.40S	872.70W	966.61	0.00
6652	20	45	s 61w	156	6493.50	445.31S	920.43W	1020.92	0.53
6811	20	15	s 59w	159	6642.43	473.15S	968.66W	1076.59	0.54
6974	21	15	s 51w	163	6794.86	506.28S	1015.96W	1134.03	1.84
7230	19	30	s 47w	256	7034.84	564.75S	1083.23W	1221.21	0.87
7488	19	0	s 41w	258	7278.42	625.94S	1142.32W	1302.55	0.79
7636	19	0	s 44w	148	7418.36	661.46S	1174.87W	1348.25	0.66
7801	19	45	s 43w	165	7574.01	701.17S	1212.55W	1400.45	0.50
7960	21	0	s 41w	159	7723.06	742.31S	1249.59W	1452.79	0.90
8127	21	30	s 35w	167	7878.71	790.01S	1286.85W	1508.51	1.34
8311	22	0	s 37w	184	8049.61	845.17S	1326.93W	1570.30	0.49
8467	21	45	s 33w	156	8194.38	892.78S	1360.27W	1622.54	0.97
8625	23	0	s 34w	158	8340.48	942.93S	1393.47W	1675.89	0.83
8781	22	30	s 35w	156	8484.35	992.65S	1427.63W	1729.88	0.41
8939	23	0	s 34w	158	8630.05	1043.00S	1462.24W	1784.56	0.40
9099	23	0	s 36w	160	8777.34	1094.21S	1498.10W	1840.75	0.49
9256	22	0	s 37w	157	8922.38	1142.51S	1533.84W	1895.42	0.68
9419	21	0	s 43w	163	9074.04	1188.27S	1572.24W	1951.20	1.48
9577	19	45	s 42w	158	9222.16	1228.83S	1609.40W	2003.36	0.82
9632	19	45	s 42w	55	9273.92	1242.64S	1621.84W	2020.94	0.00

Closure distance : 2043.16 feet.
angle : S 52 deg 32 min W

**** E N D O F R E P O R T ****

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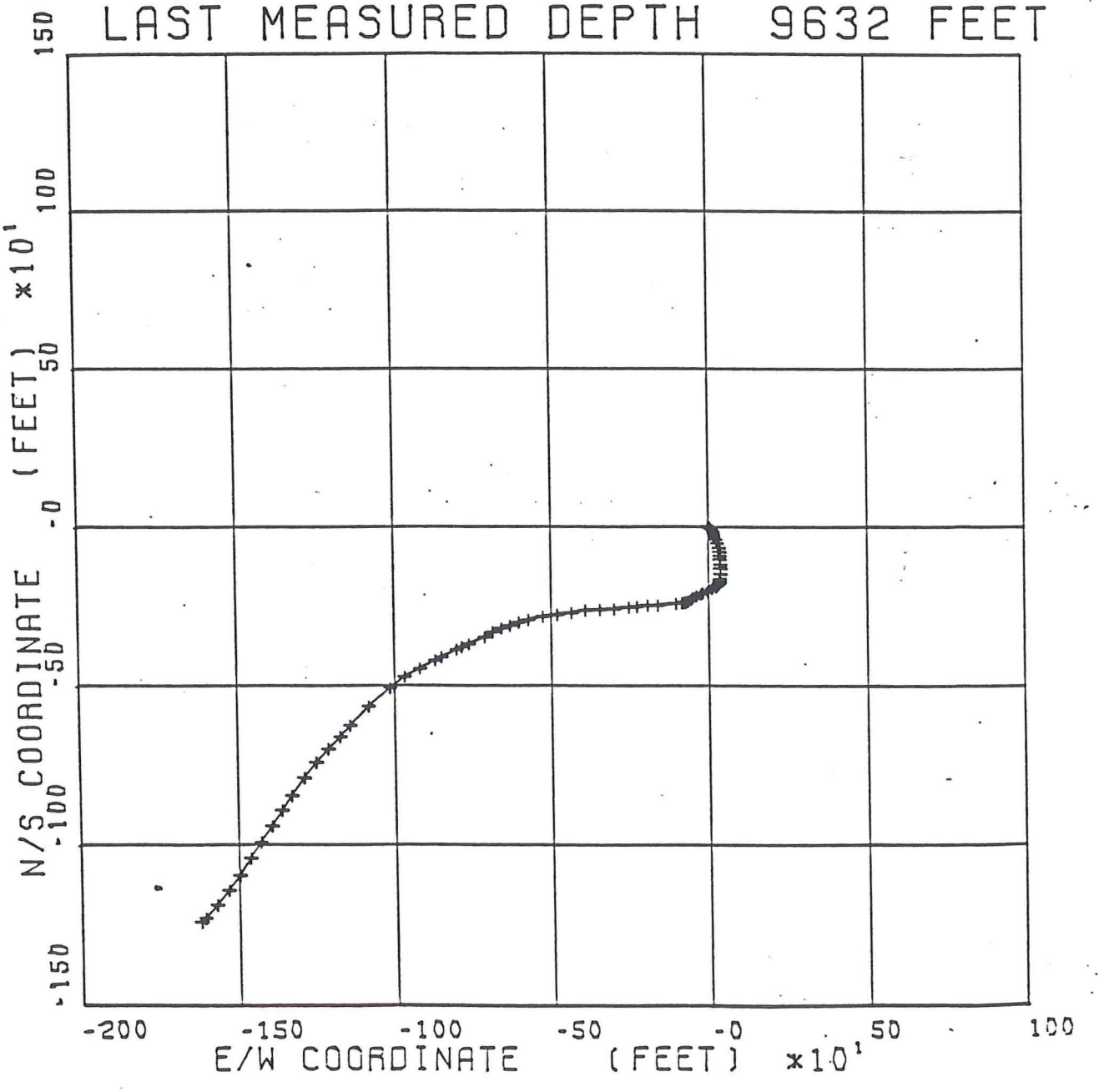
GEO PRATI ST.12 WELL COURSE



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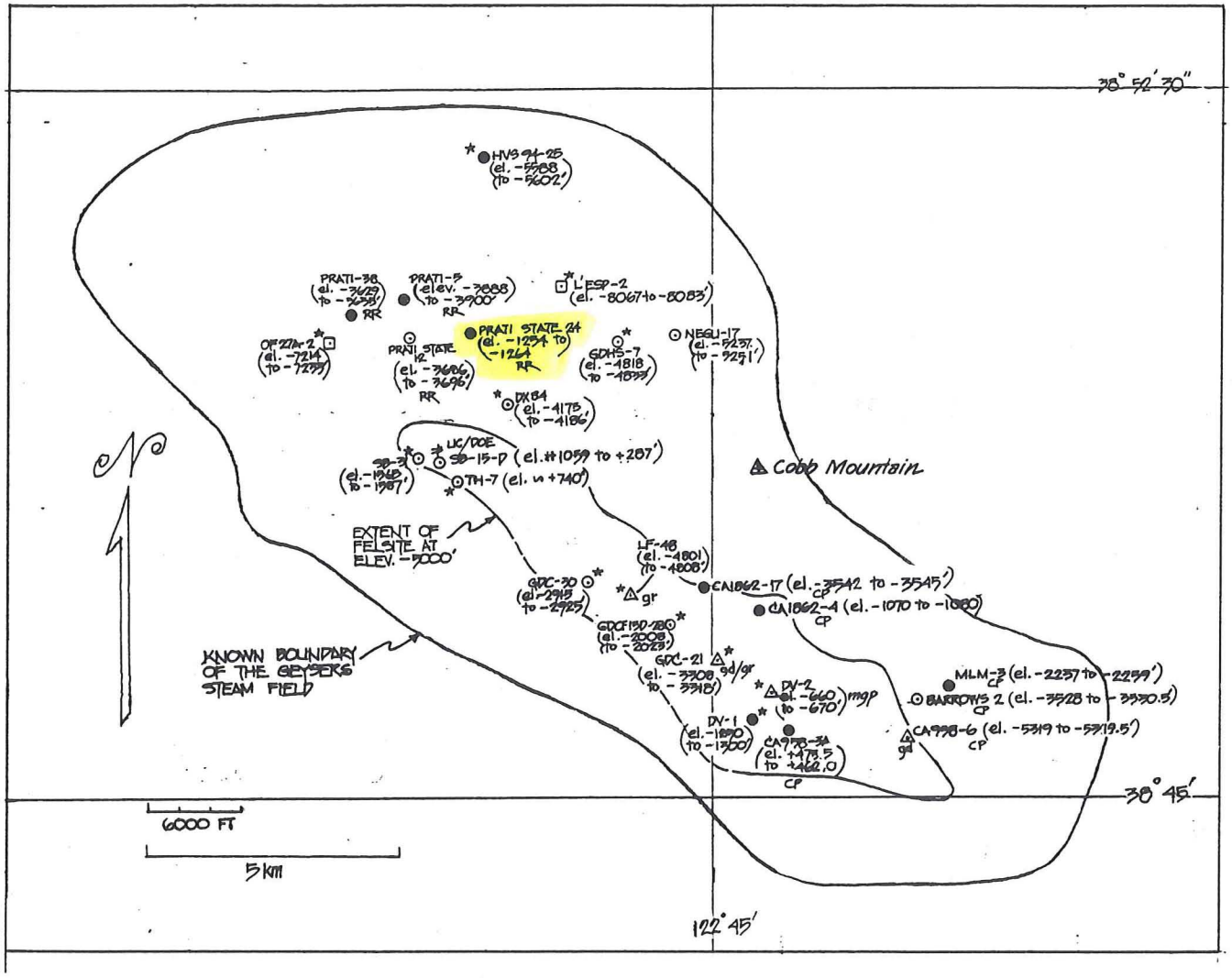
PRATI STATE 24

Sample Depth or Depth Interval	Sample Type (e.g. full-dia. core, rubble, etc.)	Purpose of Sampling (e.g. for fluid-inclusion study	Sampler (Investigator) and Institution	Date Sampled	Date of Sample Return
① 3987' (1215.2 m)	RUBBLE	SULFIDE ANALYSIS	M. McKIBBEN U. of CALIF. RIVERSIDE	05/01/90	

Core Sample Record

Well or Borehole PRATI STATE 24 (NW GEYSERS) Core Depth Interval 3983-3993' (1214-1217 m)

PRATI STATE 24



CORE LOCATIONS AND ROCK TYPES

ABOVE FIRST STEAM ENTRY

● GRAYWACKE

BELOW FIRST STEAM ENTRY

"normal" steam reservoir
- ⊙ GRAYWACKE
- △ "FELSITE"
  - mgp = microgranite porphyry
  - sparsely porphyritic: gd/gr = hybrid granite/granodiorite; gd = granodiorite; gr = granite

"high-temp." steam reservoir
- ⊡ HORNFELSIC GRAYWACKE

* Continuous core from above and below first steam entry.

* Unocal proprietary cores

UC – other Unocal cores
RR – Russian River Energy
CP – Calpine
DOE – Dept. of Energy/Geothermal Div.

Location at core depth/elev. — well designation

MLM-3 (el. -2237 to -2279')

core elevation interval

LOCATION MAP — CORES FROM THE GEYSERS STEAM FIELD

Well Name / Company / Well Elev. (at ground level)	Core Location (Top of Core)	Core Depth or Depth Interval — Drilled Depth (DD) / True Vertical Depth (TVD)	Core Elevation or Elevation Interval	First Steam Entry in Well — Drilled Depth (DD) / True Vertical Depth (TVD) / Elevation (EL.)	Rock Type	Comments
PRATI STATE 12 GEO/CCOC/RREC EL. 2435 ft	1280 ft S, 820 ft E of NW cor. sec 1, T11N, R9W (MDBM) Sonoma Co., Calif.	DD 6256-6266 ft TVD 6121-6131 ft	-3686 to -3696 ft	DD 4778 ft TVD 4718 ft EL. -2283 ft	graywacke w/ minor argillite	4"-dia. core, most sawn in half longitudinally poor core recovery highly fragmented and milled heavily sampled
PRATI STATE 24 GEO/CCOC/RREC EL. 2435 ft	∿1250 ft S, 390 ft W of NE cor. sec 1, T11N, R9W (MDBM) Sonoma Co., Calif.	DD 3983-3993 ft TVD ∿3850-3860 ft*	(approx.) -1254 to -1264 ft *	DD 6070 ft * * →	graywacke and argillite	4"-dia. core * no drift survey received with core
CA958-3A Aminoil/Calpine EL. 2900 ft	850 ft N, 1700 ft E of SW cor. sec 34, T.11N, R8W (MDBM) Sonoma Co., Calif.	DD 2440.5-2454 ft TVD 2424.5-2438 ft	+475.5 to +462.0 ft	DD 3770 ft TVD 3711 ft EL -811 ft	schistose graywacke	4"-dia. core some pcs. sawn in half longitudinally
CA958-6 Aminoil/Calpine EL. 2200 ft.	80 ft N, 870 ft W of SE cor. Sec. 35, T11N, R8W (MDBM) Lake Co., Calif.	DD 7842-7842.5 ft TVD 7519-7519.5 ft	-5319.0 to -5319.5 ft	DD 5671 ft TVD 5502 ft EL -3302 ft	biotite-hornblende-orthopyroxene granodiorite, sparsely porphyritic	4"-dia core 1 pc. remaining, ∿ 1" long
CA1862-4 Aminoil/Calpine ELEV. 3373 ft	1150 ft S 700 ft W of NE cor. sec 28, T11N, R8W (MDBM) Sonoma Co., Calif.	DD 4455-4465 ft TVD 4443-4453 ft	-1070 to -1080 ft	DD 4530 ft TVD 4517 ft EL. -1144 ft	schistose graywacke	〃

Geysers Core Samples

STORED AT ESRI AS OF 04/13/95

PRATI STATE 12

JEFFREY N. STERNFELD
GEO OPERATOR CORP.
JULY 20, 1987

PRATI STATE 24 CORE ANALYSIS

Introduction

An oriented 4" core, approximately 11.5 feet in length, was taken from Prati State 24 on March 20, 1987. The coring commenced at a measured depth of 3983 feet corresponding to a true subsurface depth of -1,333 feet sea level datum. This depth is 2,043 feet higher in the section than the first steam entry (-3,376 feet sea level datum). The retrieved core was fragmented and brecciated with the largest continuous section of core being 1.6 feet long. Approximately 10 feet of core was reconstructed from 3983 feet to 3993.08 feet M.D. The lower most 1.5 feet was too fragmented and abraded in the core barrel to piece together.

