R. F. SMITH CORP.

GEOTHERMAL DATA LOG

COMPANY THERMOGENICS INC.
WELL K 1 A
FIELD GEYSERS COUNTY LAKE
LOCATION SEC 1 T 10 N R 8 W
STATE CALIFORNIA COUNTRY U.S.A.

DEPTH LOGGED FROM 360' TO 7108'
DATE LOGGED FROM 1/29/78 TO 3/25/78
ELEVATION 2663' KB☒ DF☐ GR☐

LOGGING GEOLOGISTS CHRIS HINSON, BILL GRABERT, ARTHUR GREEN
PRESSURE INST TYPE SILICON CHIP TEMP TYPE THERMOCOUPLE

LITHOLOGY

Sandstone	Siltstone	Graywacke Type #1	Graywacke Type #4	Solution Deposit	Basalt or Greenstone	Peridotite	Schist
Breccia	Claystone	Graywacke Type #2	Chert	Mineralized Deposit	Other Volcanic	Igneous Rock	Quartzite
Conglom.	Shale or Argillite	Graywacke Type #3	Limestone	MELANGE	Tuff or Tuff Brec	Granitic Rock	Serpentine

ENGINEERING DATA

HOLE SIZE
26" to 361'
17½" to 2952'
12¼" to 4181'
8 3/4" to 7108'

CASING SIZE
20" to 353'
13 3/8" to 2939'
9 5/8" to 4181'

DRILLING RATE ☒ FT/HR ☐ MIN/FT

ROCK DENSITY

AIR AND MUD DRILLING DATA

TEMPERATURE (°F) IN OUT
CO2 ppm on Air
TOTAL MUD GAIN/LOSS
PRESSURE PSIG IN OUT
H2S ppm
% MOISTURE
METHANE ppm
ETHANE ppm

REMARKS

DESCRIPTIONS
CORE RESULTS
SURVEYS
FORMATION TESTS
MUD AGITATOR
ELECTRIC ☐
AIR ☒

Set 20" casing to 353' Begin Logging 1/29/78.

Peridotite: 30-40% alter w/10% free Serpentine, olv grn w/brn-grn, mod hd-hd, frags cross cut by Serp veins.

Peridotite: highly alter (Serpentinite) vari amts clay to 60%, blue-wht, sol, pred mechanical abrasion of formation w/rare in situ clays.

W 67 V 82 F 12.0 pH 10½ Cl 1000 Sd 4½

Clay: blue-wht, sol, sl stky, contains brn-grn, lt brn-grn (Peridotite/Serpentine) particles, sample to 80% clay before washing.

Peridotite: sl altered to Serpentine, olv-brn, grn, 10% free Serpentine w/variable amts clay.

Clay: sft-mod frm, stky, solu, pred lt blue to blue-wht, pred from high altered peridotite and mech abrasion of bit on peridotite and serpent.

Wt 67 Vis 90 Wl 15 pH 10.5 Cl 1000 Sol 5

Peridotite: mod altered to serpentine, w/ up to 10% free serp, dk olv grn-brn grn, mod hd-hd, containing sme dk inclusions, sme serp veins, dk grn-lt bl grn, fibrous-massive, 20-30% clay in sample.

Peridotite: generally as above w/ variable amts clay

Peridotite: (Serpentinite) dk olive grn w/ serp veins, mod hd, approx 10-20% free serpentine, blue-grn, massive w/occ tr fibrous.

Decr clay w/ depth, 10-20%, lt blue to blue-gry, solu, stky.

Peridotite: con't as above w vari-amts clay to 20% a/t.

Peridotite: mod altered to serpentine, dk olv grn-brn grn, mod hd, com serp veining, approx 10-20% free serp, dk grn-lt bl grn, mass w/ occ fibrous, variable amts clay (mostly less than 10%).

Peridotite: mod altered to serpentine as above.

Peridotite: olive grn w/ occ fn-med olivine incl stgly altered (serpentinite), mod hd, crossed cut by serp veins.

