

**LAKE CITY GEOTHERMAL, LLC**  
**Lake City Observation Hole No. 1**

Sheet No. 1Log By: R.F. HardymanDate: 3/5/02

(Int = interval, Rec = recovery)

Box No.	Int in box	Rod Int (Depth) (ft)	Rec for rod Int (ft)	Core Int (ft)	Lithologic Description
1	0-28	0-9	0		Interval mostly black and dark grey soil (not recovered) and a few rounded pebbles/cobbles of dark and medium dark grey, aphanitic to very fine-grained porphyritic basalt/ basaltic andesite containing scattered micro phenocrysts (< 1 mm) of plagioclase, less abundant pyroxene and possible trace olivine (altered). One pebble contains tiny "holes" which appear to result from alteration and removal of probable micro phenocrysts and /or be micro vugs. One rock fragment consists of medium to dark grey volcanic glass with no discernable micro phenocrysts. All basaltic/basaltic andesite pebbles/cobbles are moderately to weakly magnetic; probably due to micro granular magnetite in the aphanitic rock matrix. These few pebbles/cobbles may be slough material from the built up drill pad.
		9-18	1.0		Core recovery consists of stream worn rounded-subrounded and subangular pebble to tennis ball-sized clasts of predominantly volcanic rock but including an occasional fine-grained volcaniclastic sandstone clast. These clasts appear to have been set in a semiconsolidated (?) matrix of medium brown, medium to coarse-grained sandstone (mostly washed away by drill). Volcanic clasts in this interval are heterolithologic and include fine-grained micro porphyritic plagioclase + pyroxene basalt, olivine basalt and oxidized aphanitic basalt resembling chert. Except for the hematitically oxidized fragments (chert-like fragments) the volcanic clasts are mildly magnetic. Bottom 2 inches of interval consists of medium dark brown, medium-grained, well sorted sandstone which probably was the matrix sand for the clasts in this interval. This interval represents a conglomeratic interval (lens?).
		18-28	8	18-19.6	Bottom 2 inches of the sandstone in interval above grades into slightly darker brown, dark brown, coarse-grained, moderately poorly sorted, red-white and green "salted", volcaniclastic sandstone. Subrounded to subangular grains comprising this sandstone are predominantly (approximately 80%) volcanic lithic fragments. The rest of the sand grains are mineral grains, predominantly plagioclase feldspar with trace quartz, sanidine (?), probable (not confirmed) ferromagnesian minerals and magnetite.
				19.6-22.9	The above dark brown sandstone grades (within .5 ft.) into lighter brown - "coffee" brown, more well sorted, medium-grained sandstone of the same lithology. This brown, medium-grained sandstone grades within 2-3 inches into dark grey, well sorted, fine-grained sandstone with wispy lenses of lighter colored sand locally.
				22.9-24.9	Interval consists of dark grey, well sorted, fine-grained sandstone that grades downward into dark grey silty mudstone.

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Sheet No. 2

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Box No.	Int in box	Rod Int (Depth) (ft)	Rec for rod Int (ft)	Core Int (ft)	Lithologic Description
2	28-38	28-38	9	24.9-27.0	Dark grey mudstone with minor silt; no apparent varve bedding - rock is massive mudstone. Trace of a paper thin light grey layer containing tiny (<<1 mm) wheat-like oval grains - some concentric layered - these grains mildly effervesce in HCl; these grains are probably oolite structures.
				28-31.5	Dark grey, silty mudstone grading downward into muddy siltstone and into very fine-grained sandstone and back into siltstone. Interval contains an oolite zone (2 inches) thick with CaCO <sub>3</sub> oolites up to 1 mm. Other wispy, lighter grey layers (up to 1 cm thick) also effervesce in HCl but otherwise are indistinct as oolite layers
				31.5-31.8	Sedimentary breccia layer with oxidized and nonoxidized heterolithic, subrounded to angular, volcanic clasts in a dark grey very fine-grained sandstone (poorly lithified) matrix.
				31.8-37.2	Dark grey, massive, well sorted, poorly lithified, very fine-grained to fine-grained volcanoclastic sandstone.
3	38-47.5	38-48	10	38-44	Dark grey, well sorted, subrounded, very fine-grained sandstone. At approximately 42 feet depth there is a 4 inch thick light grey zone - somewhat interbedded with dark grey sandstone, consisting of clay with minor silt grains. No shearing observed; clay mineralogy uncertain. Slight varve-like laminations at the bottom of this zone along with more dark grey very fine-grained sandstone containing tiny hematite specs (grains).
				44-46.4	Dark grey volcanoclastic siltstone/very fine-grained sandstone (poorly lithified) containing unoxidized, subrounded and rounded darker grey siltstone/sandstone clasts and lighter grey clay rip up fragments. This interval grades down hole into medium-grained sandstone with more abundant small (up to 1 cm) subrounded sedimentary lithic clasts.
4	47.5-57.5	48-58	8.5	46.4-48.1	Dark grey, lithic choked, fine-medium-grained volcanoclastic sandstone containing 85-95% multicolored oxidized and unoxidized, subrounded to angular volcanoclastic sedimentary fragments mostly of fine-grained sandstone and siltstone and less abundant volcanic lithic fragments. Fragments are generally 1 cm or less in size.
				48.1-49.8	Same sedimentary breccia as above but with predominantly very fine-grained sedimentary lithic fragments in a more medium brown, poorly lithified, mudstone matrix.

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Sheet No. 3

Log By: R.F. Hardyman

Date: 3/5&8/02

(Int = interval, Rec = recovery)

