

LITHOLOGY OF 18 SHALLOW THERMAL GRADIENT HOLES
COLADO AREA, NEVADA

by

Bruce Sibbett and Michael Bullett.

In 1979, 18 thermal gradient holes were drilled by Getty Oil Company to evaluate the geothermal potential of the Colado area. The cuttings were subsequently released for study to the Earth Science Laboratory, UURI, through the DOE/DGE Industry Coupled Program. The locations, numbers and bottom hole temperatures for each hole are shown in Figure 1. Figures 2-5 illustrate the stratigraphic relationships between the drill holes across several log sections. All but one of the holes were 500 feet deep.

In general the Quaternary sediments consists of poorly consolidated gravel, sand and mudstone. The bedrock consist of slate, siltstone and sandstone of Triassic to Jurassic age (Johnson, 1977). Milky to clear quartz is widely scattered throughout the slate. Pyrite occurs separately within the slate. The pyrite and quartz may have formed from original constituents in the rock during metamorphism.

The Quarternary gravels consist of poorly sorted clasts of diverse lithologies. The sand and gravel are poorly cemented by clay and calcite. Mudstones contain subordinate amounts of coarse sand and gravel, which probably occur as thin lenses. No stratigraphy or marker beds could be found in the alluvium. The upper one-to-two hundred feet of mudstone in the western holes is probably Lake Lahontan sediments.

Only limited structural information could be determined from the cuttings. A range front fault probably occurs under alluvium between holes 16-22 and 17-24 (index map) and trends south-southeast to near the mouth of Coral Canyon, then turns south-southwest. The holes west of this line penetrated only alluvium, and the holes east of the line intercepted bedrock a hundred feet or less below the surface.

The only mineralization of possible significance occurs in hole 14-22. Pyrite cubes occur interstitially within the gravel and sand at depths of 80 to 500 feet (Figure 3), and appear to have formed after deposition of these sediments. Pyrite is particularly abundant and also occurs within clasts between depths of 280 and 380 feet. The cuttings are angular, green and appear silicified in this zone. Some rounded silicified clasts are also present in this zone, and some of this mineralization may therefore predate deposition of the sediments. Colado 14-22 is also the hottest of the gradient holes having a temperature of 112.6°C at 200 feet. The bottom hole temperature is 110.3°C at 500 feet.

Minor pyrite is present in the lower half of hole 16-22, one-half mile north of 14-22.

REFERENCE

Johnson, M. G., 1977, Geology and mineral deposits of Pershing County, Nevada; Nev. Bur. Mines and Geol., Bull. 89, 115 p.