The core is nearly 100% Franciscan graywacke with very thin (less than 0.2 inch) stringers of argillaceous material between a few of the beds. Mineralized fractures are encountered throughout the core; the fracture density is low and the secondary mineralization accounts for only about 1% of the total volume. The orientations of veins and veinlets range from nearly horizontal to nearly vertical and are dominated by 20^{o} and 50^{o} fracture sets. The core had a strong tendancy to break either along mineralized fractures or parallel to them. Most of the brecciation, however, was mechanically induced during the coring process.

Lithology

Ten distinct graywacke beds ranging in relative thickness (as measured from the primary Hugel orientation groove) from 0.46 feet to 3.5 feet are present. Each individual bed is a well indurated massive unit that grades weakly upwards. The grain size of the material is relatively constant ranging from medium to fine grained. The internal fabric shows a very weak planar orientation of elongate, platy argillite clasts. Basal contacts show abundant evidence for scouring and cut and fill deposition. Sole markings range from steeply dipping flute casts (channels?) to gently rounded troughs.

The detrital composition of the graywacke is homogeneous throughout the core consisting of sand sized particles of quartz, feldspar, chert, argillite, epidote and biotite in a matrix of dark gray clays and microcrystalline silica. Minor pockets of chlorite are also present. The geometry of the particles range from angular to subrounded and the grains are moderately sorted.

According to the Walker submarine-fan model, this material represents massive sandstone turbidites deposited in the channelized portions of supra fan lobes.

Table 1 below summarizes the lithologic descriptions of the individual graywacke beds. Plate 1, a photograph of the core, shows the turbidite divisions.

TABLE 1

Graywacke Units in Prati State 24 Core

Depth Feet M.D.	Thickness (feet)	Color	Description
3983-3984.64	1.64	Dark Gray (N-3)	Massive graywacke grading upwards from lower medium grained (2.0-1.5) to upper fine grained (2.5-2.0)
3984.64-3985.60	0.96	Medium Gray (N-5)	Massive graywacke grading upwards from upper medium grained (1.5-1.0) to lower medium grained with minor coarse grained clasts at base.
3985.60-3989.1	3.5	Dark Gray (N-3)	Massive graywacke grading upwards from lower medium to upper fine grained.
3989.1 to 3989.67	0.57	Dark Gray (N-3)	Massive graywacke grading upwards from upper med. to lower fine grained (3.0 - 2.5). The upper 1.5 inches consist of ripple crossbedded very fine grained sand (4.0-3.0) and silt with wispy, convoluted lamina of argillite.
3989.67 to 3990.3	0.63	Dark Gray (N-3)	Massive graywacke grading upwards from upper med. to very fine grained. Upper 0.5 inch is ripple crossbedded.
3990.3 to 3991	0.7	Dark Gray (N-3)	Massive graywacke weakly grading from upper to lower fine grained.

Depth Feet M.D.	Thickness (feet)	Color	Description
3991.0-3991.46	0.46	Dark Gray (N-3)	Massive graywacke grading upwards from lower medium to upper fine grained. The upper 0.5 inch consists of ripple cross bedded, convoluted lamina of very fine grained to silt sized graywacke and argillite. A thin layer of argillite (0.2 inch) overlays the rippled crossbedded material.
3991.46-3991.95	0.49	Dark gray (N-3)	Massive graywacke grading upwards from upper fine to lower fine-grained. The upper 1.0 inch consists of ripple crossbedded, convoluted lamina of very fine grained to silt sized graywacke and argillite. A thin layer of argillite (0.1 inch) overlays the rippled crossbedded material.
3991.95-3992.41	0.46	Dark gray (N-3)	Massive graywacke grading upwards from upper fine to lower fine grained. The upper 1.0 inch consists of ripple crossbedded, convoluted lamina of very fine grained to silt sized graywacke and argillite. A thin layer of argillite (0.1 inch) overlays the rippled crossbedded material.
3992.41-3993.08	0.67	Dark gray (N-3)	Massive graywacke grading upwards from lower medium to upper fine grained.

Hydrothermal Mineralization

Two styles of hydrothermal alteration are present in the core. These are disseminated pyrite and mineralized fractures. The pyrite consists of isolated grains, less than 1mm and generally euhedral idioblasts, that occur sporadically throughout the core. The pyrite replaces matrix material and averages about 5-10 grains per square inch. It also occurs as concentrations of cubes or as massive aggregated veinlets in graywacke adjacent to mineralized fractures-particularly those composed primarily of quartz.

There are two distinct vein assemblages: white opaque quartz with very rare inclusions of pyrite and yellowish gray (5Y7/2) to grayish orange pink (5 YR 7/2) calcite with rare inclusions of euhedral pyrrhotite (<1mm). The quartz and calcite assemblages generally occupy the same fractures. The quartz is deposited against the fracture walls growing inward into the centers of the fractures. Calcite infills the void spaces between quartz crystals and also occurs as veinlets within massive very fine grained quartz material. Monomineralic veinlets and veins of quartz and calcite are also present. Monomineralic calcite veinlets are observed that dissect and offset quartz veins. Therefore, the calcite ± pyrrhotite must have formed subsequent to the deposition of the quartz ± pyrite.

The veins and veinlets are simple fissure veins that commonly pinch and swell and occasionally open into drusy chambers up to 5mm in diameter. Localized gash veining, although rare, is also present. The average vein is less than 0.5mm across. The fracture-fill material is generally dense, massive and very fine grained but in open fractures terminated quartz crystals and bladed to rhomboidal calcite crystals are observed. The fracture density in each individual graywacke bed varies. Some beds are fracture-poor and others are pervasively fractured. In the majority of cases, the fractures are widely spaced and isolated throughout the bed with fracture swarms observed at either the upper or basal contact.

There is a marked tendency for veins and vein swarms to be restricted to a single turbidite bed. Few mineralized fractures could be traced across a depositional boundary. This phenomena was also observed in Prati 5 in which the fine grained graywacke beds were intensely fractured and mineralized while intercalated argillite beds were poorly mineralized. The Prati State 24 core is almost entirely composed of medium grained graywacke yet throughgoing fractures are rare and individual turbidite beds of similar compostion display preferential degrees of fracture permeability.

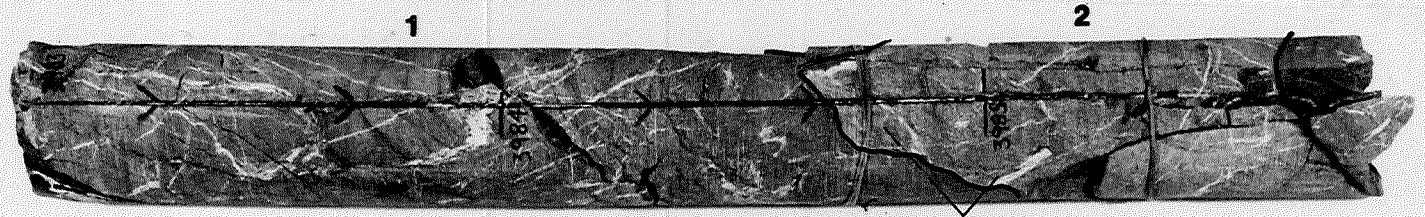
Bedding Plane Orientation

Because the graywacke beds display irregular, non-planar scour and fill basal contacts, only one strike and dip measurement was made. This was taken at a shale interface between two thin fine-grained graywacke beds at an approximate depth of 3991 feet. The strike and dip were N40W and 16° to the northeast, respectively, which agree with the regional trend and measurements taken on the Prati 5 core. Prati 5 strikes varied between N19°W to N35°W and the dips ranged from 16° to 21° to the northeast.

Fracture Orientation

Ten individual mineralized fractures were measured to determine the range of fracture orientations. The veins selected for measurement could be traced around the circumference of the core and were representative of the total vein population. The data are presented below in Table 2.

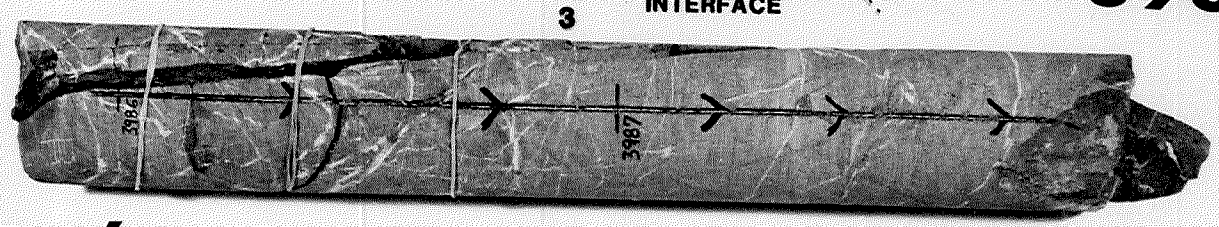
PRATI STATE 24



3983′

CHANNEL CUT WITH CALCITE VEINING TERMINATING AT SANDSTONE - SANDSTONE INTERFACE

3985.8′



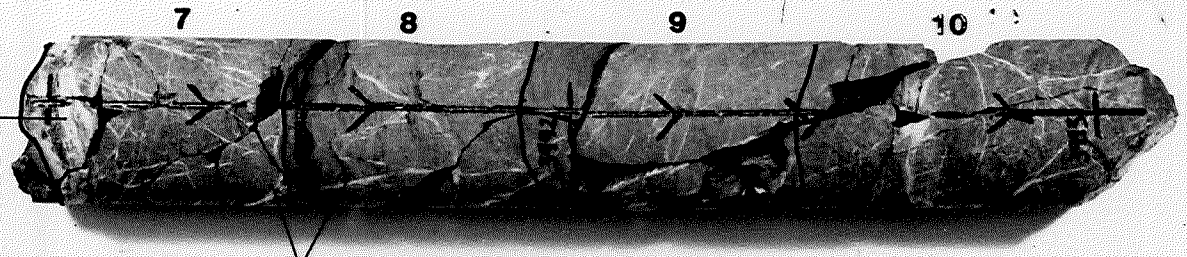
3985.8′

3988′

3988′

3990.9′

SUBHORIZONTAL QUARTZ AND CALCITE VEIN SWARM TERMINATES AT SANDSTONE - ARGILLITE INTERFACE



3990.9′

CALCITE AND QUARTZ VEINS TERMINATES AT SANDSTONE - ARGILLITE INTERFACE

3993.1′

TUBIDITE DEPOSITIONAL CONTACTS ARE DEMARCATED

PLATE 1

*** G E O ps24st1 DIRECTIONAL WELL SURVEY ***

Vertical section calculated in plane of proposal
Direction : S 16 E

** 1** Date: 04/08/87

MEASURED DEPTH feet	DRIFT ANGLE deg.	min	DRIFT DIRECTION deg	COURSE LENGTH feet	TRUE VERT. DEPTH feet	RECTANGULAR COORDINATES feet		SEC-TION feet	DOGLEG SEVERI deg/100f
0	0	0	0	0	0.00	0.00	0.00	0.00	0.00
193	1	0	s 56w	193	192.99	0.94S	1.40W	0.52	0.52
348	1	0	s 55w	155	347.97	2.47S	3.63W	1.38	0.00
499	1	30	s 89w	151	498.93	3.49S	6.76W	1.49	0.56
652	1	0	s 59w	153	651.90	4.41S	9.97W	1.49	0.53
808	1	45	s 27w	156	807.85	7.15S	12.52W	3.42	0.67
960	2	0	s 15w	152	959.77	11.79S	14.30W	7.39	0.31
1113	2	30	s 20w	153	1112.65	17.52S	16.11W	12.40	0.35
1267	3	45	s 16w	154	1266.42	25.51S	18.70W	19.36	0.82
1424	4	45	s 17w	157	1422.99	36.66S	22.01W	29.18	0.64
1548	4	45	s 20w	124	1546.57	46.40S	25.27W	37.64	0.20
1702	5	30	s 23w	154	1698.95	59.20S	30.31W	48.55	0.52
793	6	15	s 27w	91	1790.47	67.64S	34.24W	55.58	0.94
852	6	0	s 20w	59	1849.14	73.41S	36.75W	60.44	1.33
1883	5	0	s 15w	31	1879.99	76.25S	37.65W	62.92	3.57
1915	4	0	s 7w	32	1911.89	78.71S	38.13W	65.15	3.66
1945	3	0	s 0w	30	1941.84	80.54S	38.24W	66.88	3.62
2012	1	30	s 30e	67	2008.79	83.08S	37.56W	69.51	2.77
2105	1	0	s 38e	93	2101.76	84.76S	36.42W	71.44	0.57
2143	1	45	s 35e	38	2139.75	85.50S	35.88W	72.29	1.96
2174	2	45	s 52e	31	2170.73	86.38S	35.04W	73.37	3.85
2208	3	45	s 55e	34	2204.67	87.52S	33.49W	74.90	2.96
2238	4	45	s 54e	30	2234.59	88.82S	31.68W	76.64	3.34
2268	5	15	s 57e	30	2264.48	90.30S	29.53W	78.66	1.80
2298	5	30	s 52e	30	2294.35	91.93S	27.24W	80.86	1.77
2384	5	45	s 44e	86	2379.93	97.57S	20.98W	88.01	0.96
2476	5	45	s 39e	92	2471.47	104.47S	14.87W	96.33	0.54
2601	5	45	s 34e	125	2595.84	114.54S	7.42W	108.06	0.40
2724	5	15	s 28e	123	2718.27	124.64S	1.35W	119.44	0.68
2783	6	15	s 22e	59	2776.98	130.00S	1.15E	125.28	1.90
2815	7	30	s 20e	32	2808.75	133.58S	2.52E	129.10	3.98
2844	8	45	s 19e	29	2837.46	137.44S	3.89E	133.19	4.34
2874	9	45	s 20e	30	2867.07	141.99S	5.50E	138.00	3.38
2908	9	45	s 26e	34	2900.58	147.29S	7.75E	143.72	2.99
2961	11	0	s 29e	53	2952.71	155.75S	12.16E	153.07	2.57
3071	11	15	s 30e	110	3060.64	174.23S	22.61E	173.71	0.29
3196	11	0	s 23e	125	3183.29	195.81S	33.37E	197.42	1.10
3318	10	30	s 19e	122	3303.15	217.06S	41.53E	220.09	0.74
3374	10	45	s 19e	56	3358.19	226.82S	44.89E	230.41	2.45
3405	11	15	s 23e	31	3388.62	232.34S	47.01E	236.30	2.94