Box No.	Int in box	Rod Int (Depth) (ft)	Rec for rod Int (ft)	Core Int (ft)	Lithologic Description
5	57.5-92	48 (box 4) to 58	8.5	49.8-53.2	With no sharp lithologic contact (just one large - perhaps to 10 cm, coarse-grained, clay altered, porphyritic, plagioclase plus trace pyroxene andesite clast) the sedimentary breccia of above (debris flow probably) becomes medium dark green in color with a fine-grained clay altered(?) sandy matrix. This poorly lithified interval contains minor amounts of very fine-grained disseminated fresh pyrite.
				53.2-57.5	The sedimentary debris flow breccia unit becomes more dark brown grey with more abundant lithic clasts and more oxidized sedimentary lithic clasts and less abundant volcanic lithic clasts. Clasts range in size from less than .5 cm to 3-4 cm. Scattered, fresh, very fine-grained disseminated pyrite is less abundant than in the above interval but is still present. An unidentified white, fine-grained crystalline mineral (zeolite ?) is present as fracture coatings, as coatings around some lithic clasts and in small (1-2 mm) open vugs in this interval. <b>Date: 3/8/02</b>
				57.5-58	Bottom of the dark brown grey sedimentary debris flow interval; disseminated fresh pyrite still present; unidentified white, fine-grained crystalline mineral (non everescent in HCl) still present. Rock is very clay rich and poorly lithified.
				58-60	0
				60-62	0
		62-68	0		
		68-78	1.5		Recovered 1.5 ft. of core from somewhere in this 68-78 ft. depth interval consists of medium grey-greenish grey, massive clay (mudstone) now (very early AM - cold) contains dessication cracks and acicular ice crystals (these melt when set in the sun) and ice in tiny cracks. No evidence of shearing (slickensided surfaces) in this clay zone. Bottom .5 feet of zone contains
		78-88	2.5		Recovered 2.5 feet of core from the 78-88 ft. depth interval consists of reddish brown (at top) to medium grey (grading downward), clay rich, medium-grained grading downward to fine-grained, sandstone consisting of rounded to subangular grains of predominantly volcanic lithic fragments and feldspar plus trace quartz sand grains. Rock contains scattered mud pellets up to 6 mm.

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Sheet No. 4

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Date: 3/8/02

(Int = interval, Rec = recovery)

Box No.	Int in box	Rod Int (Depth) (ft)	Rec for rod Int (ft)	Core Int (ft)	Lithologic Description
6	92-101	88-98	10	88-99	Interval consists of medium grey - greenish red and brown silty mudstone with a 1 foot zone (no sharp lithologic contacts) of siltstone at 92 ft. The mudstone contains occasional vug-like intergrowths of fine-medium-grained crystalline calcite. At 96 ft. this silty mudstone horizon becomes pebbly with about 2-3% scattered rounded, aphanitic, light-medium grey and black volcanic lithic fragments and occasional light grey, very fine-grained sedimentary lithic fragments. This pebbly zone grades downward into a zone from 97.8 to 99 ft. that contains 30-40% rounded - subrounded lithic fragments.
				99-101	The moderately lithic rich silty mudstone above grades rather sharply downward into medium grey - brown grey, very clay rich, moderately well sorted, fine-grained sandstone (discernable fine-grained sand grains) with scatter oxidized sedimentary fragments and trace volcanic lithic fragments. This poorly lithified, clay-rich sandstone contains minor - modest amounts of interstitial secondary calcite.
7	101-113	98-108	7.0	101-108	The clay rich, fine-grained sandstone grades downward into similar appearing clay-rich siltstone or silty mudstone containing occasional small (< .5 cm), rounded lithic fragments. This poorly lithified rock is massive; no discernable bedding observed. The rock is weakly magnetic due to silt sized magnetite grains.
				108-113	Same lithology as above interval. Poorly lithified rock contains minor interstitial coatings and discontinuous veinlets (1-2 mm wide) of white calcite. Some oxidation "bands" occur in this rock. At approximately 111 ft the rock becomes more pebbly (rounded lithic clasts to .5 cm) and more sandy but still clay rich.
		108-118	9.0	108-113	Same lithology as above interval. Poorly lithified rock contains minor interstitial coatings and discontinuous veinlets (1-2 mm wide) of white calcite. Some oxidation "bands" occur in this rock. At approximately 111 ft the rock becomes more pebbly (rounded lithic clasts to .5 cm) and more sandy but still clay rich.
8	113-133	113-115	0	113-115	Same unit as above interval. Rounded clasts (up to 2 cm) become more abundant and rock resembles a medium-coarse-grained sedimentary debris flow with a clay-rich sandy matrix. Minor interstitial and trace vein-like white calcite is somewhat "sugary".
				115-118	Above rock unit grades fairly abruptly downward into medium grey brown-grey, clay-rich, poorly lithified, medium-grained, moderately poorly sorted, volcaniclastic sandstone containing only minor interstitial or veinlet calcite.
		118-128	0		
		128-138	10	128-129 129-132	Chocolate brown, massive, poorly lithified mudstone (grades into rock below). Greenish-grey, pebbly (clasts .5 cm or less), poorly sorted, fine-grained, clay-rich sandstone.

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Sheet No. 5

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Box No.	Int in box	Rod Int (Depth) (ft)	Rec for rod Int (ft)	Core Int (ft)	Lithologic Description
9	133-142.5	138-148	10	133-138	Lithology remains greenish grey (local blotchy dark rusty-brown oxidation), pebbly (lithic clasts up to 8mm but generally < 5 mm), poorly sorted, poorly lithified, fine-grained, clay-rich volcanoclastic sandstone containing scattered blotches of interstitial and minor discontinuous veinlets of sugary white calcite.
				138-142.5	Same lithology (unit) as above only with more (approximately 3-5%) sugary white calcite.
10	142.5-154	148-158	10	142.5-146.5	Same lithology (unit) as above but pebbly lithics fall off in abundance to < .5% and the green, fine-grained sandstone becomes more clay-rich and finer grained and grades downward into mudstone.
				146.5-152	Greenish grey and medium grey, massive mudstone containing only an occasional lithic pebble (.5 cm or less) and only trace sugary calcite veinlet (at approximately 150.8 ft.). This unit locally contains rip up clasts of very fine-grained (amorphous appearing) sedimentary rock and trace rounded volcanic pebbles (< .5 cm) at the base. This mudstone grades imperceptibly downward into clayey siltstone.
				152-154	Medium green-grey, clayey siltstone containing scattered light grey and reddish (oxidized), rounded lithic fragments (< .5 cm). This siltstone layer grades downward into a lithic rich sedimentary breccia zone.
11	151-160.5	158-168	10	154-156.4	Interval consists of a greenish-grey sedimentary breccia zone containing abundant (60% +/-) subrounded, light reddish brown and green mudstone clasts (up to 3 cm), dark brown siltstone (up to 3 cm), and much smaller (6 mm or less) rounded volcanic clasts set in a clayey siltstone to fine-grained sandstone matrix. The base of this sedimentary breccia zone consists of a 5 cm thick coarse-grained volcanoclastic sandstone/wacke layer that grades upward into the sedimentary breccia. This sandstone/wacke layer has a slightly sharp but irregular - channel fill contact with underlying mudstone but both this sharp contact and bedding (green and dark grey layers) in the underlying mudstone dip about 10-13 degrees from the horizontal.