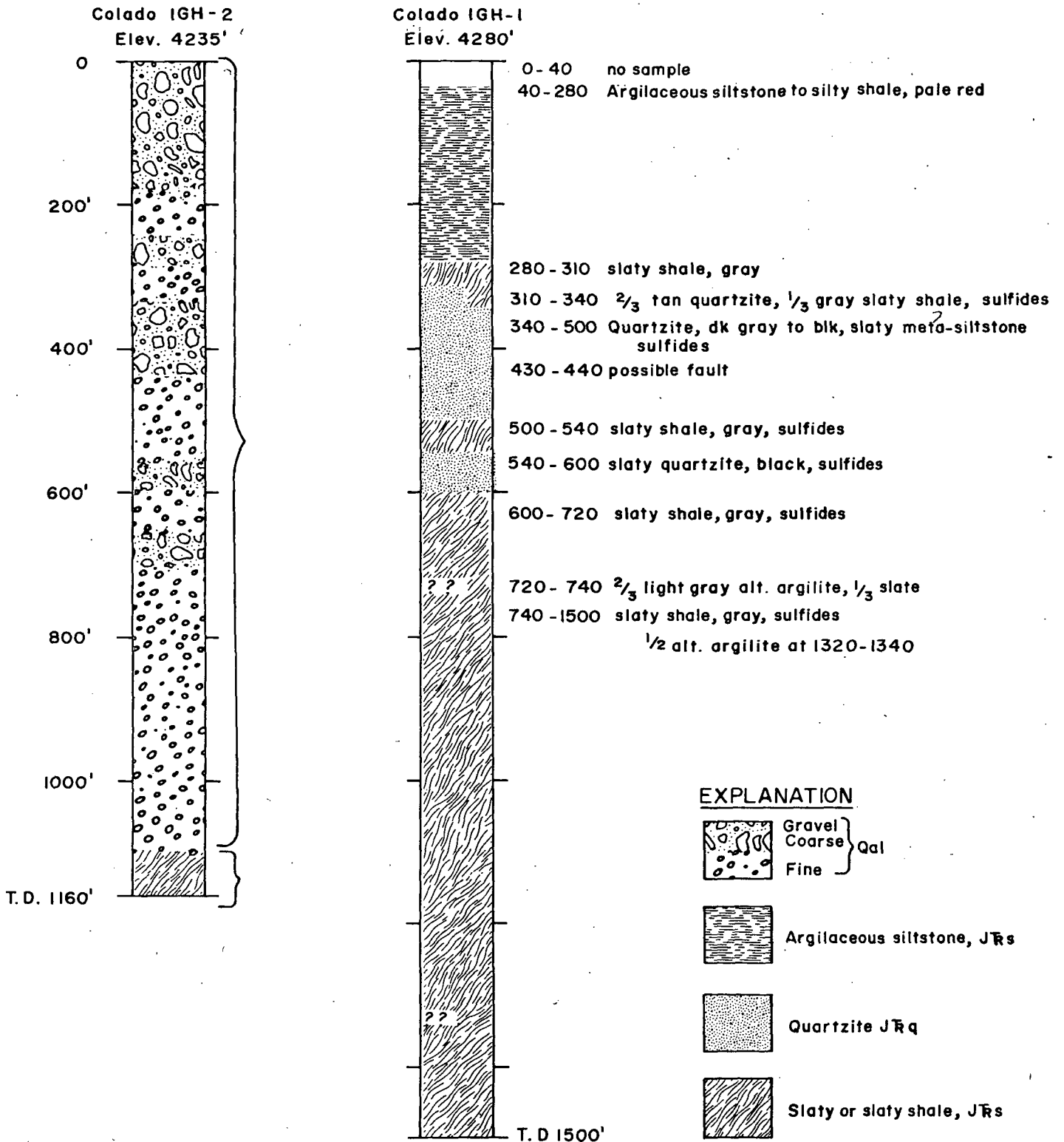


Figure 8. Lithology logs for holes IGH-1 and IGH-2


February 8, 1980

MEMORANDUM

TO: Howard P. Ross
FROM: C. E. Mackelprang
SUBJECT: Proposed Dipole-Dipole Survey at Colado KGRA, Pershing Co., NV

The attached map shows locations for five dipole-dipole lines in the Colado area. Line layout is such that most of the cultural effects will be minimized. It is proposed that 1000-foot dipoles be used initially. However, two lines (A & B) are amenable to 2000-foot dipoles should the need for greater penetration be required.

Getty Oil (Wayne Shaw personal communication) is proposing to drill a deep test well in sec. 26. Lines A & B should therefore be given top priority; the others could either be completed or dropped altogether depending upon information need and money available.