Date: 04/08/87

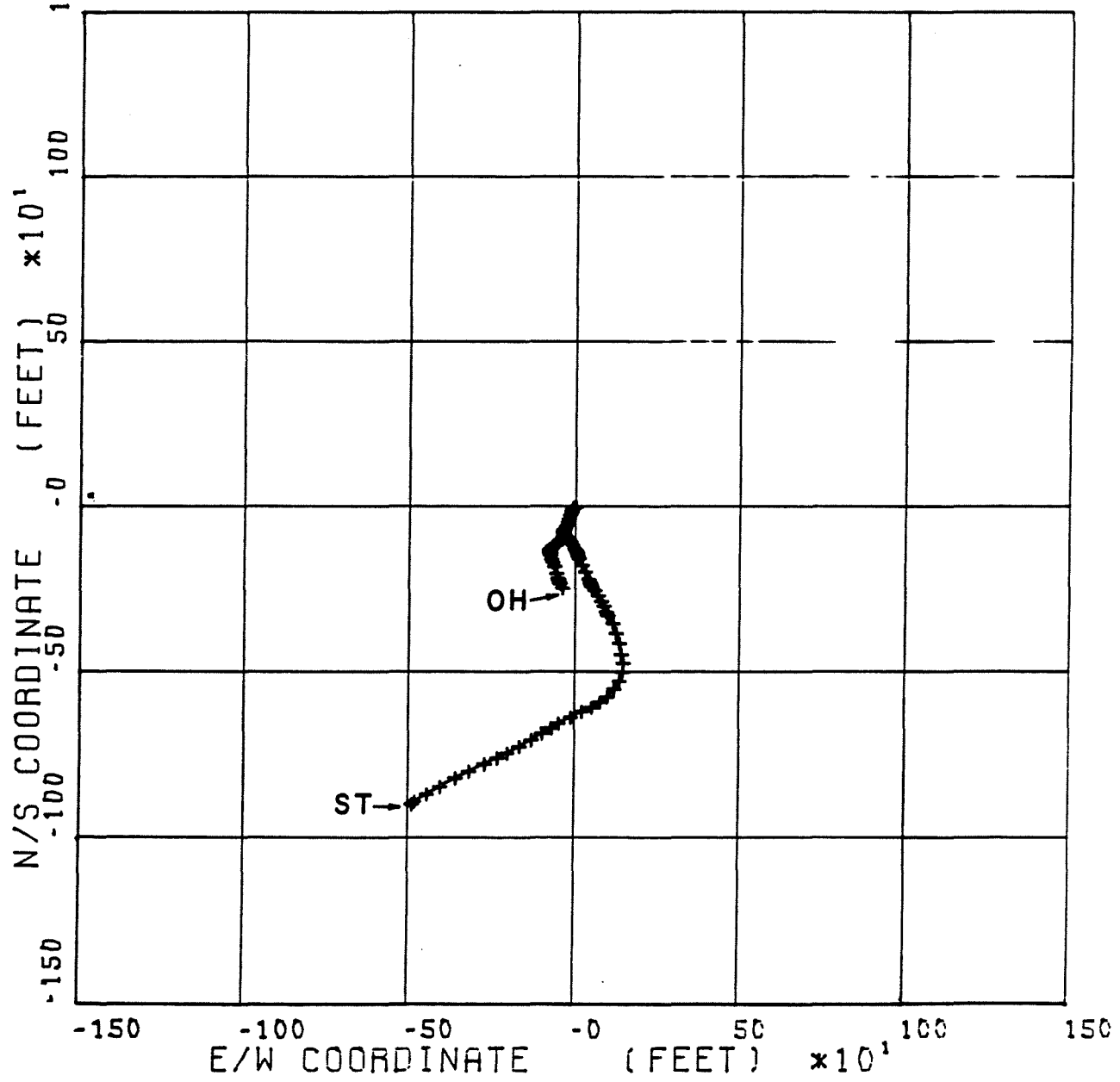
MEASURED DEPTH feet	DRIFT ANGLE deg.	min	DRIFT DIRECTION deg	COURSE LENGTH feet	TRUE VERT. DEPTH feet	RECTANGULAR COORDINATES feet		SEC-TION feet	DOGLEG SEVERIT dg/100f
3436	11	15	s 28e	31	3419.03	237.80S	49.61E	242.26	3.15
3468	12	0	s 32e	32	3450.37	243.38S	52.84E	248.52	3.44
3523	12	30	s 33e	55	3504.12	253.23S	59.11E	259.71	0.99
3607	12	30	s 33e	84	3586.13	268.47S	69.01E	277.09	0.00
3700	11	45	s 30e	93	3677.05	285.13S	79.21E	295.92	1.05
3793	11	0	s 29e	93	3768.22	301.09S	88.25E	313.75	0.83
3886	11	0	s 24e	93	3859.52	316.97S	96.16E	331.20	1.03
3945	10	30	s 26e	59	3917.48	326.95S	100.82E	342.07	1.06
4099	11	15	s 27e	154	4068.71	352.95S	113.78E	370.64	0.50
4256	11	45	s 18e	157	4222.56	381.87S	125.76E	401.74	1.19
4416	12	0	s 16e	160	4379.14	413.35S	135.38E	434.66	0.30
4573	11	30	s 13e	157	4532.85	444.31S	143.39E	466.62	0.50
4725	10	30	s 4e	152	4682.06	472.99S	147.68E	495.37	1.31
4878	10	30	s 12w	153	4832.49	500.81S	145.73E	524.57	1.90
5032	11	0	s 28w	154	4983.79	527.80S	135.91E	544.81	1.96
5185	11	15	s 37w	153	5133.92	552.70S	120.04E	564.37	1.15
5342	10	30	s 49w	157	5288.10	574.36S	99.84E	579.63	1.52
5501	10	0	s 56w	159	5444.56	591.58S	77.40E	590.00	0.84
5655	11	30	s 62w	154	5595.86	606.38S	52.78E	597.43	1.21
5812	12	45	s 67w	157	5749.35	620.58S	23.01E	602.88	1.04
5992	12	15	s 65w	180	5925.09	636.42S	12.58W	608.30	0.37
6189	11	45	s 61w	197	6117.78	655.02S	49.07W	616.11	0.49
6329	11	15	s 60w	140	6254.97	668.76S	73.37W	622.63	0.38
6488	11	30	s 59w	159	6410.85	684.68S	100.39W	630.48	0.30
6677	11	30	s 59w	189	6596.06	704.08S	132.69W	640.24	0.20
6866	12	30	s 60w	189	6780.93	724.03S	166.54W	650.07	0.54
7052	15	0	s 63w	186	6961.59	745.12S	205.40W	659.64	1.40
7173	15	45	s 65w	121	7078.26	759.19S	234.23W	665.21	0.75
7333	15	45	s 63w	160	7232.26	778.22S	273.27W	672.76	0.34
7517	14	45	s 63w	184	7409.78	800.20S	316.39W	681.99	0.54
7701	14	0	s 64w	184	7588.02	820.58S	357.27W	690.31	0.43
7929	14	0	s 61w	228	7809.24	846.05S	406.20W	701.31	0.30
8108	14	30	s 61w	179	7982.74	867.41S	444.73W	711.22	0.22
8292	13	15	s 54w	184	8161.37	891.12S	481.95W	723.75	1.14
8340	13	15	s 54w	48	8208.09	897.58S	490.35W	727.52	2.22