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Sheet No. 6

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Box No.	Int in box	Rod Int (Depth) (ft)	Rec for rod Int (ft)	Core Int (ft)	Lithologic Description
				156.4-160.5	Greenish grey and dark grey (at top) grading downward into greenish-grey massive mudstone containing scattered small (< .5 cm) rounded sedimentary (mudstone - siltstone) pebbles near the top and increasing in abundance to 2 - 3% downward. The top few inches of this mudstone contain definite plant fragments and very fine-grained pyrite "smears" on apparent bedding planes. Most of the plant fragments are replaced by specular hematite. This mudstone unit grades downward into silty mudstone, still with small (< .5 cm) rounded to subangular lithic fragments and traces of fine-grained disseminated pyrite.
12	160.5-170			160.5-163	Greenish-grey silty mudstone. At 163 ft. there is a zone 6 inches thick of relatively abundant (3-5%) white, sugary and crystalline calcite veining.
				163.5-165	Same lithology as above; grades abruptly (no discernable contact) into fine-grained sandstone.
				165-169.5	Medium grey-greenish grey, fine-grained sandstone without pebbles at the top grading downward into same sandstone with a pebble (rounded to subrounded, to 1.5 cm, volcanic and sedimentary lithic clasts) rich zone approximately .9 inches thick at 166.5 ft.; pebbles fall off in abundance down to 169.5 ft.
13	170-180	168-178	8.9	169.5-171.1	Medium grey to dark grey, lithic-rich, sedimentary breccia zone that grades downward into a 4 inch "layer" of coarse-grained volcanoclastic sandstone of the same lithology which has channeled into a 2 inch fine-grained sandstone layer below which contains a 1.5 inch "conglomeratic" layer (lithic fragments to 1 cm but one fragment is 4 cm) at its base. Apparent faint bedding in the fine-grained sandstone dips 10-15 degrees from horizontal (in the core). Abundant coarse-grained interstitial and trace hairline veinlet calcite occurs at 170.4 to 171.1 ft.
				171.1-174.9	Medium grey, pebbly (pebbles generally < .5 cm but up to 1.5 cm), fine-medium-grained sandstone which is channeled into an underlying 9 inch thick siltstone layer which, in turn, is channeled into more fine-medium-grained, pebbly sandstone (as above in this interval) about 1.5 ft. thick which contains a coarse-grained sandstone (pebbly at its base) layer 2 inches thick at its base.
				174.9-180	Massive medium grey siltstone with occasional interbedded fine-medium-grained sandstone layers (2-4 inches thick). Vuggy calcite veining and tight hairline (to 1mm +) veining are prevalent in this interval. Fairly convincing evidence is present of solution pressure brecciation/separation of bedding, within the siltstone locally. Occasional narrow (1-2 inch) pressure solution breccia dikelets are present - generally these are subparallel to what is probably bedding.

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Sheet No. 7

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Box No.	Int in box	Rod Int (Depth) (ft)	Rec for rod Int (ft)	Core Int (ft)	Lithologic Description
14	180-213	178-188	5.6	180-188	Interval consists of the same medium-dark grey, massive, siltstone as above. Interval contains approximately 1-2% hairline and 1-2 mm wide calcite veinlets; some subhorizontal and others subvertical. Calcite veinlet crosscuts at a high angle a pressure solution breccia dikelet (2 inches wide) at 180 ft. Calcite veinlets decrease in abundance downward in this interval. Trace amount of occasional red (oxidized) volcanic/sedimentary(?) lithic fragments (< .5 cm).
		188-196	0		
		196-206	1	196	Recovered interval (1 ft.) consists of medium-medium dark grey, massive mudstone containing scattered sand grains (1 mm or less) that are mostly lithic grains. No calcite veining.
		206-212.5	5.5		Recovered interval (5.5 ft.) consists of same mudstone unit as above with moderately abundant sand grains and lithic clasts (up to 3 cm, rarely, but generally < .5 cm) of mostly mudstone and siltstone and minor volcanic rock. No calcite veining present.
15	213-228	212.5-218	5.6		Recovered interval (5.6 ft.) consists of more moderately lithic clast rich sandy mudstone - probably a muddy distal part of a sedimentary debris flow. Lithic pebbles (rounded to subangular) constitute approximately 15-20% of the rock.
		218-228	4.5	228	Same pebbly mudstone unit as above but lithics fall off in abundance downward and a less mud-rich siltstone zone ("layer" - no distinct sharp contacts) is present at 226.8 to 227.5 ft.
16	228-241	228-238	6.6	228-230.5	More of the same pebbly mudstone unit with scattered (to 1-2%) rounded-subrounded pebbles (< .5 cm) that are mostly fine-grained sedimentary lithic fragments (mudstone/siltstone). No calcite veining.
				230.5-231	Subvertical (parallel to and on margin of core) coarsely crystalline calcite vein at least 1 cm thick.
				231-232.8	More medium to dark grey mudstone (same unit as above) containing modest interstitial to clotty calcite. Rock contains only scattered lithic pebbles. This mudstone unit grades rather abruptly into the underlying sandstone.
				232.8-234.2	Interval consists of medium grey, medium-grained good hard volcanoclastic sandstone. Rock consists mostly of lithic sand grains + magnetite (mostly altered to hematite - rock is weakly magnetic) cemented by calcite. Trace rounded sedimentary and volcanic(?) lithic clast (up to 2 cm). Scattered "blebby" patches of calcite are present in this sandstone.

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✓ 231

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Sheet No. 8

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(Int = interval, Rec = recovery)

Box No.	Int in box	Rod Int (Depth) (ft)	Rec for rod Int (ft)	Core Int (ft)	Lithologic Description
17	241-251	238-248	8.8	234.2-238	This interval is probably where most of the core loss occurred in the 238-248 rod (depth) interval. Interval consists of medium-dark grey silty mudstone.
				238-240.3	Medium grey silty mudstone grading downward into medium dark grey siltstone.
				240.3-242	Medium grey - dark grey massive siltstone (poorly lithified). No calcite veining. Silt layer grades rather abruptly downward into more pebbly silty mudstone (same unit as recovered above from 196-232.8 ft.).
				242-246	Interval consists of same medium grey-dark grey, massive, pebbly mudstone-silty mudstone (not well lithified) unit as above the sand and silt layers above.
18	251-261	248-258	9.3	246-246.6	6-7 inch breccia horizon. This breccia appears as if it was formed in situ (solution overpressure ? brecciation). Creamy grey amorphous/microcrystalline(?) silica encases and partially replaces the pebbly mudstone breccia fragments. Late calcite in fills vugs in the breccia and calcite veinlets crosscut the creamy grey silica and pebbly mudstone breccia fragments. This breccia zone is very hard.
				246.6-258	More medium dark grey, massive pebbly mudstone-silty mudstone (poorly lithified); same unit as above breccia zone.
19	261-270.5	258-268	10	258-263	Massive medium grey-dark grey mudstone with only scattered lithic pebbles (slightly increasing in abundance downward). This unit grades downward into more lithic rich, silty mudstone with more abundant and generally larger (1 cm) lithic pebbles which appears to be a separate debris flow unit with perhaps this interval marking its top.
				263-265.5	Medium grey, massive, generally coarse-grained, lithic rich, silty mudstone-siltstone debris flow containing 70-80% rounded to subangular lithic fragments ranging in size from < .5 cm to 3-4 cm and occasionally 8 cm. The majority of lithic fragments in this debris flow are sedimentary; identifiable volcanic (lava) fragments constitute perhaps only 1-2% of the lithic fragments and generally are in the < 1 cm size range. Pebbly mudstone-siltstone fragments (reworked debris flow fragments) are dominant along with abundant mudstone, siltstone and fine-grained sandstone fragments. Fine-grained disseminated pyrite is moderately common in the matrix and in lithic clasts. Some clasts contain more abundant and finer grained pyrite suggesting perhaps early pyrite mineralization and later (fine-grained disseminated cubes) pyrite.
				265.5-267.3	Same unit as above only fairly well silicified (rock very hard) with minor open quartz lined vugs and late hairline calcite veinlets and vug infillings.