C. E. Mackelprang

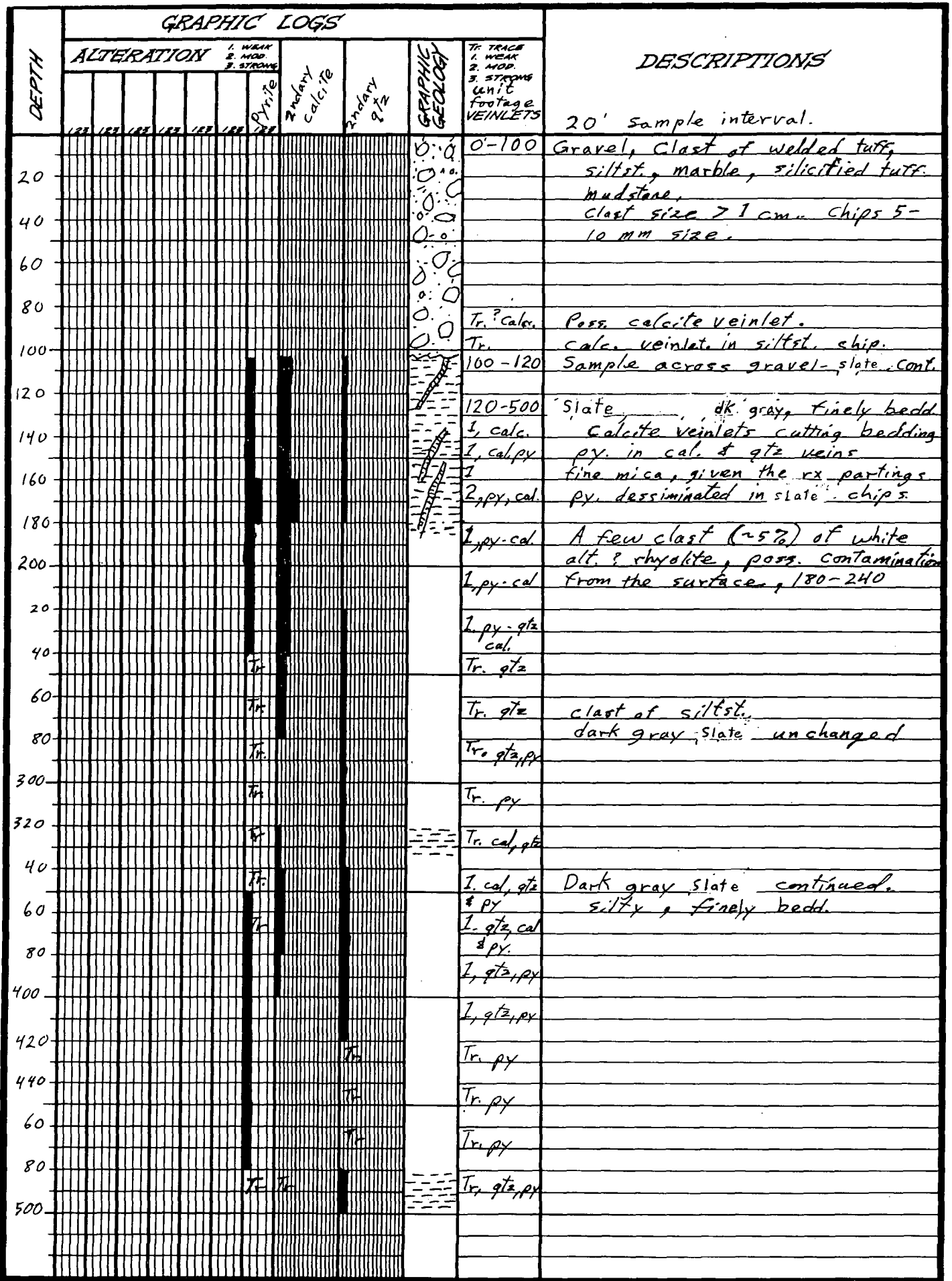
CEM/hb



GRAPHIC LOGS										DESCRIPTIONS	
DEPTH	ALTERATION						Secondary Calcite	Secondary Quartz	GRAPHIC GEOLOGY		TR. TRACE 1. WEIGHT 2. MOD. 3. STRONG Unit Footage VEINLETS
	1. WEAK	2. MOD.	3. STRONG	Pyrite							
										20' sample interval	
0-20										Siltstone, pale brn. & med gray minor mudstone included	
20-40										Mudstone, li brn, minor silt & sand grains.	
40-80										Siltstone, pale brn & grayish or pk with minor mudstone 40-60	
60-80										minor fine Ss in siltst. Calcite in siltst. & mudst.	
80-100										Mudstone, pale yel. brn. with minor siltstone	
100-120										Siltstone, pale brn, ~50%, Ss ~30%, slate ~20% pale yel. brn	
120-500										Slate, dk gray, fine, even text, mic. 3-4 pale brn slate & siltst. chip per sample.	
180											
200										Tr. cal. white qtz clast, 2mm cal. vein cutting li. brn siltst. chip.	
220										Milky qtz chip with brn. mudst. massive py in gray slate	
240										Milky qtz in gray slate	
260											
280										Tr. cal. clear calcite chip ~10% of sample is li. brn. mudst py in gray slate, ~15% li. brn mudstone to slate.	
300											
320										Tr. cal. cal. cryst in mudst., few li. brn siltstone & slate chips. Slate, dark gray continued.	
340										few li. brn. siltst & mudst. chips in dark gray slate.	