Closure distance : 1023.03 feet.
angle : S 28 deg 40 min W

**** E N D O F R E P O R T ****

GEO PRATI ST. 24 WELL COURSE

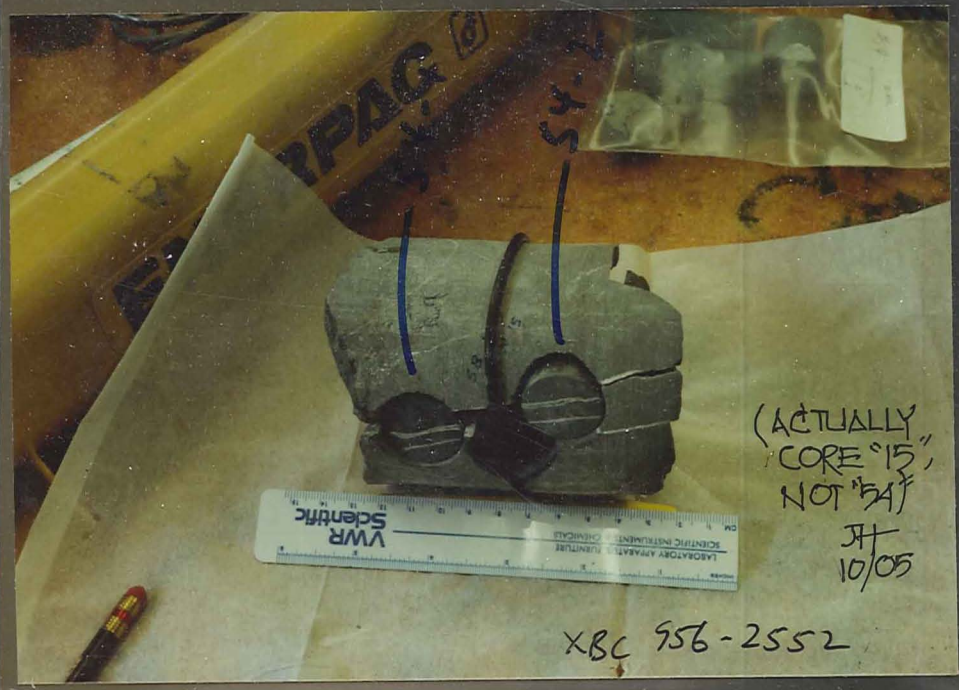
LAST MEASURED DEPTH 8340 FEET

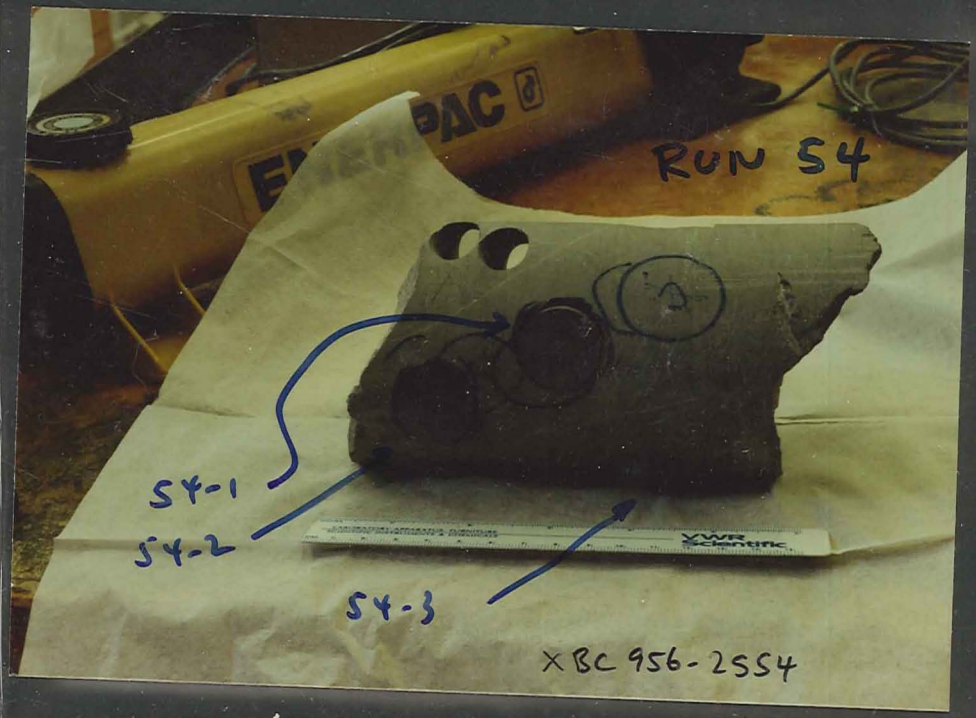


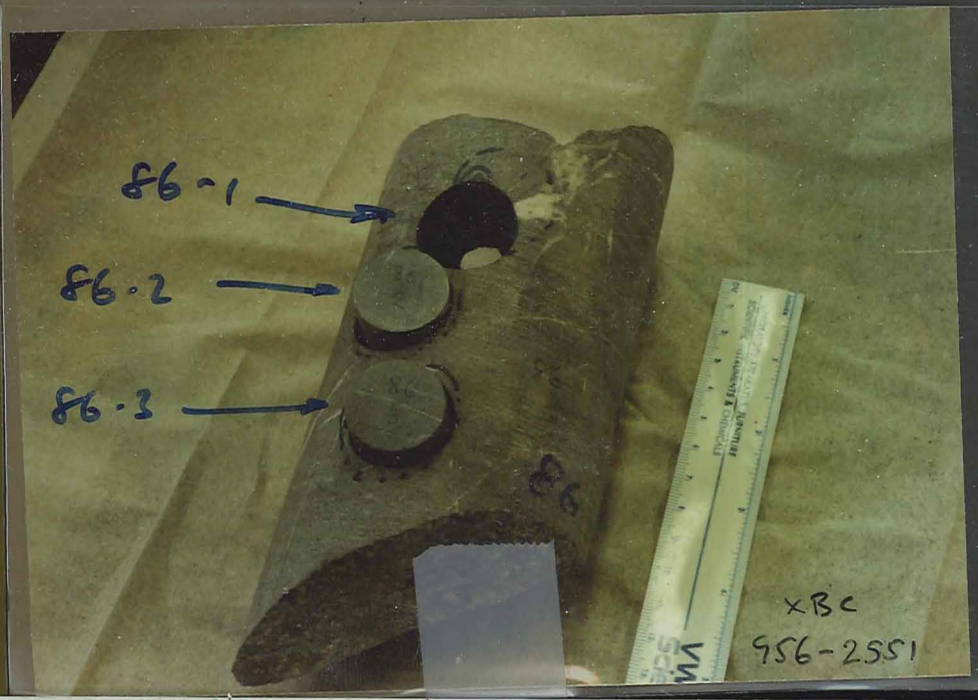
SAMPLES TAKEN BY DEB BERGFELD, MAY 1996 UNM

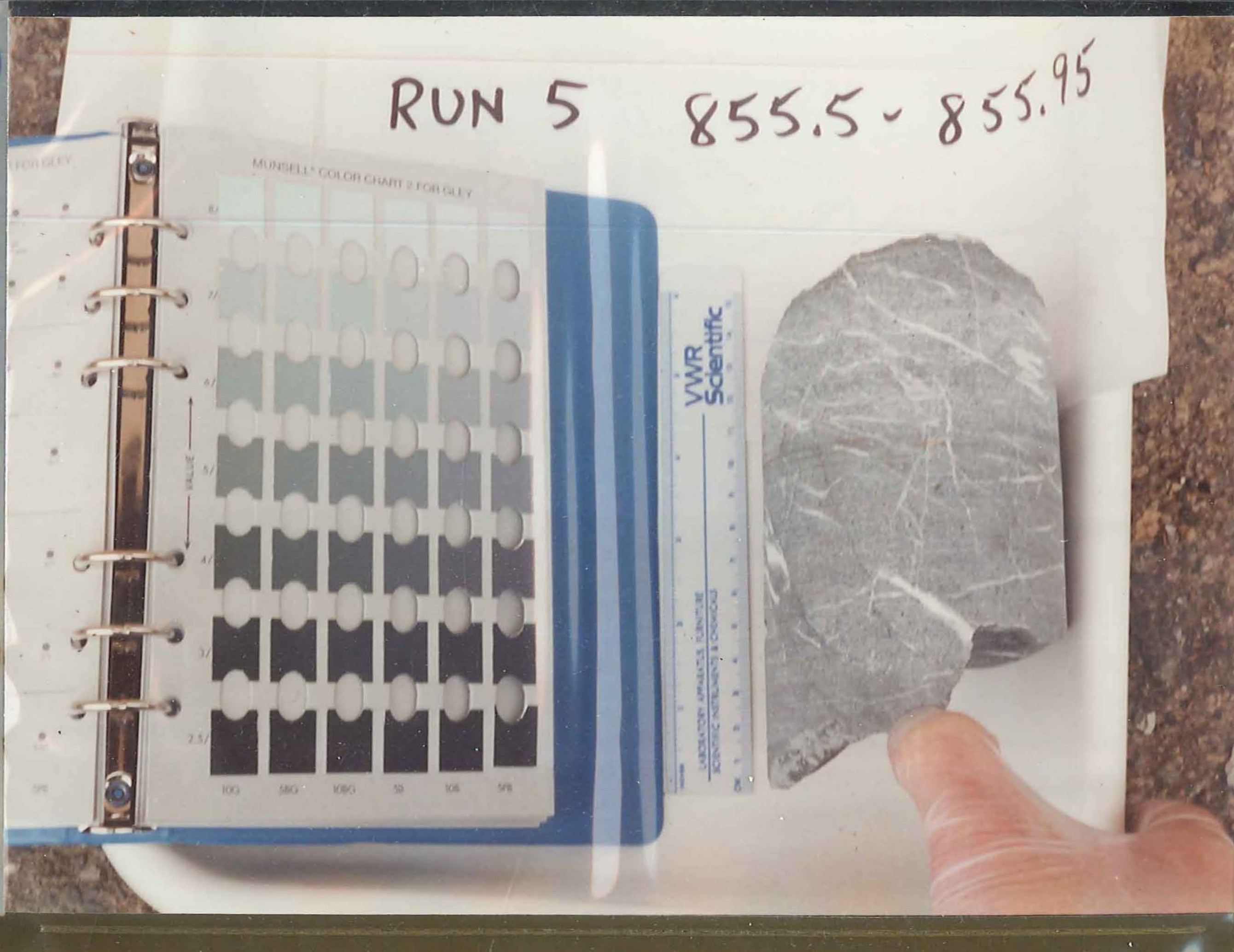
SAMPLE LIST SB-15-D CORE (GEYSERS)

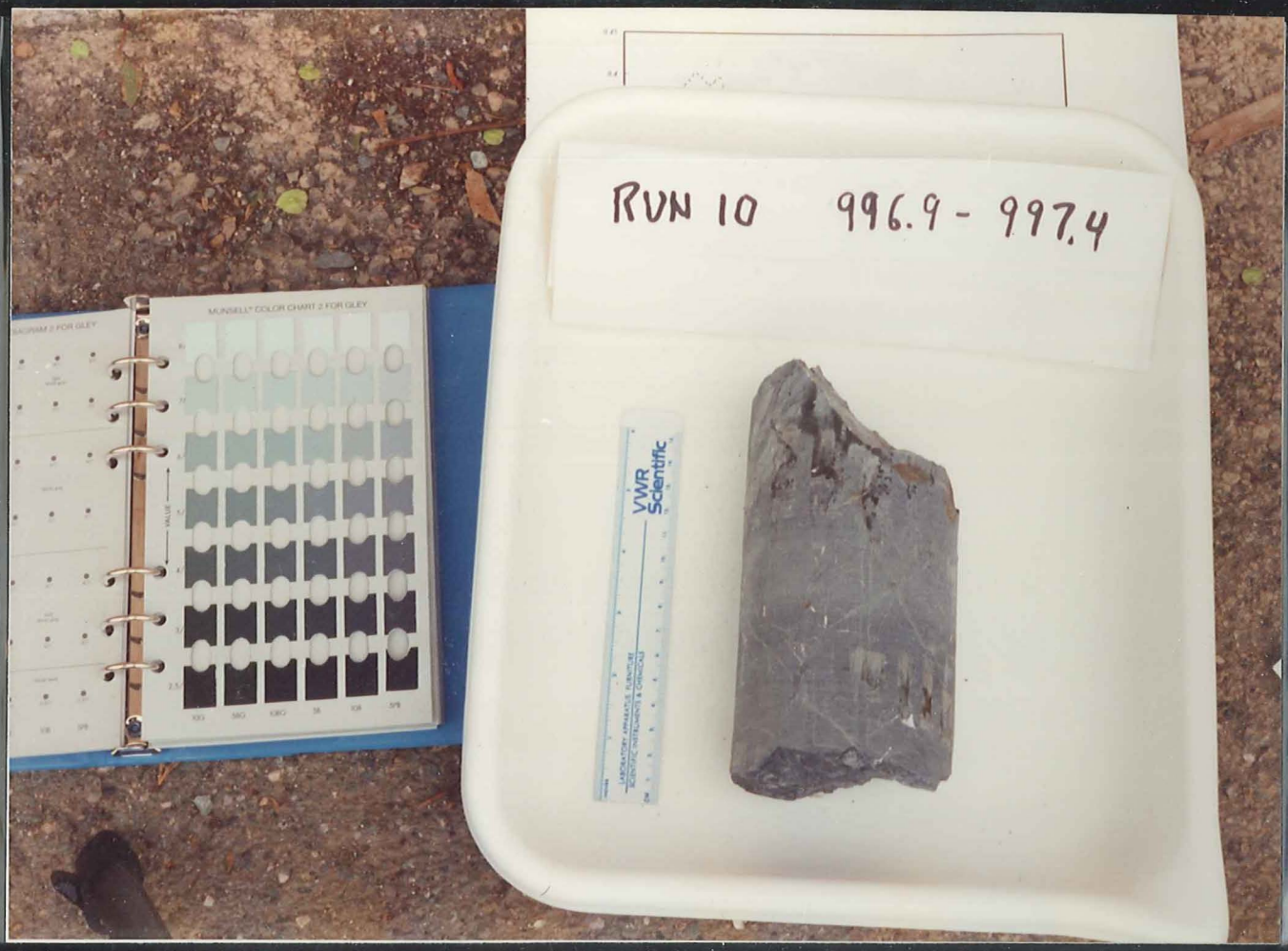
869.5	1229.8	1420.9
933.5	1254.3	1421.8
964	1258	1429.8
1024.7	1370.4	1466.3
1159.8	1375.2	1562