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Sheet No. 9

Log By: R.F. Hardyman

Date: 3/9/02

(Int = interval, Rec = recovery)

Box No.	Int in box	Rod Int (Depth) (ft)	Rec for rod Int (ft)	Core Int (ft)	Lithologic Description
20	270.5-280	268-278	10	267.3-268.7	9 inch thick, medium grey, coarse-grained, moderately well sorted volcanoclastic sandstone layer. Volcanic +/- sedimentary lithic sand grains + magnetite/hematite (rock weakly magnetic) are cemented in interstitial calcite. Trace pyrite.
				268.7-271	More massive, dark grey, lithic-rich, silty/sandy debris flow unit - moderately silicified and with minor calcite veinlets. Debris flow is channeled into underlying more coarse-grained volcanoclastic sandstone.
				271-273	Interval consists of a complicated intermix of coarse-grained volcanoclastic sandstone and debris flow breccia; debris flow sedimentary breccia appears to channel into and rework the sandstone and possibly the reverse. A 1 inch to 1/2 inch calcite cemented breccia vein occurs at 273 ft.
				273-276.2	Same moderately silicified debris flow breccia only with a more sandy matrix and moderately abundant calcite veining/breccia veining. Some open vugs occur along some veins. Locally in this zone, the carbonate-rich fluids appear to have brecciated the debris flow and reworked the sandy matrix and smaller lithic fragments. At 276.2 ft., more calcite veining (.5 - 1.5 cm wide) crosscuts the debris flow unit. In one vein calcite replaced blades of (?) (gypsum?/barite?).
				276.2-277.5	Same debris flow unit but rock is medium brown in color; still moderately well silicified but without calcite veining.
				277.5-278.6	Dark brown, coarse-grained volcanoclastic sandstone layer; layer appears to have been channeled into by debris flow unit above and overlies (fairly sharp contact) more debris flow sedimentary breccia.
21	280-289	278-288	10	278.6-282	More lithic-rich debris flow breccia (as above) with abundant interstitial and veinlet (tight veins) calcite. Lithic fragments in the debris flow appear to be falling off in abundance down core and be getting smaller (generally 6 mm or less but occasionally to 2 cm).
				282-286	Same debris flow sedimentary breccia unit (as above) but more dark brown-grey in color. Heterolithic with lithic clasts still dominated by sedimentary rock (one rounded 3.5 cm clast consists of medium-grained porphyritic plagioclase +/- pyroxene basalt). Minor calcite veining in this interval. Matrix of the debris flow in this interval is more sandy (fine-medium-grained sand).
				286-289.5	Same dark brown-grey debris flow unit; modest calcite veining. Traces disseminated fine-grained pyrite and hairline veinlet pyrite

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Sheet No. 10

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(Int = interval, Rec = recovery)

Box No.	Int in box	Rod Int (Depth) (ft)	Rec for rod Int (ft)	Core Int (ft)	Lithologic Description
✓2915 22	289-297	288-298	10	289.5-290	Interval is a medium brown siltstone layer within the same sedimentary breccia debris flow unit as above.
				290-290.6	Same dark brown-grey debris flow unit. Abundant interstitial and vein (somewhat vuggy) calcite. A greenish grey 2 inch thick siltstone layer is present at 290.6 ft.
				290.6-294.6	Same medium grey - dark brown-grey debris flow unit with fairly abundant calcite veining and patches - some vuggy. Calcite veins/patches may equal 12-15% of the interval.
				294.6-298.2	Interval is a grey brown mudstone layer filling a slight channel (with sharp contact) cut into the underlying medium-coarse-grained volcanoclastic sandstone.
				298.2-297	Medium grey - brownish grey, medium-fine-grained sandstone; very weakly magnetic.
23	297-305	288-298	10	297-299.5	(298 ft. "block" in this box) Same medium grey - brownish grey, fine-medium-grained sandstone layer.
				299.5-302.5	Interval is a 3 ft. thick light grey, pebbly, silty debris flow sedimentary breccia containing rounded heterolithologic volcanic and sedimentary clasts up to 1.5 cm. Interval contains abundant (approximately 30%) interstitial, patchy, and vein-like (slightly vuggy) calcite. Some apparent brecciation of the debris flow is present adjacent to and associated with the calcite veining.
24	305-315	298-308	10	302.5-305	Medium grey, medium-grained (top) to fine-grained (lower) volcanoclastic sandstone with trace lithic pebbles. Interval contains a siltstone "parting" (1 - 2 cm thick) and associated calcite veining near the top of the sandstone layer that dips 28 degrees from the horizontal (relative to core). This interval contains some brecciation that resembles over pressure sedimentary vein-like brecciation (reworking of lower sedimentary units upward into pebble dike-like breccia zones/veins) with associated modest calcite veining.
		308-315	7	305-307	(308 ft. "block" in this box) Appears to be same sandstone unit as above only fining down section into very fine-grained sandstone. Six inch thick "zone" of heavy vuggy calcite occurs at 305.3 ft.
				307-315	Interval consists of dark grey, relatively fine-grained, pebbly ( rounded lithic clasts rarely to 3.5 cm; generally .5 cm or less) sedimentary debris flow breccia with identifiable fine-grained sedimentary debris flow and probable lava lithic clasts. Interval contains some brecciation, probably due to the abundant (50-60% of core) introduced calcite. Calcite occurs interstitially to breccia clasts and in fairly vuggy (fairly abundant open spaces) massive clots.