Serpentine: 40-60%, grn, blue-grn, mass to frib, assoc w/ abdt blue-wht clay, abrasion product.

Peridotite: olv grn, hghly altered to serpentine, up to 60% free serp, grn-lt bl grn, mass-fibrous, w/ vari amts clay.

Graywacke: (Type One) gry-blk, gry-wht, wht, hd-vhd, sl fri, calc, mod srtd, vfn, fn-med, mod secondary wht qtz, sme dism argillite mat.

Mod uphole sluff.

Graywacke: (Type 1) dk gry-blk, vfn, wl-mod srtd vhd, wl indurated, apparent silic w/ abndt argillaceous matrix; med gry, vfn-fn, mod-p srtd, sub ang-mod round, vhd, wl ind, abndt silic, felds?, argil matrix, mnr calc (prob secondary), sme sl glauconite gr orientation, no apparent rextn; com wht silic-calc frac fill, com perid-serp sluff

Peridotite: Serpentinite bright med grn serp w/ disim pyrite, mod hd-v frm, sme wht talc, occ dk grn serp, abdt clay from bit action; blue-wht, grn-wht.

Peridotite: hghly altered to serpentine, olv-med grn, com free serpentine: mod grn, lt grn, mass, fibrous & occ platy.

Peridotite: con't as above

Peridotite: pred alter to serpentinite w/ up to 15% free serpentine, mod hd, olive grn to dk grn, abdt serp veining.

Peridotite: sltly altered to serpentine, grn brn-olv grn, w/ occ blk, yellow grn (olivine?), & lt-med grn serp inclusions, approx 10% free serp, vari amts bl/wht clay.

Peridotite: sltly altered to serpentine con't as above.

Peridotite: sltly altered to serpentine, olv grn to grn brn, mod hd, med-wl indurated, occ serp veins, tr blk inclusions, less than 10% free serp; lt grn-bl grn com platy, occ mass, tr fibrous, vari amts clay.

W 67 V 83 PV 39 YP 17 F 25 pH 9.5 Slds 4.5%

Peridotite: con'd as described, slty serpentinized; becoming more serpentinized @ 2155' w/ increase in lt blue, sol clay.

Peridotite: serpentinized med-dk olv grn, highly altered, abnt fib/plty Serp, com lt blu/wht, sol clay.

Peridotite: med-dk olive grn, vis Serp veinlets, varying amts of Serpentinization (10%-60%), com fibrous var (Chrysotile) w/platy & massive var.

Clay: wht, lt blu wht, vy sol, sft, poss Serpentine alteration product.

Peridotite: up to 90% serpentinized, olv grn-grn, com massive Serp., occ fibrous-platy, sme red mnrlzn (Cinabar) @ 2410', tr amts dism Pyr.

Serpentinite: med-dk grn vy mineralized, com dk, brt red (Cinabar) dismd in Serpentinite, possible dism (Chromite) gry, metallic.

W 69 V 55 PV 26 YP 13 F 18 pH 9.5 Cl 900

Serpentinite: med-dk grn dk grn gry, occ wht grn, hd, wl ind, mass, vy mineralized, v abnt dism gry metallic min (poss Chromite), com brt rd patches (Cinabar), com wht effervescent veinlets (poss silica carbonate).

Peridotite: con'd as described w/decr amts of mineralization.

Peridotite: med-dk grn, com altered Serpentine becoming clayey @ 2680' decr in mineralization, becoming more competent below 2710'.

W 71 V 92 PV 45 YP 20 F 12 pH 9.5 Cl 1000 S 8

Serpentinite: med-dk grn sme v dk grn, firm, vitreous, tr Cinnabar, tr poss Chromite, tr poss dism Pyrite, tr calc/silic veining.

Greenstone: lt-med grn, hd, grainy tex, v dense, occ qtz veining, tr calc

Serpentine: med-dk grn, vitreous, sme mineralization, mnr Cinnabar, Chromite & Pyrite, com wht, vy sol clay.