360										320-360 ~15% light brn. siltst. & mudstone.	
380											
400										Tr. qtz milky qtz, free py. chips. py is probably syngenetic.	
420											
440										milky qtz, py not assoc. with qtz but both in gray slate. mudstone and li. brn. siltst may be contamination from up the hole.	
60											
80											
500										4 chips of li. brn. slate in the dk gray slate.	

DRILL HOLE, Colado 11-36, Getty Oil
 LOCATION Sec 36, T.28N., R.32E, Pershing Co.

LOGGED BY Sibbett



DRILL HOLE Colado 2-2
 LOCATION Sec. 2, T 27N, R 32E.

LOGGED BY Sibbett

DEPTH	GRAPHIC LOGS							Secondary calcite	Secondary quartz	GRAPHIC GEOLOGY	TRACE 1. WEAK 2. MOD. 3. STRONG 4. n/c FOOTAGES VEINLETS	DESCRIPTIONS
	ALTERATION											
	1. WEAK	2. MOD.	3. STRONG	GYP SUL	Lim. n/c	Pyrite						
												20' sample intervals
0-60'												Siltstone, clast of siltstone li. brn. to li. olive gray, few mudst. and ls. or marble chips.
60-300'												Slate, dark gray, uniform v. fine grain, mica sheen. 60'-80' Few li. brn siltst. chips, may be contamination or thin siltst. zone. 80'-100' py. dissim. & mass. in phyllite
300-500'												75% slate, dk. gray, 25% siltst. tan. limonite on fracture in slate.
480-500'												2/3 slate, dk. gray, 1/3 siltstone. few clast silicified siltst.?

DRILL HOLE Colado 1-12
 LOCATION Sec. 12, T 27 N, R 32 E Pershing Co., Nev.