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✓314

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Sheet No. 11

Log By: R.F. Hardyman

Date: 3/14/02

(Int = interval, Rec = recovery)

Box No.	Int in box	Rod Int (Depth) (ft)	Rec for rod Int (ft)	Core Int (ft)	Lithologic Description
25	315-323.5	315-318	3	315-318.5	Recovered core interval consists of the same (as above) dark grey, well lithified, moderately coarse (rounded to occasionally subangular lithic clasts ranging in size from < .5 cm to 2.5 cm), silty fine-grained sedimentary debris flow breccia. Clasts consist predominantly of siltstone (dark grey and dark brown), mudstone (tan and green grey), fine and medium-grained sandstone (light grey, brownish grey), silty debris flow fragments and trace volcanic (aphanitic to micro porphyritic) lithic fragments. Lithic fragments constitute approximately 20-25 % of the rock. Interstitial to slightly brecciated matrix cementing and vein/minor fracture cementing calcite is abundant. The interval from 317 - 318.5 feet consists of approximately 55 - 70% calcite (patchy and vein calcite) that is somewhat vuggy (open spaces 1 - 2 cm long to .5 cm wide). Late euhedral quartz crystals line some vugs in the calcite.
				318.5-323.5	
26	323.5-332	318-328	10	323.5-332	Interval consists of the same medium grey - brown-grey sedimentary debris flow breccia unit as above. Clasts increase in abundance to 30 - 40% of the rock and include a greenish debris flow lithic clast/cobble (12 cm), medium-grained sandstone (5 cm), and fine-grained porphyritic lava (andesitic - basaltic) clasts (3 cm). Most clasts are 2.5 cm or less in size. Calcite constitutes generally < 1% of the rock but locally (325.5 - 327.5) calcite (interstitial, vein and patchy) constitutes 3-5% of the rock. At 326.5 ft. a 1 inch fairly vuggy crystalline calcite vein irregularly crosscuts the debris flow unit.
27	332-340.5	328-338	10	332-335.3	Same dark grey - brown grey debris flow unit as above with 1% calcite or less. At 333.6 ft. a 7.5 cm wide massive calcite vein (trace intergrown cockscomb bladed quartz at the top) crosscuts the core at a 30 degree angle (from horizontal to the core).
				335.3-339	

✓ 318

✓ 333

**LAKE CITY GEOTHERMAL, LLC**  
**Lake City Observation Hole No. 1**

Sheet No. 12

Log By: R.F. Hardyman

Date: 3/14/02

(Int = interval, Rec = recovery)

Box No.	Int in box	Rod Int (Depth) (ft)	Rec for rod Int (ft)	Core Int (ft)	Lithologic Description
28	340.5-349.5	338-348	10	339-340.5	The above sandstone layer appears to channel into underlying sedimentary debris flow breccia. Trace tiny (1-2 mm wide to 5 mm long) silicified (?) plant fragments occur at this "contact". The underlying debris flow breccia is also "battleship" grey, and medium-grained (rounded clasts to 1.5 cm). Clasts constitute perhaps 20% of this silty, matrix supported debris flow. At about 340 ft. this debris flow breccia itself is brecciated with solution (overpressure ?) breccia dikelets veining through the rock and isolating the debris flow rock into "fragments" 2 - 6 cm in size. The breccia dike-like vein material contains abundant fragments (1 cm or less) of reworked debris flow rock cemented in silt and modest amounts of interstitial calcite.
				340.5-342	Locally in this zone, calcite constitutes 3 - 5% of the brecciated debris flow. The
				342-344.5	Brecciation of the debris flow unit decreases downward in this interval. At 344.5 ft. the debris flow unit grades downward into very coarse-grained, moderately poorly sorted, volcanoclastic sandstone.
				344.5-346.5	Medium grey - greenish grey, coarse-grained, moderately poorly sorted, volcanoclastic sandstone; very weakly magnetic. This sandstone interval contains 1 - 3% vein calcite, and sand grains are cemented with interstitial calcite. Some irregularly shaped intermixed silty clay stringers/patches occur in this sandstone layer.
29	349.5-357.5			346.5-347.4	The sandstone layer becomes very pebbly - lithic rich (rounded - subangular clasts generally < .5 cm but up to 1.5 cm in size). Lithic fragments (40 - 45%) are predominantly of fine-grained sedimentary rock with noticeably abundant lavender brown siltstone fragments. Lithic fragments become smaller perhaps downward and drop in abundance to approximately 30% of the rock.
				347.4-350	Same pebbly sandstone unit as the above interval but rock is highly fractured and somewhat silicified. Fractures and "cracks" are open to calcite and silica cemented. A faint fabric is present with these fractures/cracks that dips 40 degrees from horizontal (to the core). One 4 mm wide calcite vein also has this orientation another 2-4 mm wide vein orthogonal to it. At 350 ft., a 5 - 7 mm wide silica and calcite vein, encased in silicified clay, dips 50 degrees from horizontal. Trace fine-grained pyrite occurs in the silicified clay. No shearing observed in the clay.
				350-353	Same sandstone unit as above but more greenish in color and more clay rich. Green clay is somewhat irregularly distributed in the sandstone in irregular patches and stringers. Rock displays a weak fabric (not shearing but not really bedding either) that dips approximately 60 degrees from horizontal.
				353-354.3	Same rock as above but containing 10 - 20% scattered "patches" (up to 2 cm) and "rhombs" (.5 - 1 cm) of white calcite.

**LAKE CITY GEOTHERMAL, LLC**  
**Lake City Observation Hole No. 1**

Sheet No. 13

Log By: R.F. Hardyman

Date: 3/14/02

(Int = interval, Rec = recovery)