Greenstone: lt-med grn, mottled, mnr dk grn inclusions, hard, vy dense, mnr Pyrite, abnt calc veining, mnr Serp.

Ran Temp, Density, Gamma & E Logs; Set 13 3/8 Casing; Drilling 12 1/4" hole.

Serpentine: med-dk grn, vitreous-mottled, occ-com mineralization; Chromite, tr Cinnabar, occ wht clay.

Greenstone: dk grn-dk grn gry, v hd, sm grny appr, motld, dk vnlike minlztn, sm grdg to altd Serp

Serpentinite: med-v dk grn, vitreous-motld, occ fibrous, sm transluc, com metallic minlztn, occ calc-silic frac fill

W 68 V 85 PV 42 YP 23 F 17 pH 11 Cl 800 S 5.5

Serpentinite: lt-dk grn, translucent in pt, vit, scat fibr, w/ scat Talc minls, tr aggr Pyr; gd tr Bl Sch to 10%, Grnst to 10%, scat Perid/Dunite tr 5%

Serpentinite: con't generaly as above, w/Grnst to 20%, Bl Sch to 10%, mnr calc-silic veinlets sme bl-wht clay @ 3290-3310.

W 71 Vis 110 F 16 S 8%

Graywacke: (Type 2 w/1) lt-dk gry, sm wht, catacl tex, abun calc & silic wh frac fill; intbd w/sl sdy Phyl dk brn-dk gry, grdg to micGwke; tr pyr

Melange: w/ Graywacke (Type 2) & Argillite 20-50%, 10-60% Serp, up to 35% Greenstone, up to 35% Blue Schist, com calc-silic frac fill, tr pnk-wht silic frac fill.

Graywacke: (Type #2 w/ occ #1) lt-med gry, wht, hd, p srtd, silic, gd cata/foliated tex, sm vis gr boundries, tr grn incl (Epidote?), com calc-silic frac fill.

Lost appx 150 bbls fluid at 3565', LCM added.

Graywacke: (Type #2) lt-med gry, generally con't as above, w/ com lt grn tint (poss Chlorite), decreasing amnts frac fill.

W 68 V 66 PV 21 YP 5 F 15 pH 9.8 Cl 700 S 6%

Graywacke: (Type 2) lt-med gry, occ wht, v silic, com catacl tex, banding, 5-10% silic frac fill, tr calc & scat epid xls

Graywacke: (Type #2) lt-med gry, hd-v hd, v silic, cata tex, com wht silic frac fill, tr Epid, sme Serp & Greenstone @ 3780'.

Lost circulation @ appx 3837'-fluid loss appx 275 bbls-add LCM

Lost appx 200-400 bbls while POH-15' fill aft trip

Graywacke: (Type 2) lt-dk gry, v silic, com cata/foliated tex, occ wht qtz frac fill, tr calc, tr Epid, tr poss Chlorite

Argillite: to 10% of sample, dk gry, sm sl sdy, tr calc, silic, intbd w/in banded Gwke (Type 2) a/a

W 66 V 68 PV 30 YP 14 F 12 pH 10.5 Cl 800 S 3

Graywacke: (Type 2) lt-dk gry, v silic, v rextln, mod banding, up to 40% wht-salmon qtz frac fill com Chlorite, tr calc, tr Pyr, intbd w/ Argil a/a to 70% of sample. (Salmon frags @ 4060'-fm 1-4% of sample)

Arglt: med-dk gry, gry-blk, lam in pt, wht-dk gry silic bndg, intbd/grdg to micGwke, phyl sheen to 5%; cont tr salmon silic frags to 3%

Graywacke: (Type 2) lt-dk gry, v silic, abndt cata tex, v banded, occ wht silic frac fill.

Ran E-Logs; Hung 9 5/8" csg to 4181'; Drlg 8 3/4" hole on AIR

Graywacke: (Type 2) lt-med gry, abun bndg, v silic, sm intbd Arglt, scat pyr, tr Serp, com wht-gry qtz frac fill, vfn samp sz

Graywacke: (Type 2) pred lt gry-lt grn, vfn samp sz, bnd, grn cast fm clrtztn, scat Arglt; appx 20% pk-wht-salmon Soln Dep. frags

Note: drilling w/ 3 compressors & no mist.