LOGGED BY Sibbett

GRAPHIC LOGS										p. 1
DEPTH	ALTERATION						Secondary calcite	GRAPHIC GEOLOGY	Tr. TRACE 1. WEAK 2. MOD. 3. STRONG Footage VEINLETS	DESCRIPTIONS
	Limonite	1. WEAK	2. MOD.	3. STRONG						
0									20' Sample intervals	
10								0-500'	Gravel, most clast are siltst, tan to med. gray, also welded ash flow tuffs.	
20									clast lava. Few coarse xline calcite	
40									clast and qtz., Few caliche coated	
50									clast. Hematite pseudomorphed	
60									after pyrite at 80-100'	
80									No evidence of matrix cement.	
100									A few shale or mudstone clast.	
120									Probable marble clast, white-glass	
140									qtz chips, clear calcite chips	
160									that could be marble or calcite	
180									vein material.	
200									Limonite surface stain on some	
220									clast 140'-	
240									Coarse xline Calcite increases	
260									below 140'. Some and poss. all	
280									are marble.	
300									180' sand size clast increase to	
320									~ $\frac{1}{2}$ at sample. 180-340	
340									Clay coating on pebbles 200-500	
360									Secondary? xline ^{clear} calcite cementing	
380									clast of calcite or ls together.	
400									clast of C. sand with clay matrix.	
420									Hematite clast, rounded.	
440								Tr. cal-s;	Calcite & silica band attached to	
460									siltst. chip, poss. vein. & reh. Cal.	
480									The clear, coarse xline calcite	
500									chips may be from calcite veins	
520									limonite pseudomorphed after py. cubes	
540									in a siltst. clast.	
560									The entire 500' of the hole is	
580									gravel with avg. clast size larger	
600									than the drilling chips (>5mm).	
620									The few small clast, pebb. & granule	
640									are rounded.	
660									clast of yellow banded silica, poss.	
680									opal.	
700									Pink opal? or silicified tuff.	
720									clast.	

DRILL HOLE Getty Oil 3-10
 LOCATION Sec 10, T. 27N., R. 32E., Colado

LOGGED BY Sibbett

GRAPHIC LOGS										DESCRIPTIONS
DEPTH	ALTERATION						Secondary Calcite	GRAPHIC GEOLOGY	TR. TRACE 1. WEAK 2. MOD. 3. STRONG 4. N/C FOOTAGE VEINLETS	
	1. WEAK	2. MOD.	3. STRONG	limonite	Pyrite					
										20' sample interval
20								0.0	0-100	Gravel, pebbles, 5mm-10mm ⁺ peb. are dark gray, li. gray, tan & white. Lith. of ls, siltst., qtz, slate minor calcite cement, alt. igneous Tr. red hem. or cinnabar?
40								0.0		
60								0.0		
80								0.0		
100								0.0	100-180	Gravel, granules & small pebbles clast of ls, qtz, siltst, ss, 1/2 gray clast & 1/2 tan clast. below 140, sand fraction increa. to ~ 1/4
120								0.0		
140								0.0		
160								0.0		
180								0.0	180-320	Gravel, granules & sm. peb. 85% yellowish gray shale clast minor ls, marble, siltst, qtz minor calcite coating on a few clast.
200								0.0		
220								0.0		
240								0.0		
260								0.0		
280								0.0		
300								0.0		
320								0.0	320-340	Gravel, pebbles, qtz, marble, siltst shale, slate
340								0.0	340-360	Gravel, granule & pebbles, clast are qtz, qtz, siltst, ls, slate
360								0.0	360-420	Gravel, granule & peb, ~60% shale minor: slate, qtz, ls, siltst.
380								0.0		
400								0.0		
420								0.0	420-500	Gravel, peb & granules, Below 420 pebbles of slate, qtz and siltst increase to ~ 1/2 samp
440								0.0		
460								0.0		440-480 some clast cemented with calcite.
480								0.0		
500								0.0		

DRILL HOLE Colado 4-16 Getty Oil
 LOCATION Sec. 16, T. 27N., R. 32E., Pershing Co., Nev.

LOGGED BY Sibbett

Colado 13-26 nw
Getty Oil
Pershing Co, Nevada
Sec. 26, T28N, R32E

0-20' Calcareous reddish f.g. sandstone, and grayish white and tan noncalcareous f.g. fragments, goethetic staining (trace) w/ gr. white dolomitic clasts up to 1/2" in size.

0-40' Same as 0-20.

40-60' Same - Staining moderate (goethetic)

0-80' Same as 0-20.

Tr. of mag. 0-100' gravel.

0-100' F.g. noncalcareous grayish white s. stone. 1/2" av. 4-6 mm in size
Tr. of goethetic staining
Fragments of reddish noncalcareous s.s.

0-120' Calcareous f.g. tanish sandstone fragments up to 1/2" in size av. 2-4 mm
100-120. 1/2 gravel 1/2 ss. f.g.