Box No.	Int in box	Rod Int (Depth) (ft)	Rec for rod Int (ft)	Core Int (ft)	Lithologic Description
				354.3-355.3	Rock appears to be the same fine-grained sandstone but more clay rich grading down hole into brown siltstone around 355.3 ft.
				355.3-356.5	Interval consists of medium brown siltstone with occasional hairline to 1 - 3 mm wide tight and drusy quartz veinlets and planar fracture fillings dipping generally 45 degrees from horizontal (to the core). The bottom 6 inches of this siltstone consists of interlayered, hard, chocolate brown clay and greenish, soft, amorphous smectite that together looks like this 6 inch zone could be a minor fault/fracture zone oriented about 60 degrees from horizontal (to the core). Trace hairline pyrite and silica veinlets occur in this narrow zone. No unequivocal slickensided surfaces observed associated with this zone.
		348-358	10	356.5-357.5	Interval consists of greenish grey and brownish grey, medium grained, pebbly sandstone that is slightly clay altered(?). Core is not good - very broken up - in this interval.
30	357.5-374			357.5-358	Apparently the same unit as the above interval, but with better pieces of core it is apparent that the rock consists of medium brown grey - brown, lithic-rich (rounded to subangular clasts ranging in size from < .5 cm to 3 cm), sedimentary debris flow containing 45 - 60% lithic fragments in a matrix supported fine-medium-grained sandy matrix. Calcite veinlets (1 - 2 mm wide or less) constitute approximately .5 - 1% of the rock.
		358-368	2		Recovered pieces of core from this interval (rod interval) appear to be of the same sedimentary debris flow unit as above. Interval may have contained poorly lithified clay lenses. Some lithic fragments appear to be moderately silicified. Trace calcite veining.
				368-374	Same sedimentary debris flow unit as above. Surprisingly, the dominant clast lithology is volcanic not sedimentary. Sedimentary fragments are rare; fine- and medium-grained porphyritic (phenocrysts up to 2 mm) plagioclase +/- pyrobole (pyroxene - amphibole) phenocrystic intermediate composition volcanic fragments (at least 2-3 different lithologies) make up nearly 100% of the lithic fragments. Calcite veins (2 mm or less wide) and calcite + green smectite veins constitute 1 - 2% of the rock; some veins are irregular in trace - some are planar.
31	374-383	368-375.5	7.3	374-377.5	Same medium grey - brownish grey volcanic lithic fragment rich sedimentary breccia as above which grades downward into nearly lithic devoid medium brown grey, medium to coarse-grained, massive volcanoclastic sandstone (from 375 to 377.5 ft.) containing ubiquitous rounded - subrounded sand grain sized plagioclase feldspar grains and volcanic lithic grains in a finer grained silty matrix containing some calcite cement. Except for the occasional obvious lithic clast (up to 4 mm), the nearly uniform grain size and grain abundance makes this rock almost resemble a fine-grained lava. Calcite and calcite + smectite veins and planar fracture fillings constitute 2 - 4% of the rock.

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# LAKE CITY GEOTHERMAL, LLC

## Lake City Observation Hole No. 1

Sheet No. 14

Log By: R.F. Hardyman

Date: 3/14/02

(Int = interval, Rec = recovery)

Box No.	Int in box	Rod Int (Depth) (ft)	Rec for rod Int (ft)	Core Int (ft)	Lithologic Description
				377.5-379.5	Rock in this interval consists of more medium grey - brown grey sedimentary breccia; part of the same unit as above the sandstone horizon. Again calcite and calcite + smectite veins/fracture fillings (up to 7 mm wide) constitute 2 - 4% of the rock are steeply dipping. Traces of fine-grained pyrite are present.
		375.5-384	8.5		
				379.5-383	The sedimentary breccia grades rather sharply downward into medium grey siltstone containing scattered small lithic pebbles and plagioclase grains (up to 1.5 mm) suspended in a silt matrix. Rock interval contains 1 - 2% calcite veins.
32	383-393	384-388	4	383-393	Rock cored is the same medium grey - brown grey, lithic rich (50 - 60%, rounded to subangular lithic fragments ranging in size from < .5 cm to 4 cm) sedimentary debris flow breccia (I.e. mudflow breccia) as in the intervals above the sandstone and siltstone horizons (lenses ?) above. Lithic clasts are multicolored (greys, greens, browns) and heterolithologic but are dominated by clasts of intermediate composition and mafic (?) composition volcanic rock. Several different textural varieties of volcanic clasts are present including various porphyritic lithologies and micro vesicular and amygdaloidal lava. Amygdules in some clasts are filled with an amorphous green mineral which is probably chlorophaeite. Siltstone and fine-grained sandstone clasts are present in this debris flow breccia but vary in amounts. Rock is crosscut by hairline to 6 - 8 mm wide calcite and calcite + smectite veins of random orientation but usually steeply dipping. Veins are not vuggy. Traces of pyrite occur throughout this interval.
		388-398	10		
33	393-402			393-397.9	Interval consists of the same medium grey - brown grey, volcanic lithic rich sedimentary debris flow unit as above. One 15 cm clast (small boulder) occurs at 393.3 ft. Most of the clasts in the rock in this interval are 4 cm or less in size. Calcite and calcite + smectite veins in this interval of rock are generally steep to subvertical (one vein can be traced for 2.5 ft.) and constitute 1 - 3 % of the rock. This rock is weakly magnetic. This debris flow unit displays an irregular channel cut and fill contact (dipping about 40 degrees from horizontal to the core) with underlying volcaniclastic sandstone.
				397.9-399	The core in this interval consists of medium grey, fine-medium-grained volcaniclastic sandstone containing dominant feldspar grains. The sandstone is fairly well sorted but contains traces of small (< 4 mm) lithic "grains" and scattered altered pyrobole (pyroxene +/- amphibole) "grains". The matrix of this sandstone appears to be rich in clay and contains interstitial calcite cement. This sandstone probably represents a channel fill sandstone lens within the sedimentary debris flow unit above.
		398-408	10		

**LAKE CITY GEOTHERMAL, LLC**  
**Lake City Observation Hole No. 1**

Sheet No. 15

Log By: R.F. Hardyman

Date: 3/15/02

(Int = interval, Rec = recovery)