Graywacke: (Type 2) pred lt gry, highly xtln, vfn, bnd, pred qtz w/ mnr amts of Argil also highly xtln, occ mnr amts of chlorite, tr pyr, occ tr calc, occ rose qtz. Slugging hole every 30 Note: incr WOB to 35,000 lbs @ 4477'.

Graywacke: (Type 2) lt gry-wht, highly silic, pred qtz, com mnr rose qtz, mnr phyllitic Arglt, loc abnt calc, var amts of clrtztn, occ tr pyr.

Note: med-heavy torque on drill string fm 4450'-samp quality poor/fair

Graywacke: (Type 2) wht-lt gry, v silic, v fn gr sz, transitional to Type 3-Begin misting @ 4573' to decr serious torque

Graywacke: Type 2/3, wht-lt-med grys, trnslcnt, w/ appx 5-20% silic rexln arglt, scat pk-rose coll silic matls

Note: pressure & temp flux due to misting.

Graywacke: (Type 3 marg Type 2) lt gry-wht, v xtln, v silic, pred vit-wht qtz w/occ dkgry Phyllitic Arglt bnds, var amts of clrtztn, mnr pyr, tr epidote. Note: sample 4730-46 contaminated.

Graywacke: (Type 3) pred wh-lt gry, cldy-frstd qtz, scat clr, scat dk bnds, sl chlrtztn

Sample quality v good

Solution Deposit: fm appx 4815', org-tan-pnks-rose-gry silic frac fill

Solution Deposit: lt brn, org-pnk, silic, som vit veinlets, mnr clrtztn, mnr pyr, var amts of calc, wht frags & som gry veinlets.

Solution Deposit: tan, org, pnk, wht, vit, mnr pyr & calc w/vit & gry silc frag fil.

Graywacke: lt brn, wht, pnk, vit, (Type 3), v silic hd, mnr clrtztn, tr pyr.

Soln Dep / Gwke: tan, lt brn, occ lt pnk, whts, as sol dep a/a grdg to Gwke Type 3 (w/ staining) appx 10-15% lt-dk gry xln silic argil Gwke

Graywacke: (Type 3) cont wht-lt gry, decr amts tan-lt brn, v silic, com med-crs grns (prob sluff; appx 20-30% med-dk gry silic Gwke

Note: poss sample contamination, i.e., non loc frags mixed w/com vfn frags (Sluff).

Graywacke: (Type 3) wht-lt gry, pred wht-vit silica, mnr dk gry, xtln arglt, occ abnt calc, tr clrtztn, tr pyr, tr wht mica?.

Note: serious torque on drill string from 5218'.

Graywacke: (Type 3) wht-lt gry, rexln, frstd-cldy-sm clr silica, vfn grn sz; abun med-small pebble frags slough fm uphole; sample quality fair-good; cont torque problem

Graywacke: (Type 3) con't as above w/occ pyr, chlorite, occ rose pur min. Note: poss minor steam entry @ 5360'.

200+ PPM H2S during trip; Ream 360' to btm

Graywacke: 50' (Type 3) wht-lt gry, med gry, rexln, v siliceous, sme lt grn chlorite cast, gen'lly poor-fair samp quality.

Greenstone: lt-dk gry grn, mottled, rextlzd, occ dk inclusions, occ wht inclusions, occ frstd wht-clr qtz, com disim pyr.

Note: sample quality very poor due to lack of water washing thru sample trough.-sample improved by 5560'

Graywacke: (Type 3/2) wht-lt-dk grys, vfn-silt sz samp, v silic, transitional w/both types Gwke, lt grn cast (chlrtzd); com scat Grnst frags as abv (sluff); scat Pyr & Epid

Graywacke: (Type 3 w/ some poss Type 2) cont'd a/a w/ cont'd Grnst sluff.