10-140' Same - but f.g. ^{grayish} white noncalcareous ss seems to be bleached (water entry?)
Tr. of mag. 120-180 ss, fin. gr.
Tr. of goethetic staining.
Tr. of reddish f.g. sandstone. Av. 2-4 mm in size or smaller.

0-160' Same as 120-140' Av. size 2-4 mm

0-180' Tr. of mag. - Same as 120-140 - but ~~has~~ reddish f.g. sandstone and goethetic staining on f.g. grayish-white ss.

180-200 1/2 ss, 1/2 siltst.

0-200' F.g. reddish sandstone, Goethetic staining
Av. 4-6 mm in size

200-500 siltst.

Tr. of mag.
clay material -
w/ quartz fragments: Smokey

00-220' Same as 180-200

220-240 F.g. reddish ss with weak goethitic staining
 some clay fragments
 F.g. grayish white s.s.

240-260 Same as 220-240
 Tr of sulphide
 Alteration products of clay

260-280 Same as 240-260
 Tr of sulphide

~~Change~~
 280-300 Black f.g. Silicious material
 Tr of sulphides, and magnetics

check ←

300-320 Same as 280-300

320-340 Same as 300-320
 No sulphides noticed

340-360 Same as 300-320 95% black f.g.
 Tr of mag., Tr of sulphides
 Tr milky qtz
 w/s light colored frag.

360-380 Same as 300-320
 Some milky qtzite fragments
 95% black

380-400' Same as 280'-300'
 95% Black f. grain
 5% light colored ~~is~~ very fine

Colorado 13-26
Getty Oil

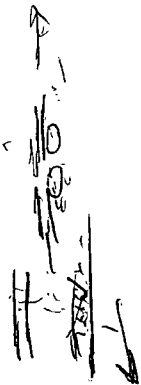
420-430 Same
Tr of mag.

430-440 Same
Small frag. of qtz scattered through-out.
W/s altered frag. to sericite

440-460 Black f.g. Same
Tr of mag.
Tr of sulphides some associated with milky qtzite
W/s hematitic staining

460-480 Same

800-500' Same
Tr of mag.



Well History

Getty Oil Company - Operator

Well No. USL-1GH#1

Location: Section 26 - T28N - R32E; Pershing County, Nevada

Elevation: 4325 ± Grnd.

Drilled by: K. O. Burt Drilling Co., Inc. Springville, Utah

- 3-4-80 Rig arrived on location at 1000 a.m. Started rigging up, prep to spud. Hauled water, mixed spud mud. Unloaded pipe and other tools. Suction hose to pump to short, Pusher will go to Reno for new one. One crew back to Utah for extra mud pump.
- 3-5-80 Pusher to Reno, crew hauling water and refilling pits. Conditioned mud and spudded well at 1700 hours p.m. Drilled one hour with rerun Hughes 9 7/8" Tricone Bit. Conditioned mud and circulated hole, repaired rig. Shut down at 2000 hours p.m. Will run 12 hour tours only.
- 3-6-80 Crew on location 0700 hours. Depth 66', mud weight 8.9# Gal., Vis 45-50 sec, Gel-H₂O system. RIH, drilled ahead, lost circulation at 135', mixed LCM into mud system. Drilled ahead with partial returns. Regained full system 175'-180'. Drilled to 198'. Bit plugged. POOH at 1500 hours. Jets and bit sub plugged with rocks. C.O Bit & Sub, RIH to bottom, drilled ahead to 1900 hours with hole taking some fluid. Mixed mud and LCM during drilling operations. Pulled off bottom, shut down rig for night. Depth 236'.
- 3-7-80 Crew on location 0700 a.m. Pusher wanted backhoe to C.O. pits. Had berms raised round pits to increase volume and drop out cuttings. Mixed and conditioned mud, on bottom drilling ahead at 1030 a.m. Crew back from Utah with extra mud pump. Can now mix and jet pits while drilling ahead with other pump. Drilled until 1500 hours, POOH, bit not cutting hard quartzite formation. Lost circulation during drilling. Mixed new mud and LCM, filled hole with mud. Put crew on standby and shut rig down at 1600 hours to 1900 hours while waiting on new bit. Depth 269'. Formation - hard dense chert.
- 3-8-80 Crew on location at 0700 hours. RIH with new Smith 9-7/8" journal insert bit. On bottom prepared to drill ahead at 0850 a.m. Mixed and conditioned mud, drilling with hole taking fluid. Lost circulation and regained. Mixing mud and LCM all day. Hit hard black Phylittic slate at 345'. Made hole down to 351' (casing point) at 1645 p.m. Pulled up off bottom, mixed heavy mud, added LCM and pumped hole slowly. Pulled up 100', repeated circulation procedure and pumped hole for 15 minutes. Hole stabilized at that point. POOH at 1830 p.m. filled hole with mud, secured rig at 1900 hours. Called B.J. Hughes in Woodland, CA. Will send pump truck from Beowawe and bulk truck from Woodland.