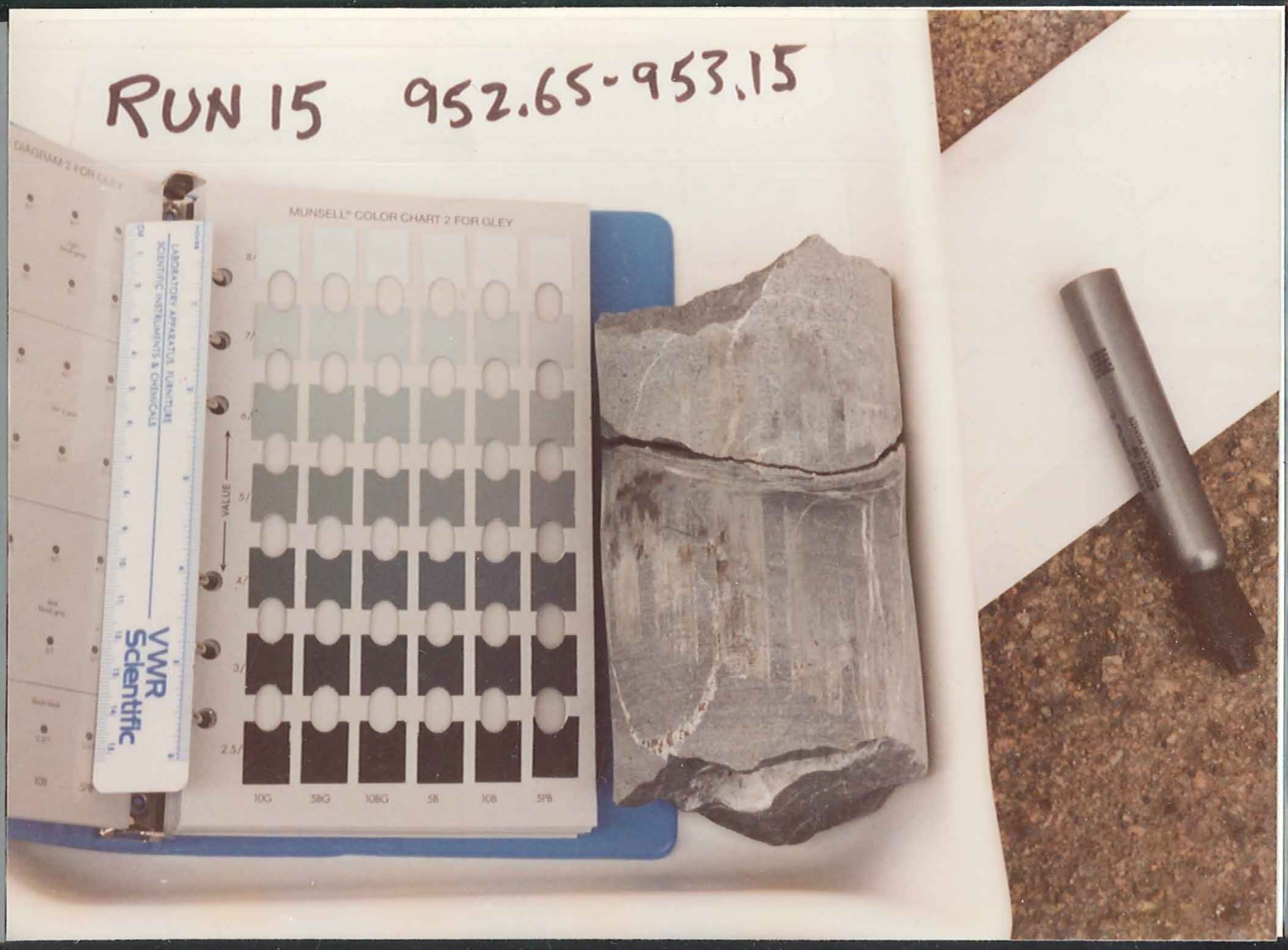




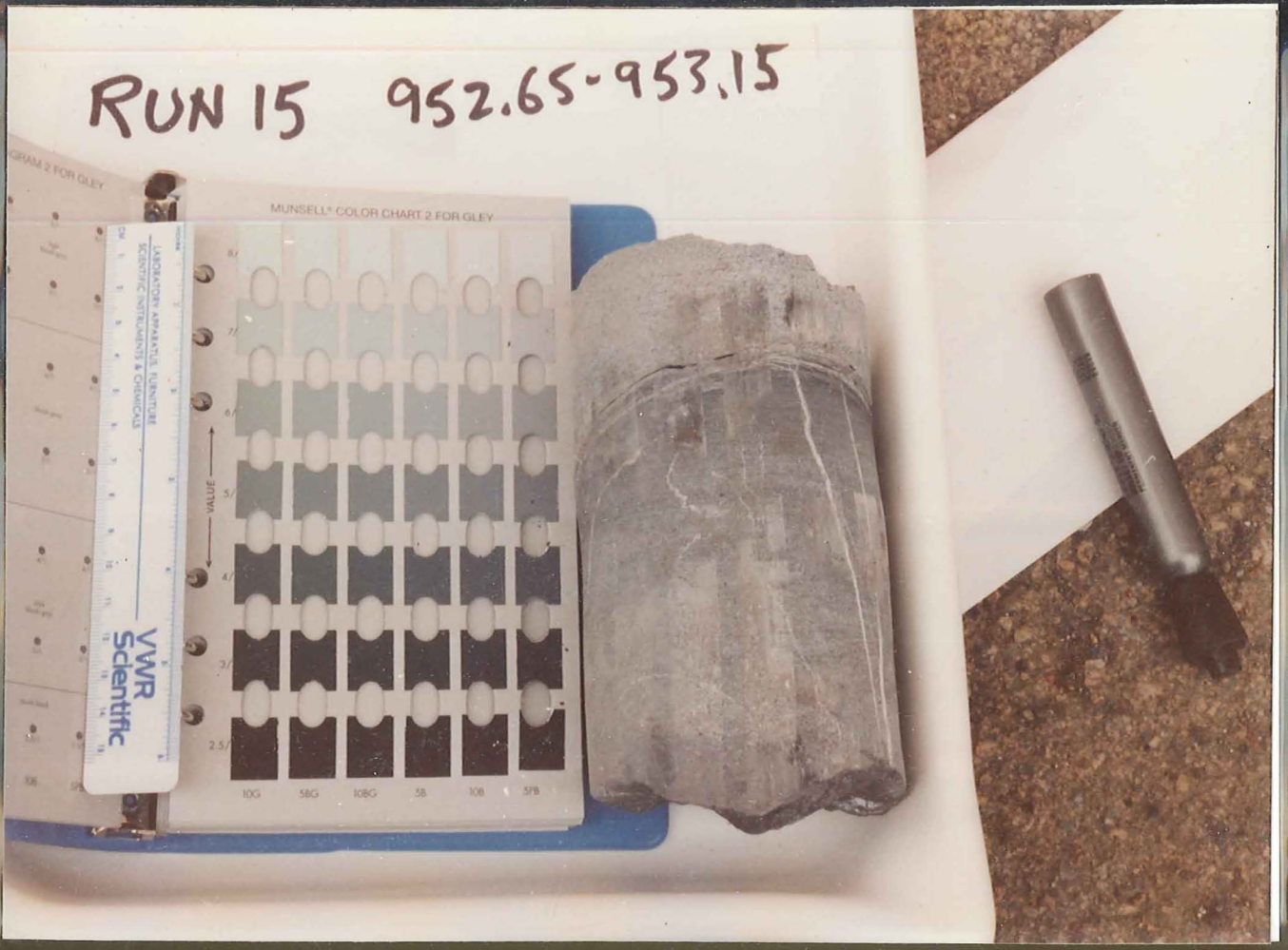



RUN 10 996.9 - 997.4
MUNSELL® COLOR CHART 2 FOR GLEY
VALUE
VWR Scientific

RUN 15 952.65-953.15

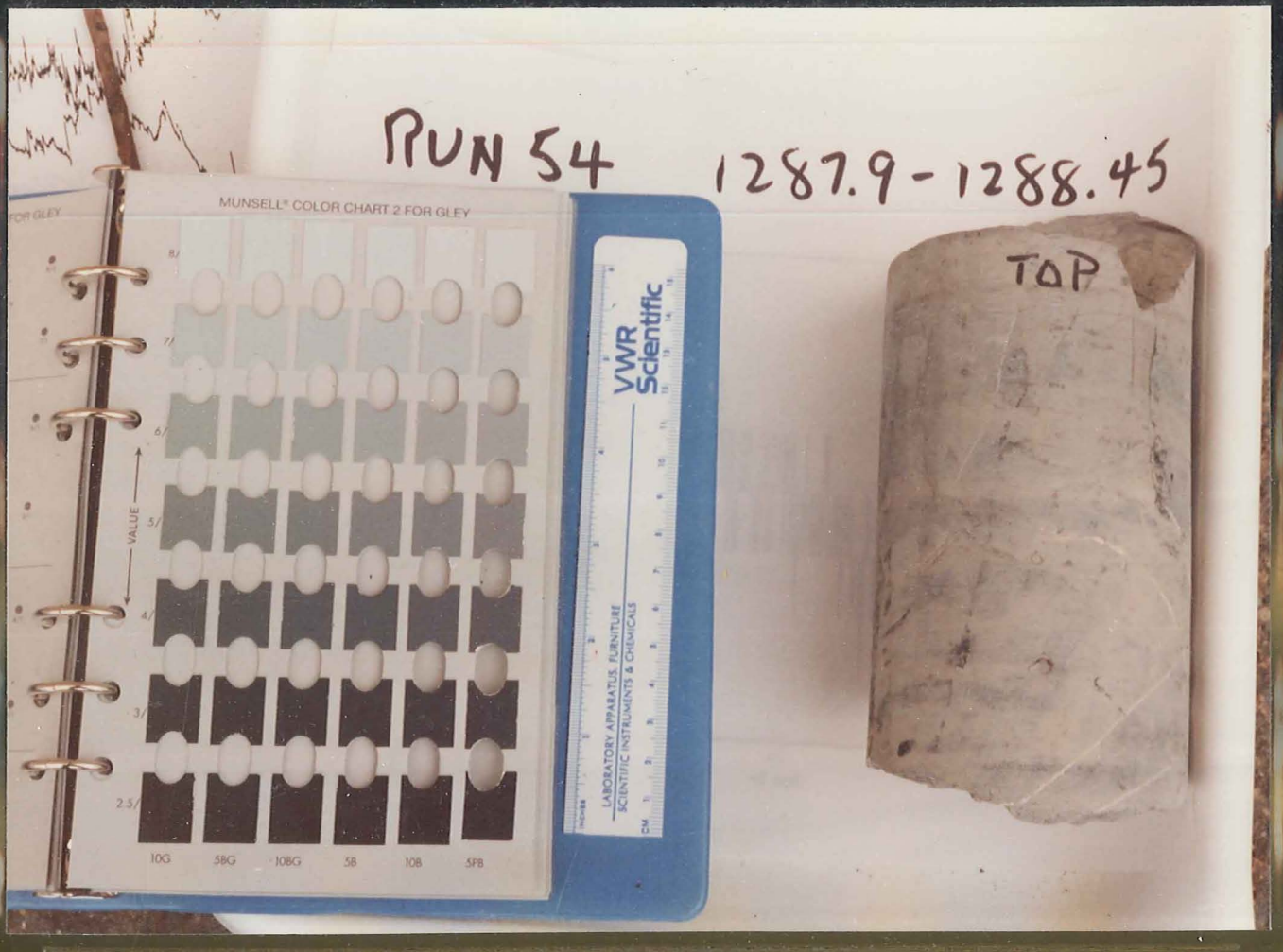


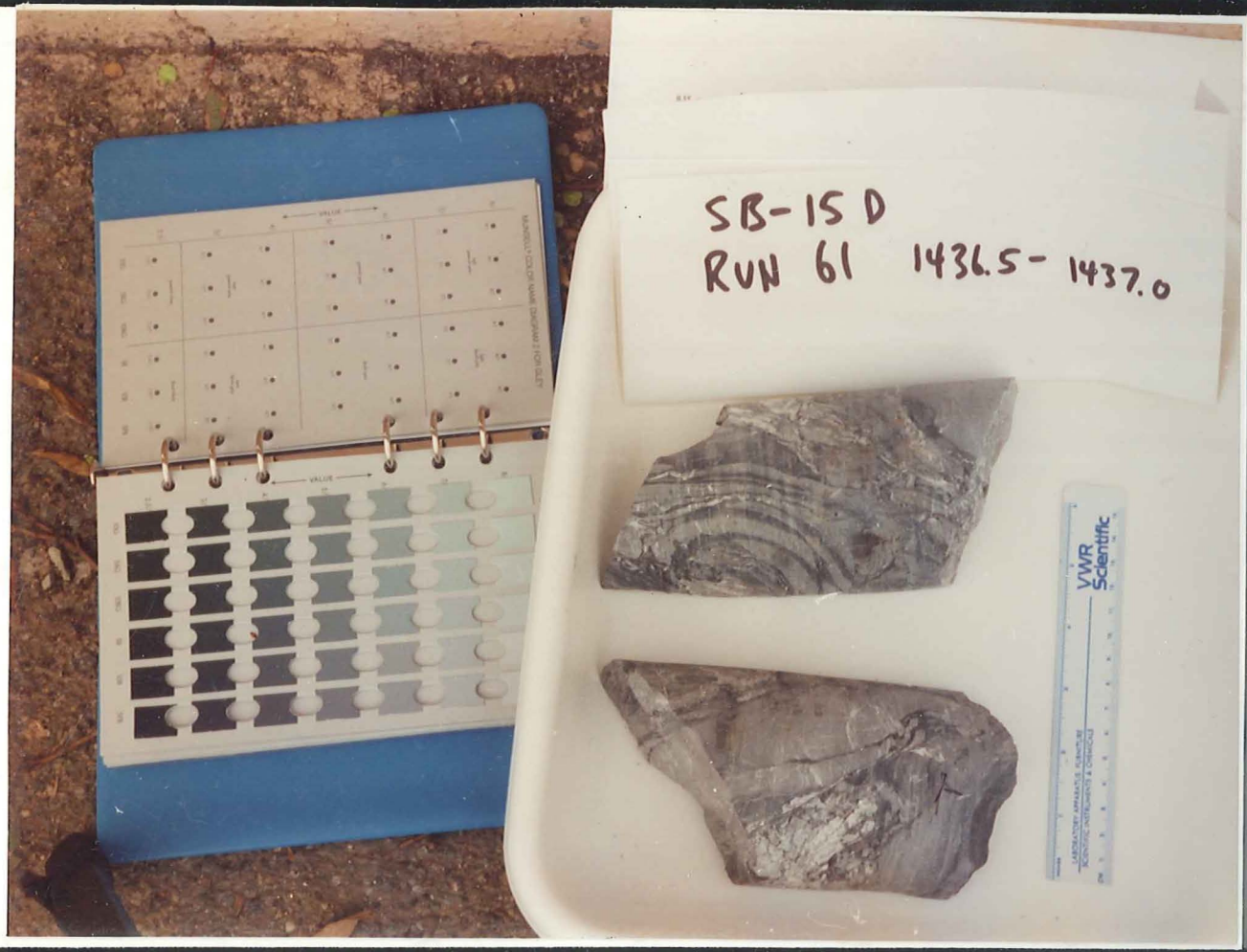
RUN 15 952.65-953.15

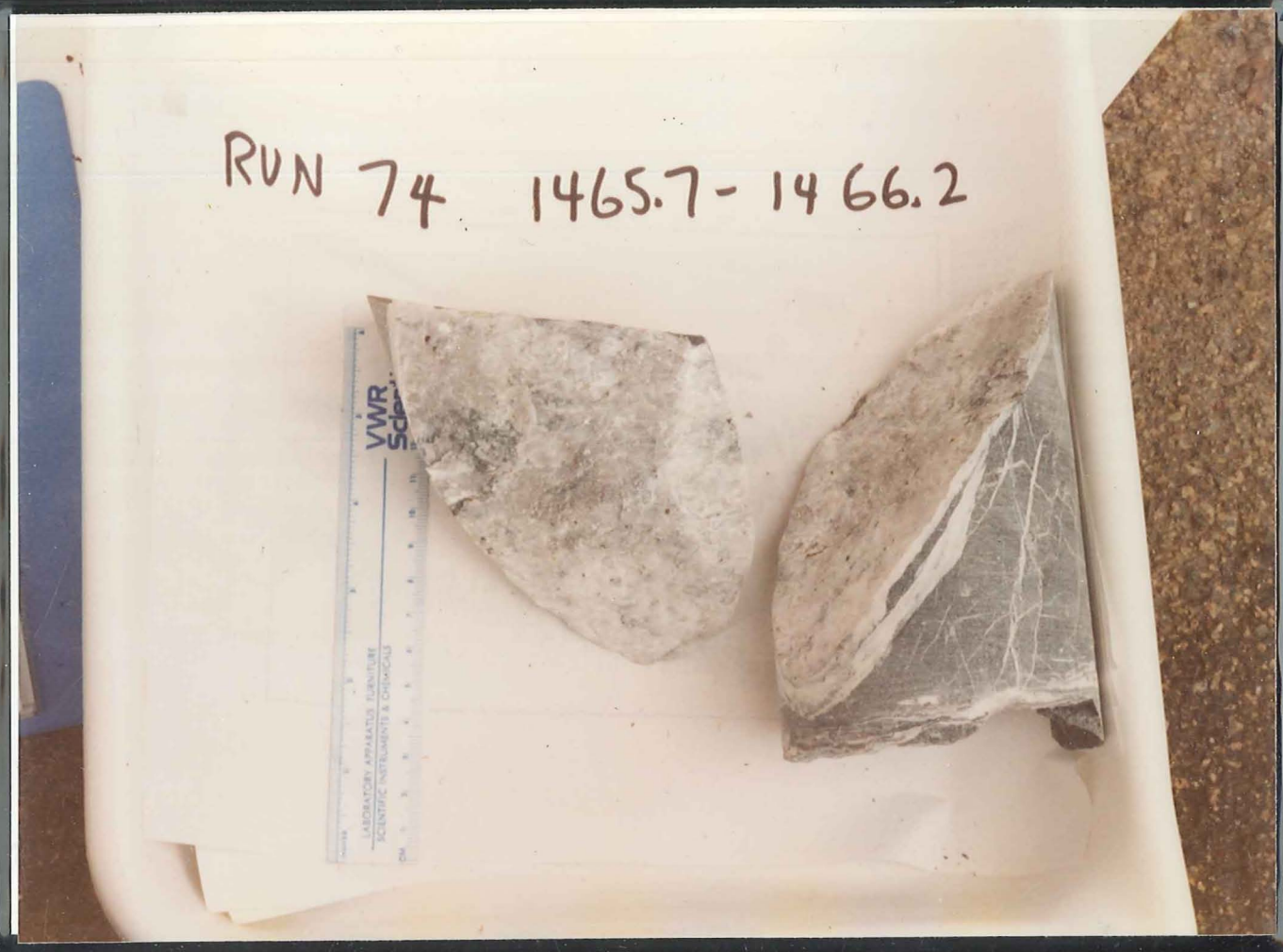


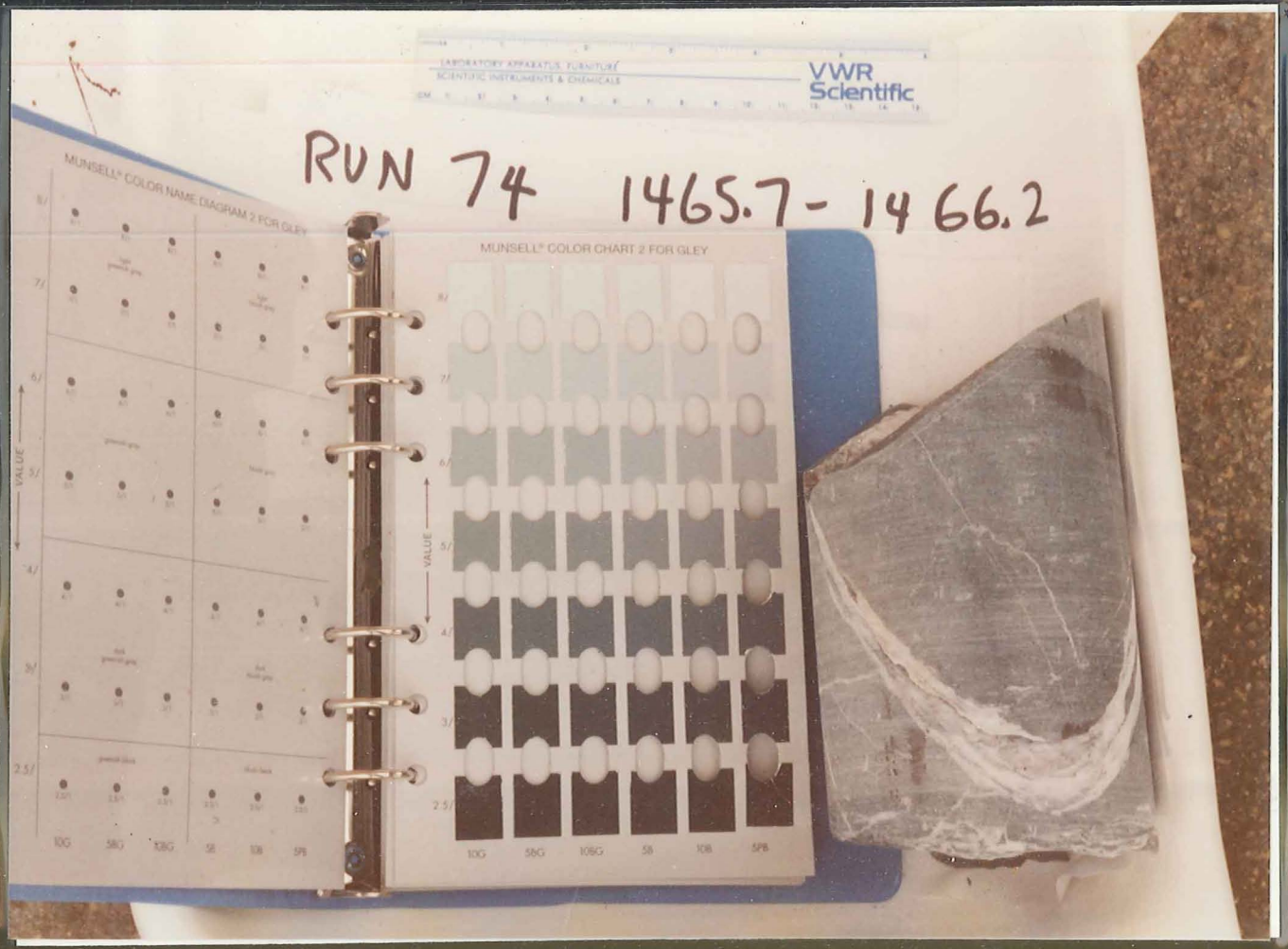