200 ppm H2S on trip-152' ream to bottom

Graywacke: (Type 4) samp 80% med-dk gry; appx 50% Gwke, dk gry, silic, sm gr dg to Type 3; 20% dk gry altd Grnst, v dense, xln; 10% lt pnk-gry trnslnt Sol Dep; Samp extr difficult to ID due to size

Note: torque problem on drill string from 5900'

Note: tripped @ 5940' to check suspected twist-off-string/BHA ok

Graywacke: (Type 3) wht-lt-dk gry, v silic, rextlzed, occ chlorite, tr pyr, tr epid, scat Grnst sluff.

Graywacke: (Type 3) appx 60% samp wht, lt gry, v lt grn, silic, occ bndg; 20-30% med-dk gry, silic, grdg fm Phyl/Arglt to micGwke (poss slough); 10% rose-gry Grnst (slough) Samp quality very poor due to decr muffler water

Graywacke: (Type 3?) wht-med gry, v lt grn, silic v hd, sugary tex, sme 3% tex com wht & dk inclusions, up to 40% med-dk gry Phyl/Arglt, com foliated, occ phyl sheen, occ pyr, occ grn fibr-vitreous min (Actinolite?)

Note: lightened up on bit to 15000 lbs from 6063'-6126'.

Graywacke: (Type 3?) pred wht, lt-med gry, lt grn, abun silica, sm chlrtzd/mnlzd sms, bndg, var amts argil(?) content grdg clr to dk gry-dk brn; Appx 20% m-dk gry, dk brn Arglt/Phylt, com sheen, silic bndg, sm motld, sl sft w hd

No sample recovery fm 6180'-muffler drainage packed off-temp, gases, pressure returns ok

STEAM ENTRY @ 6232'-50% initial incr, dropping off slowly

Note: sample returns @ 6320'- sample quality good

Graywacke: (Type 4) wht-brn wht-lt gry, v silic, com frosted-clear qtz, sample size v fine, approx 50% of samp passes through 140 mesh.

Graywacke: (Type 4) a/a continued w/ apparent type 2-3 & Grnst sluff.

Note: lightened up on bit to 15,000 lbs @ 6400'

Graywacke: (Type 4) pred lt brn stained qtz, sm frstd-clr; 5% med brn silic frags; samp v fn-elt sz

Argillite?: fm 6490', dk gry-blk, silic, rexln, sm vfn xl faces, to 40% of sample

Graywacke: (Type 4) color grdg fm clr/wht to tan-beige, sl trnslcnt, extr fn; Arglt a/a thins out by 6560'

Graywacke: (Type 4) wht-beige, clr-opaque, 95% qtz, com lt brn stain.

Graywacke: (Type 4) wht w/ lt brn stain grdg to tan-beige, pred qtz w/ sme rd/brn cuttings w/ wht spots, tr pyr.

Graywacke: (Type 4) continued as above, sample size v fine.

Graywacke: (Type 4) wht-med brn, sme w/ lt brn stain, pred qtz, frstd-clr, occ dk gry micGwke cutting.

Graywacke: (Type 4) med gry to blk, silic, poss micGwke/Argil, 15% wht-clr qtz, tr brn silic rk.

Graywacke: (Type 4) med gry-blk, brn, tr wht qtz, samp size silt.

Graywacke: (Type 4) med-dk gry, v silic, xln, to 60-70% of samp; appx 10-30% brn-brn rose: 10% wh-lt gry; samp qual good

Graywacke: cont as abv, incr amts lt-med brn silic matls to 30-50%;

Graywacke: (Type 4) wht-lt gry qtz to 50%; lt-m grys to 40%, lt brns 10%

Graywacke (Type 4): med-dk gry, argillaceous, silic, to 50% of samp, wht-med gry, rexln, to 40%, com grn min (chlorite?) tr yel (epid?), tr metalc

Ran Temp. Logs, set cmt plug for redrill