3-9-80

Crew on location at 0700 hours. RIH with bit to turn over mud, tagged bottom, pulled up circulated for 20 minutes. Hole OK with fluid level in pit holding. POOH with D.P. and bit. Measured casing and started in hole with shoe joint at 1000 a.m. Ran 19 joints of K55, 23#, 8 Rnd, ST & C, to 361'. Bottom 10' shoe joint equipped with drillable cement guide shoe and insert valve at the top dressed with a centralizer and at each 80' thereafter. Tack welded each collar except last three inside conductor pipe. Rigged up B. J. Hughes Cementers at 1330 p.m. Loaded H₂O, dropped ball, pressured up, ruptured insert valve at 200#, mixed cement, sent 30 cu/ft H₂O ahead, followed with 135 sacks class 'G' cement treated with 3% CaCl. Displaced cement with H₂O and bumped plug with 500# at 1450 p.m. Reciprocated casing during cementing operations. No returns after bumping plug. Broke head off with cement in place at 1500 p.m. Rigged up 1" BLP, ran in to feel for cement in annulus. Hit firm cement at 23'. Mixed 25 sacks class 'G' treated with 3% CaCl, pumped down annulus, good returns immediately. Pumped away 15 sacks, voided rest into sump. Rigged down B. J. Hughes at 1650 p.m., cleaned out "1" Pipe, Standing cemented at 1700 hours.

3-10-80

Crew on location at 0700 a.m., cut off 12" conductor 1 ft below ground level. Cut off 7" casing, welding on landing plate and 7" SOW Casing Head. Installed a Shaftco Hydraulic Class II 3000# Blow-Out Preventer. Cleaned out mud pits with a backhoe, ran flow line to shaker, mixed mud, made up Hughes 6 1/4" re-run bit. RIH to 200', closed Pipe Rams; pressured up with mud to 300#. Held for 10 minutes. No leaks. Closed flow line valve to mud pump. Held for 15 minutes at 300#. Tested OK, bled off pressure, opened rams, ran to bottom, drilled out insert valve, 10' cement and guide shoe. Drilled ahead to 368'. Secured rig at 1845 hours. Hole took some fluid during drilling operations.

3-11-80

Mixed and conditioned mud, added LCM, drilled ahead with partial returns. Bottoms up temperature 114° F. Drilled until 0930 a.m. Pulled up, dropped Totco. POOH to change bits, depth 387'. Totco 6° with baffle ring turned sideways on top of bit. RIH with Hughes 6 1/4" rerun bit. On bottom, drilling at 1120 a.m. Drilled to 448' in hard dense black phylittic slate with trace pyrite and quartz. Secured rig at 1900 hours p.m.