RUN 26 1046.05- 1046.40

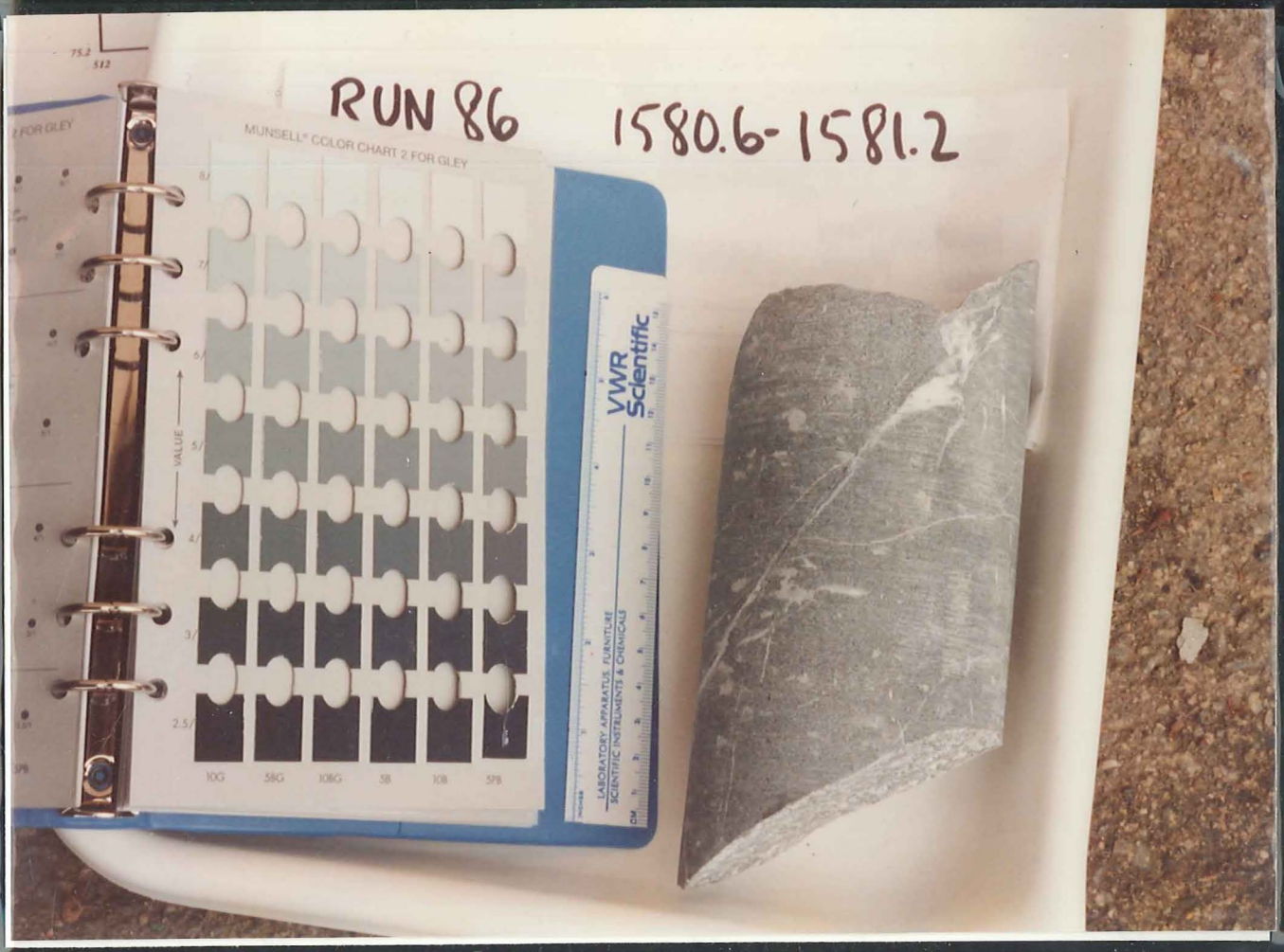
RUN 26 1046.05- 1046.40

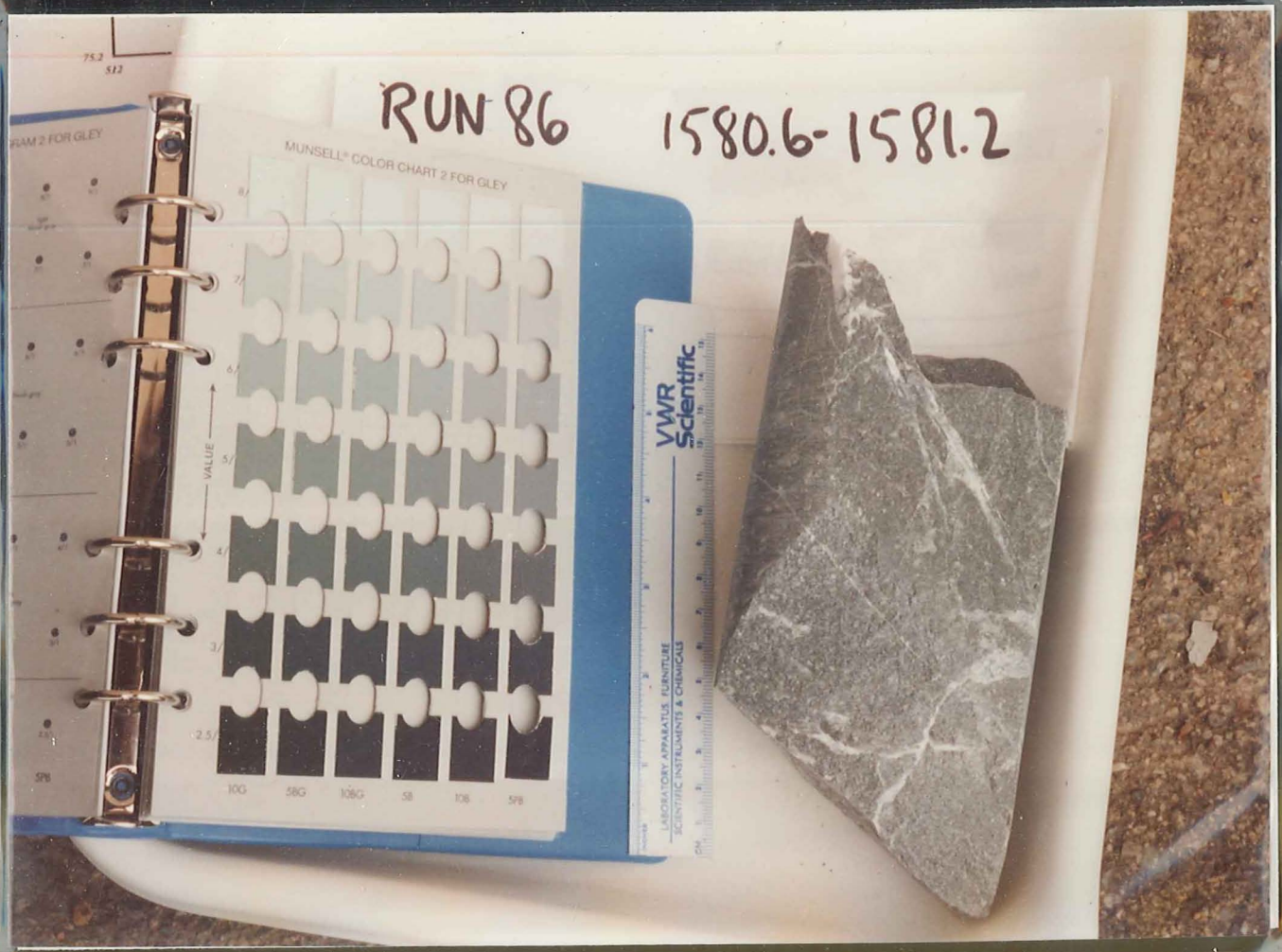



SB-15 D
RUN 61 1436.5 - 1437.0
VWR Scientific






RUN 86
1580.6-1581.2
MUNSELL® COLOR CHART 2 FOR GLEY
VALUE
10G
5BG
10BG
5B
10B
5PB
VWR Scientific
LABORATORY APPARATUS, FURNITURE
SCIENTIFIC INSTRUMENTS & CHEMICALS