Box No.	Int in box	Rod Int (Depth) (ft)	Rec for rod Int (ft)	Core Int (ft)	Lithologic Description
				399-402	This interval consists of the same sedimentary debris flow breccia rock as is present above the sandstone lens (above) only this section of core is dominated by two volcanic boulders, each approximately 1 ft. across. One boulder consists of micro amygdaloidal aphanitic andesite containing abundant amygdules (< 1 mm in size) filled with chlorophaeite and the other aphanitic boulder contains fresh pyrobole (pyroxene +/- amphibole) microphenocrysts. These boulders are separated by three inches of debris flow rock and overlie more debris flow breccia.
34	402-410	408-418	9	402-420	Interval consists of more of the medium grey, dark brown grey, lithic rich, nearly exclusively volcanic lithic bearing sedimentary debris flow breccia. Rounded to subangular heterolithologic lithic clasts (up to 8 cm but generally 2 - 5 cm or less) constitute 40 - 60% of this unit and are matrix supported in dark brown, fine to medium-grained silty sandstone. Clasts consist of various shades of grey (light and dark), medium - dark brown and reddish brown volcanic rock displaying multiple textures; lithic fragments range from aphanitic, aphyric to fine-grained porphyritic. Lithic fragments appear to consist mainly of intermediate composition (andesite) volcanic rock. Clasts are with and without micro amygdules (chlorophaeite infilled) and with and without unaltered pyrobole phenocrysts. Trace fine-grained sedimentary lithic clasts (siltstone - fine-grained sandstone) are present. Crosscutting calcite and calcite + green smectite +/- chlorite veins/veinlets constitute 1 - 3% of the core and are steeply dipping to subvertical (to core) for the most part. Traces to minor amounts (< 1%) of fine-grained, fresh, disseminated pyrite occur within this core interval.
35	410-420				
36	420-429	418-428	10	420-428.2	Interval consists of the same medium grey - dark brown grey sedimentary debris flow breccia as above; clast abundance is still 40 - 60% of the rock and perhaps generally larger (10 cm rounded cobbles to 16 cm small rounded boulders) but 2 - 6 cm or less is the dominant size. Calcite veining constitutes 1% or less of the rock in this interval.
				428.2	Composite moderately steeply dipping (50 degrees), 5 - 7 cm wide vein consisting of brown clay + quartz "band" (.5 cm wide) at the top, a .5 cm - 1.5 cm wide central micro crystalline quartz (with fine-grained disseminated fresh pyrite) "band" and a lower more irregular calcite veining "zone" 2 - 4 cm wide at the bottom. This composite "vein" crosscuts the debris flow unit.
37	429-439	428-438	10	428.2-437	Same debris flow unit as above (clasts still 40 - 60% of the rock but smaller - generally 2 cm or less); calcite and calcite plus chlorite veining < 1%.

✓428

# LAKE CITY GEOTHERMAL, LLC

## Lake City Observation Hole No. 1

Sheet No. 16

Log By: R.F. Hardyman

Date: 3/15/02

(Int = interval, Rec = recovery)

Box No.	Int in box	Rod Int (Depth) (ft)	Rec for rod Int (ft)	Core Int (ft)	Lithologic Description
38	439-446			437-442	The sedimentary debris flow unit grades downward into green and dark brown fine-grained sandstone and muddy siltstone (green and brown "layers") locally (best displayed around 439 ft.) displaying 1 - 2 cm scale bedding. Bedding is somewhat cut and fill to lensoid and some soft sediment compaction deformation features are present. Calcite and calcite plus chlorite veining constitutes < 1% of the interval near the top to 3 - 5% near the bottom; some 1 - 3 mm calcite + chlorite veins cut earlier calcite veins. Fresh fine-grained disseminated pyrite locally constitutes up to 1% of the greenish grey rock in this interval.
				442-446	The fine-grained sandstone interval grades abruptly downward into more medium grey - dark brown sedimentary debris flow breccia, the same sedimentary debris flow unit as above the sandstone horizon.
					Note: The whole interval of the debris flow unit is well lithified.
39	446-455	438-448	10	446-452.5	Interval consists of the same dark brown, volcanic lithic rich sedimentary debris flow unit as above. Lithics are generally 2 cm or less and have fallen off in abundance to about 30%. Calcite veining constitutes 1 - 1.5% of the interval.
				452.5	The debris flow unit overlies in sharp contact (subhorizontal - probably the bottom of a large channel or trough) more dark brown, fine-medium-grained volcaniclastic sandstone with scattered lithic pebbles. A brown mudstone "parting" at the contact (base of sandstone) displays soft sediment deformation "flame" structures. Calcite and calcite with minor chlorite (selvages) veins constitute < 1% of the rock.
40	455-462	448-458	10	452.5-462	Interval consists of the same dark grey - dark brown grey fine - medium-grained sandstone containing an occasional obvious lithic clast (up to 3.5 cm) of fine-grained, dark grey, intermediate composition (andesitic) lava. Very coarse to coarse-grained sand grains in the sandstone are composed mostly of this same andesitic lava unit. The sandstone unit locally displays faint bedding and/or slump features with intermixed sandstone and silty clay "layers". Calcite and calcite + smectite veins and fracture fillings constitute < 1% of this rock interval.
41	462-471	458-468	10	462-471	π
42	471-479	468-478	10	471-479	Interval consists of the same massive sandstone unit containing discernable lithic clasts but no discernable bedding.



# LAKE CITY GEOTHERMAL, LLC

## Lake City Observation Hole No. 1

Sheet No. 17

Log By: R.F. Hardyman

Date: 3/15/02

(Int = interval, Rec = recovery)

Box No.	Int in box	Rod Int (Depth) (ft)	Rec for rod Int (ft)	Core Int (ft)	Lithologic Description
43	479-487	478-488	-10	479-487	Core interval consists of same sandstone unit as above with rounded - subangular, monolithologic, fine - medium-grained, plagioclase + scattered pyrobole bearing andesitic lava clasts (lithic fragments constitute 25 - 30% of the rock and are 1.5 cm less in size), abundant plagioclase feldspar and scattered altered pyrobole grains in a matrix support of fine - medium-grained sand. Calcite + smectite veins constitute 1 - 2% of this core interval; generally they are oriented subparallel to the core long axis.
44	487-495			487-495	Same sandstone unit in this core interval as above but the rock is becoming finer grained and without many obvious lithic clasts going down section ( except for a 1 ft. thick sedimentary breccia zone at 488 ft). "Wavy" - somewhat contorted "bedding" with partings of more clayey siltstone suggest soft sediment deformation locally within this sandstone unit. Calcite and calcite + smectite veinlets constitute < 1% of this core interval.
45	495-504	488-498	10	495-499 499-504	Same sandstone - pebbly sandstone unit as above but sandstone is grading down section into more sedimentary debris flow breccia rock. Interval consists of medium dark brown, moderately coarse-grained (rounded - subangular clasts up to 2 cm or less), heterolithologic sedimentary debris flow breccia. Clasts consist predominantly of intermediate composition volcanic lithologies of more than one type and an occasional very fine-grained sedimentary rock fragment. Calcite +/- smectite veining constitutes < .5% of this core interval.
46	504-512.5	498-508	10	504-508.5 508.5-512.5	The dark brown debris flow unit contains perhaps 2 - 3% calcite + smectite veins/veinlets (1 - 2 mm wide) in this interval. Debris flow unit becomes medium grey - brown grey in color and coarser grained with rounded to subangular, heterolithologic volcanic and trace sedimentary lithic clasts up to 7 cm (cobble size) but generally 3 - 4 cm or less in size. Clasts constitute 25 - 30% of the rock and include aphanitic, aphyric, and fine-grained porphyritic volcanic lithologies of various colors. Trace hairline calcite veining is present.
47	512.5-520	508-518	10	512.5-520	Same unit and description as above; trace hairline calcite veining; trace irregular patchy calcite intergrowths/vein segments (.5 cm wide). Traces of wispy carbon fragments (carbonized plant fragments) occur at 519.8 ft. and below.
48	520-529			520-520.5 520.5-524	More debris flow unit as above with traces of carbon fragments is in sharp irregular contact with an underlying very fine-grained sandstone - silty sandstone. Medium grey - dark grey very fine-grained sandstone with scattered matrix suspended rounded lithic fragments (.5 cm or less, rarely to 2 cm) constitutes this core interval. This sandstone layer contains wispy, black carbonized plant debris (perhaps .25% of rock) fragments from < .5 cm up 3.5 cm in size. Calcite + smectite +/- chlorite veins (1 - 4 mm wide but one vein 4 cm wide) and some "ladder" veins constitute approximately 2 - 4% of this sandstone interval. The sandstone grades downward within .5 ft. into more of the same sedimentary debris flow breccia unit as above the sandstone layer.