3-12-80

On location at 0700 a.m., ran bit to bottom, broke off Kelly, dropped Totco. POOH with bit. Rigged up air hammer and compressor. Deviation 5 1/4°. On bottom with hammer at 1945 a.m., blew mud out of hole, drilled ahead at 1100 a.m. Shut down, made shield for table, drilled until 1830 p.m. Set back two stands. Shut down for night, depth 672'. Hit hot H₂O aquifer at 445'-450', temp. 140°-150° F. Flowing in hole at 30-50 gpm mixed with foam.

3-13-80

Crew on location at 0730 a.m., ran to bottom, drilling ahead at 0755 a.m. Made 40' to 712' depth. POOH to check hammer. Changed to 6 1/8" hammer, RIH pressured up, blew fluid out, drilled ahead to 732'. Hole getting very hot with flowline temps 150°-160° F. Can not circulate very well thru hammer ports if mud needed to kill well, will POOH and put on tricone bit. Made trip, changed bits, reamed down last two singles of 6 1/8" hammer hole. On bottom, drilled 15', bit plugged. POOH, on bank at 1730 p.m. Drill collar sub and bit full of gravel. C. O., put in check valve. RIH and secured location at 1945 p.m. Depth 747'.

3-14-80

On location 0715 a.m., ran to bottom, pressured up air, drilled ahead. Drilling rate 60'/hr. Made hole til 1415 p.m. with depth 1047'. Circulating temperature 155°-158°F. After connection 174°-178° F for 5-10 secs. Drilled to 1107'. Pulled back to 700' to wipe hole. On bottom again drilling at 1720 p.m. Lost circulation, pulled up 120' added more soap emulsifier, staged back to bottom, drilled ahead to 1147', picked up single, could not regain circulation after connection. Stuck DP, worked pipe, pumped mud, got loose at 2140 p.m. Pulled up, set back 6 stands, secured location 2230 p.m.

3-15-80

Crew on location 0715 a.m. POOH to check bit. Mixed and conditioned mud, added Barite. Mud Weight 9-9.5#. Staged back to bottom, reamed tight spots in hole. Circulating off bottom, rerigged shaker. Flowline temperature 98°-100° F with mud. Heavy mud shut off hot fluid entry into hole. Drilled until 2200 p.m., POOH to 1000', shut down rig 2230 p.m. Depth 1313'. Formation hard dense black Phylittic slate with thin interbeds of fine sand and clay stringers.

3-16-80

Crew on location 0750 a.m., rig, mud hose, pits all partially frozen, temperature overnight 15°F. Thawed out, ran to bottom, drilling ahead at 0805 a.m. Put Schlumberger on standby notice for tomorrow. Drilled until 2145 p.m., depth 1501' ±. Pulled up 6 stands, filled hole with mud, secured rig at 2245 p.m. Released Strata-Log logging unit.

3-17-80

Crew on location 0815 a.m., RIH to bottom, circulated for 20 minutes, hole in excellent shape. Schlumberger on location, POOH, rigged up Schlumber, RIH with DILL Log at 1105 a.m. Logged out, RIH with FDC-CNL Sonde and Temperature tool on top. Temperature tool ceased to function in open hole. Ran Sonic, N.G., rigged down loggers. Secured location 1900 hours p.m.

3-18-80

Crew on location at 0700 a.m., RIH with bit to 1500 T.D., circulating for 15 minutes on bottom. POOH laying down drill pipe and collars. OOH at 1105 a.m. Filled hole with heavy mud. Tore out BOPE including picher nipple and blowdown and kill lines to casing head. Ran 47 joints including on 10' pup of 2 3/8" 4 7# E.U.E. ST & C tubing and hung at 1482' ± from 7' combination casing-tubing flange bolted to the casing head. Filled with fresh H₂O and installed 2" full gate valve above tubing flange. Well finished 1800 p.m. 3-18-80. Released Contractor

3-19-80

Clean up location.

Wayne A. Shaw
Agent