RUN 86
1580.6-1581.2
MUNSELL® COLOR CHART 2 FOR GLEY
VALUE
10G
5BG
10BG
5B
10B
5PB
VWR Scientific
LABORATORY APPARATUS, FURNITURE
SCIENTIFIC INSTRUMENTS & CHEMICALS

45 X 25 mm

15th 17th

plug

15-1: Fine- to med-gr. lithic metagraywacke, med-dk. gray, msv to indistinctly bdd, cut by 2 sub-// qtz-cal hydroth. veinlets 1–1.5% diss. pyrite; anh., 0.1–0.7 (avg. 0.3) mm. in diameter.

py locally & erratically concentrated adjacent to hydroth. vnlts.

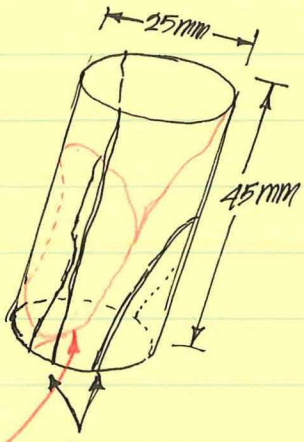
vnlts. account for ~4% of TRV, (one has) opened along strike ⇒ qtz. selvages → bladed calcite interiors. 2% diss py in the vnlts.

vnlts dip avg. 80° relative to the large core axis, & are sub-// to the plug axis — separated by 7–10 mm on one side of the plug; by 0 to 5 mm on the other side.

width of veinlets 0.7–2 (avg ~1.3 mm)

...d. vnlts.

plug 15-2



same fx as plug 1, exc. indistinct bdding dips 25-30° relative to plane normal to brg core axis ⇒ (plane // to plug ax's slightly coarser grain size 3-4% oversize (up to crs. sand argillite chips.

like this

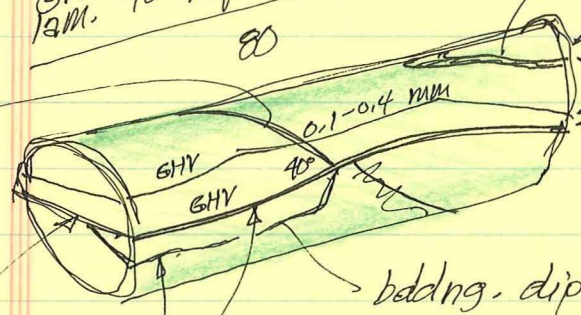
2 crosscutting hydrothermal veins (qtz-cal-py) same as plug 1

irregular, v. hackly, latest stage, unmineralized frx up to 0.3 mm. wide — seems to break around some grains.

Grades fr. arg. sltst. finely lam. to mgr. metagrw

axis ⊥ to big-core axis.

Plug 15-3



Geysers Hydrothermal Veinlets

poss. a (F) qtz unit which has refix — infilled w/ GHV

2 concealed by tape pfs, sparsely ill/sm ec. — coated fix

bdding. dip ∩ 20°

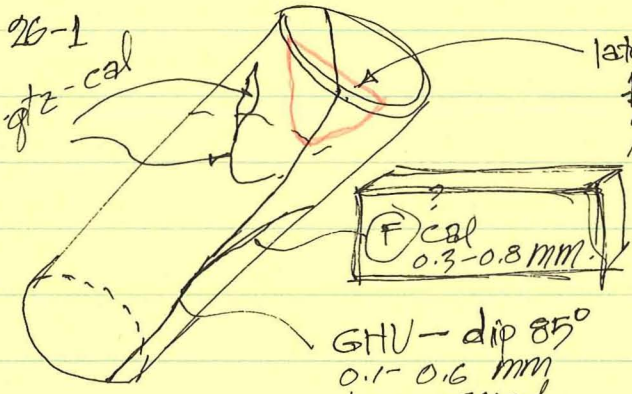
opened along strike

1-2 mm. wide qtz-cal-py — def. w/ minor late il-sm where it's opened

fix. sparsely coated w/ il/sm — poss. drilling-fluid residue

all CORES // to big core

plug 26-1



latest — py-cal-qtz(?) 0.1-0.4 mm. irreg ∩ 60° dip

GHV — dip 85° 0.1-0.6 mm has opened along strike

veins 1.5-2% of TR

CAL-py-il/sm (qtz?)

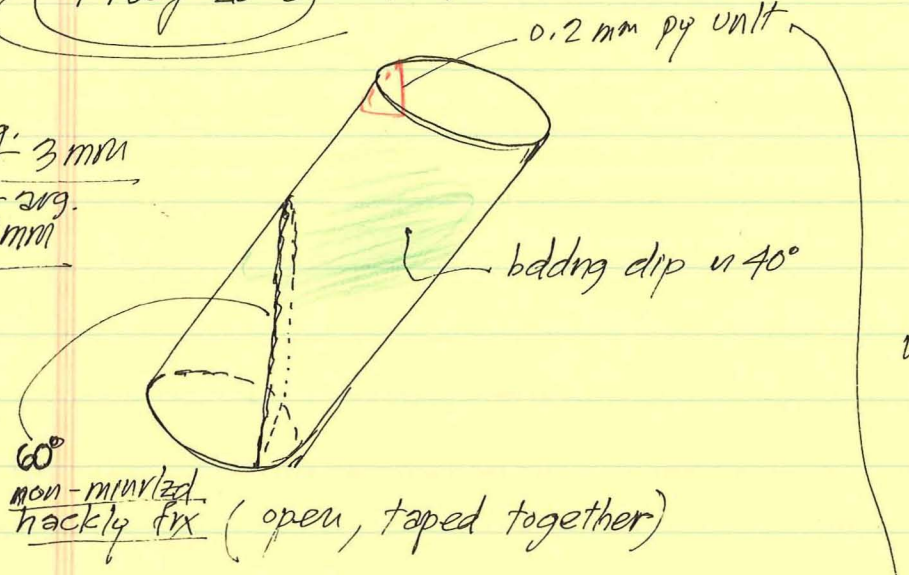
0.3-0.4 mm. avg. f-mgr lithic mdst w/ 3-5% elongate oversize shale/argillite chips up to 3 mm. L avg. dip ∩ 60°

max non-avg. grain 1.5 mm
max elongate avg. grain 3 mm

also < 0.3% diffuse, discontinuous, contorted qtz-cal-py-po veinlet. < 0.1 mm. wide seems to pre-date mm. the GHV

all 26 — axes // to big-core axis

Plug 26-5 55 X 22.5 mm.



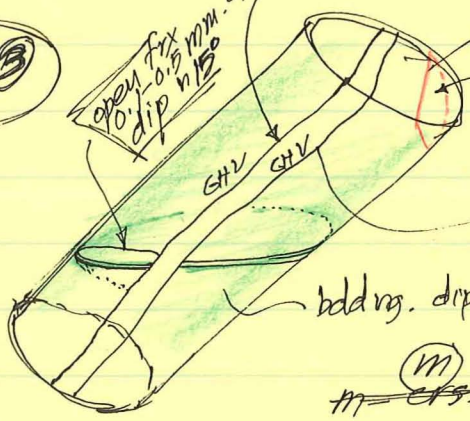
max. elong. arg. grain — 3 mm
max. non-arg. grn. — 2 mm
avg. 0.3

non-mlnrlzd hackly frx (open, taped together)

2-3% diss py
0.1 — 0.4 mm
(avg u 0.2 mm)

vf-mg. lithic MGW

Plug 26-3



qtz-cal-py 0.1-0.3 — opened along strike (frxd.)

~~m — crs.~~ (m) gr. lithic MGW
max non-arg. grain 1 mm — (avg. 0.4 mm).
max elong. arg. grain 3 mm

volts < 0.5% TRV

54-1

msv — med. gr., lithic MGW — few shale chips
uns. in 1% of TRV — dom GHV's
cal — IL — Ir. py
2% diss. py 0.1 mm.
pors. minor qtz.
25 X 25 mm.

GHV: mineral

	RX	VU%	GHV%	FMV%	diss py	fix foll. GHV	unmineralized fix
C-Q-PY-	15-2	f-MG LITH MGW	1-1.5%	—	1-1.5	✓	✓
	26-2		0.2%	0.			
C-AQtz-PY-	54-1	MG LITH MGW	1%	0.9%	0.1%	2%	
C-PY-Qtz	86-2	F-MG LITH MGW	3.5%	0.5%	3%	none	✓ ✓

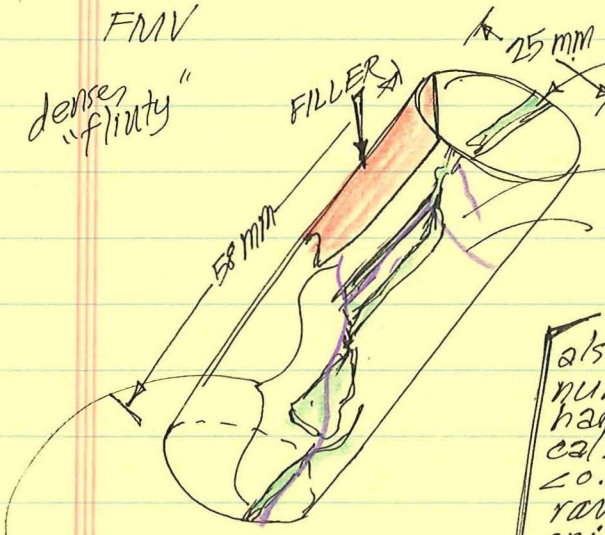
$10^{-21} - 10^{-20}$ m²
10^{-8} — 1-10 md

15 — 952.6' — 953' — 290.3 m — 290.5m
26 — 1046.4 — 1046.8 — 318.9 — 319 m
54 — 1287.9 — 1288.4 — 392.5 — 392.7 m
86 — ~~1579.6 — 1580~~ 1580.6 — 1581.1 — 481.7 — 481.9 m

86-1

all 86's axis ⊥ to big-core axis

vns, TRU 7%, 0.7%-1% of which are GHV, remainder FMV



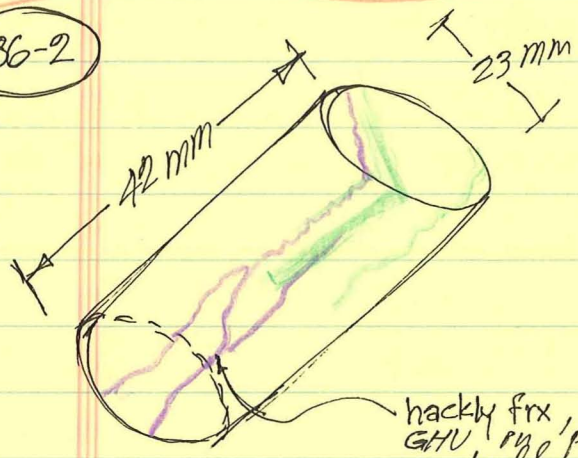
& mcgr. lithic MGW
max elong. arg. clast 1 mm²
max non-arg. clst 1 mm
avg. 0.3 mm

also in FMV's numerous hairline cal. vuln. <0.05 mm, randomly-oriented

non-mineralzd, hackly frx sub ⊥ to FMV's, 0.1-0.3 mm. avg. dip is 65°

bdding. dip vague, variable, but in general sub ⊥ to FMV's

86-2



vns 3.5% of TRU
3% FMV; 0.5% GHV's

FMV's "frozen" to wallrock. qtz-cal

qtz-cal note no py

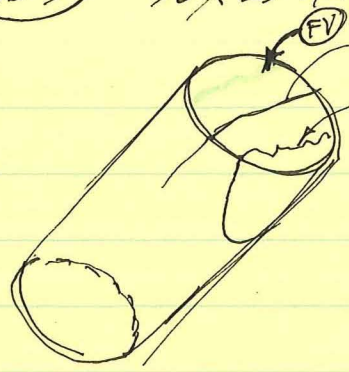
** mgr. lithic MGW no diss. pyrite

hackly frx, 0.1-0.3 mm, follows GHV in part (re frxd, partially mineralzd, frx)

max non avg 1 mm
max elongate avg 2 mm

bedding dip as above

86-3 50 X 25 mm ~~TRU~~. VNS. ~~0.7~~ 1.3 % TRU
~ 50/50 FMV & GHV

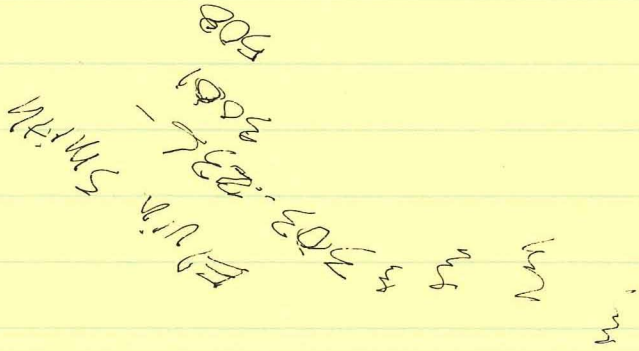


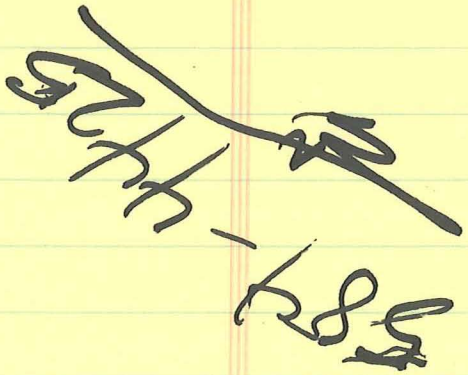
mgr lithic mgw same as (1) and (2)

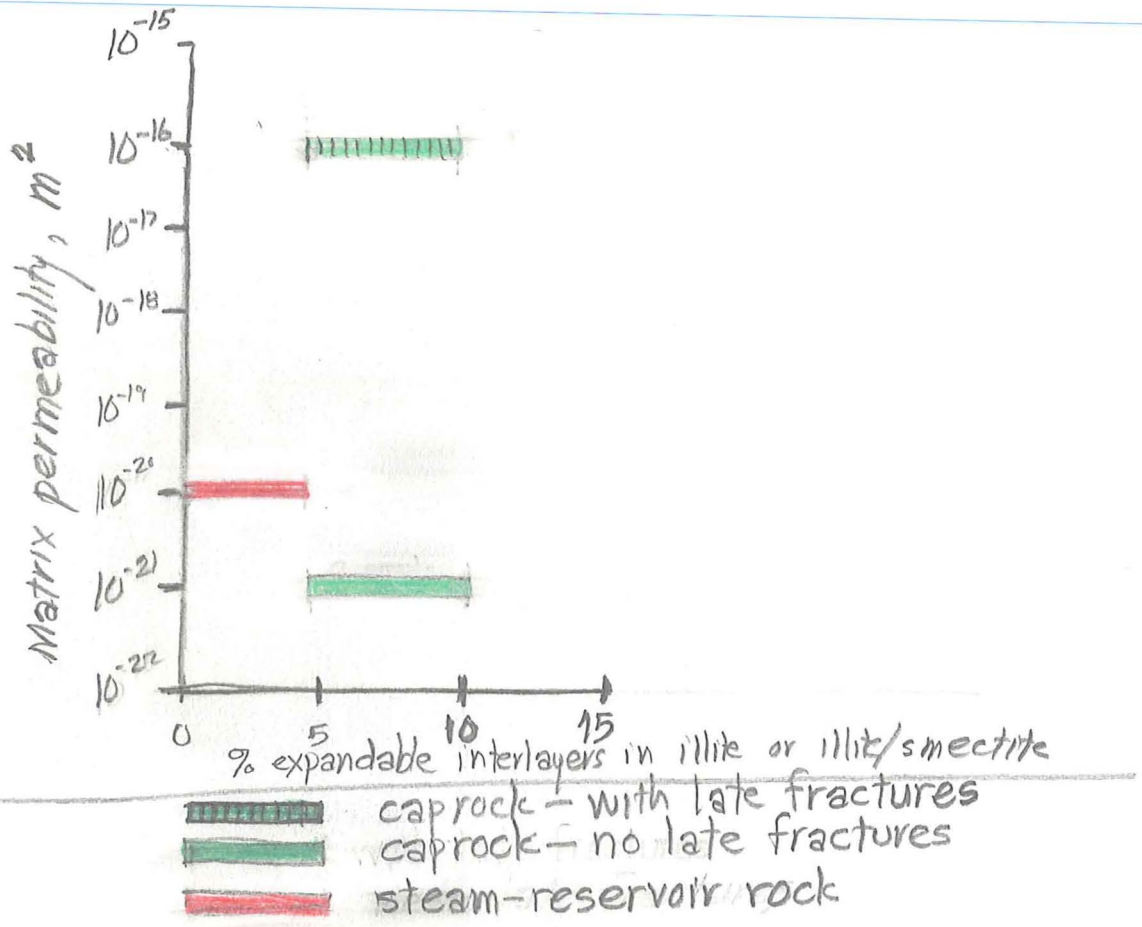
0.5 mm LCG
1.5 mm L Arg. Gru.

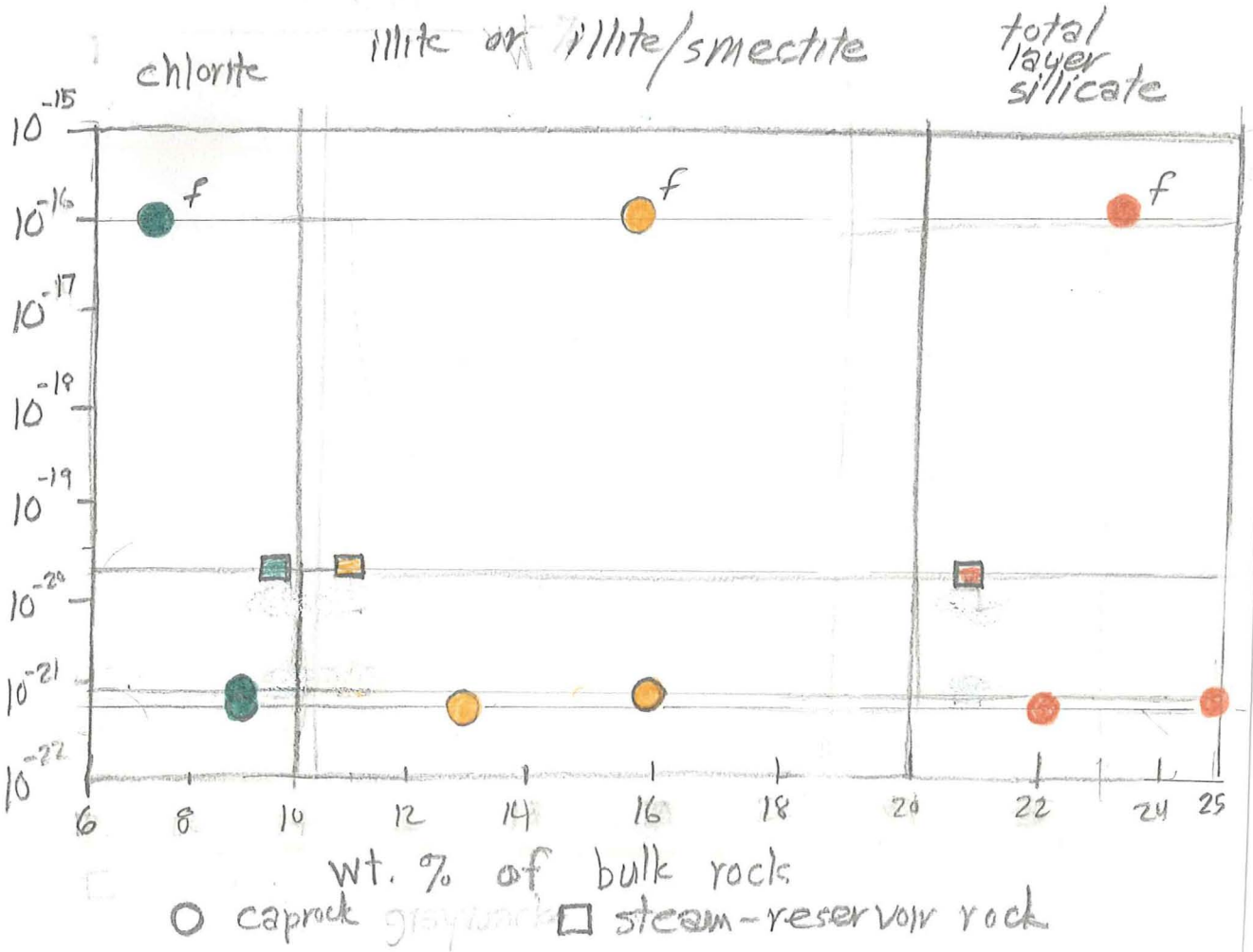
Tr diss. py

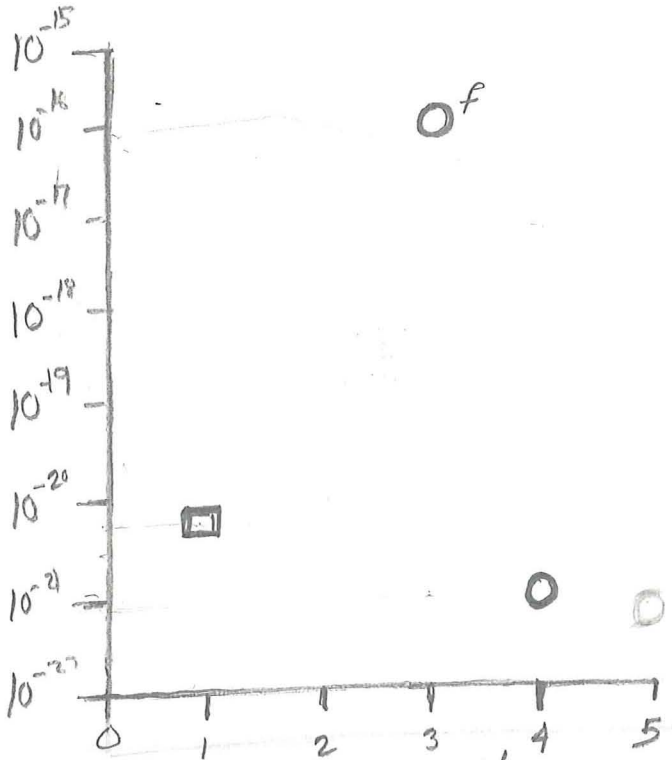
bedding indistinct — sub // to core axis





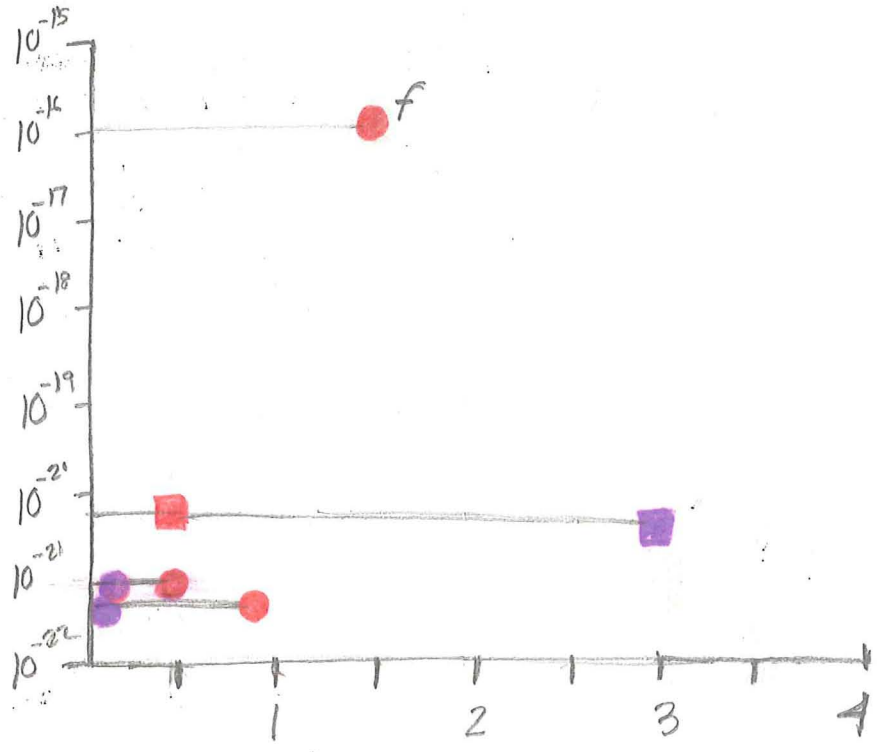

Matrix permeability, m^2
10^{-15}
10^{-16}
10^{-17}
10^{-18}
10^{-19}
10^{-20}
10^{-21}
10^{-22}
0
5
10
15
% expandable interlayers in illite or illite/smectite
caprock – with late fractures
caprock – no late fractures
steam-reservoir rock


chlorite
illite or illite/smectite
total layer silicate
10^{-15}
10^{-16}
10^{-17}
10^{-18}
10^{-19}
10^{-20}
10^{-21}
10^{-22}
f
f
f
6
8
10
12
14
16
18
20
22
24
25
wt. % of bulk rock
caprock
steam-reservoir rock



○ caprock □ steam-reservoir rock

f = with late fractures



Geysers hydrothermal veins

Franciscan metamorphic

□ steam-reservoir rock ○ caprock

f-with late fracture