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# LAKE CITY GEOTHERMAL, LLC

## Lake City Observation Hole No. 1

Sheet No. 18

Log By: R.F. Hardyman

Date: 3/15/02

(Int = interval, Rec = recovery)

Box No.	Int in box	Rod Int (Depth) (ft)	Rec for rod Int (ft)	Core Int (ft)	Lithologic Description
		518-528	10		
				524-529	Medium grey - brownish grey sedimentary debris flow breccia (as above) containing 20 - 30% rounded - subrounded volcanic (andesite) and definite fine-grained sedimentary (siltstone - very fine-grained sandstone) lithic fragments (up to 2.5 cm) set in a medium - coarse-grained sandstone matrix. Calcite and calcite + smectite veins constitute < 1% of the rock but one .5 - 1 cm vein fragment parallels the core for approximately 1 ft. at 526 ft.
49	529-538			529-538	Same sedimentary debris flow unit as above with no description changes.
		528-538	10		
50	538-547	538-548	10	538-547	Same sedimentary debris flow unit as above. Rounded to occasional subangular, heterolithologic clasts are generally 3 - 4 cm or less but occasionally are up to small boulder size (15 cm). Hairline to 1 - 2 mm wide calcite veins are less than .5% of the rock in this core interval.
51	547-556			547-556	Core interval consists of the same dark grey - brown grey, moderately coarse grained and moderately lithic - rich sedimentary debris flow breccia as above. Rounded to occasionally subangular lithic clasts (20 - 25% of rock) are approximately 90% volcanic rock and 10% fine-grained sedimentary rock. Volcanic lithic clasts range in size from 2 - 6 cm but are generally 2 - 3 cm or less. Sedimentary lithic clasts are generally 2 cm or less in size. Variably colored volcanic lithic fragments include aphanitic, aphyric, fine-grained granular and fine-grained porphyritic lithologies that appear to be predominantly andesite. Ferromagnesian phenocrysts/microphenocrysts are fresh, chlorite altered or oxidized to hematite in various clasts. Calcite veining in this interval is minor (<< .5% of rock).
		548-558	10		
52	556-565			556-565	Core interval consists of the same dark grey - brown grey sedimentary debris flow breccia as above; clasts (25 - 30% of rock) are up to 7 cm but generally less than 3 - 4 cm. Calcite and calcite + smectite veins (hairline to 1 - 2 mm wide) are < .5% in abundance and are sub vertical to vertical (parallel to core) in orientation.
		558-568	9		
53	565-574			565-574	Core interval description same as above (same debris flow unit); calcite and calcite + smectite veins (hairline to 1 - 3 mm wide; a couple are .5 - 1.5 cm wide with trace vugs in the widest veins) constitute < 1% of the rock; are subvertical, slightly splay and extend for 2 + vertical feet in the core. Lithic clasts are still occasionally up to 10 cm.
		569-578	10.5		(Note: .5 ft. of core from interval above
54	574-582			574-576.5	More of the debris flow unit (as above). At approximately 575.9 ft. a .5 - 1 cm wide dark brown clay "seam" dips at 30 degrees (from horizontal to the core); this clay seam displays internal slickensided surfaces - some with a thin film of calcite coating. This slickensided clay seam (gouge) represents a minor shear plane.

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**LAKE CITY GEOTHERMAL, LLC**  
**Lake City Observation Hole No. 1**

Sheet No. 19

Log By: R.F. Hardyman

Date: 3/15/02

(Int = interval, Rec = recovery)

Box No.	Int in box	Rod Int (Depth) (ft)	Rec for rod Int (ft)	Core Int (ft)	Lithologic Description
				576.5-577	The rock in this core interval is a medium - dark grey, fine- medium-grained granular volcanic rock (andesite) containing abundant ( 85 - 90%) white, euhedral - subhedral plagioclase feldspar phenocrysts and scattered (approximately 10% of the rock) chlorite altered pyrobole crystals in an aphanitic matrix. One faint contact indicates this rock crosscuts (?) the debris flow unit or the debris flow unit encloses a boulder of andesite. No baking or interdigitation occurs along the contact.
				577-578	More debris flow unit rock
				578-582	Rock is the same fine - medium-grained equigranular andesite as the 576.5 - 577 ft. interval above. Because of a core break at the 578 ft. "block" the upper contact of the andesite in this interval is not preserved. This andesite could be a dike/sill of flow (probably not). The andesite at 576.5 - 577 ft. could be an hypophesis of this dike/sill; otherwise this andesite is a large boulder in the debris flow unit.
55	582-591	578-588	10	582-583	This core interval consists of the same andesite as above that, here, is somewhat "blotchy" in appearance with oxidized blotches - some resembling rounded clasts. Possibly this blotchy "zone" represents a somewhat auto brecciated margin to the andesite sill/dike that has in part incorporated some of the debris flow unit. This "contact" zone is not definitive in core.
				583-591	More of the same debris flow breccia as above. Trace minor fluid pressure (?) breccia dikes crosscut the clasts in this debris flow. Heterolithologic lithic clasts (to 7 cm) constitute approximately 35-45% of the rock and are matrix supported in well lithified, fine - medium-grained sandstone. Hairline to 1 + mm calcite veins constitute << .5% of the rock in this interval.
				591-599.5	Interval consists of more debris flow breccia - probably of the same unit as above. Heterolithologic clasts of volcanic rock and fine-grained sedimentary rock constitute approximately 45 - 50% of the rock but are still matrix supported. Very fine-grained, equigranular, plagioclase + pyrobole (plagioclase to .5 mm) bearing andesite lithic clasts are perhaps more common in this interval. Only trace hairline calcite and calcite + smectite veins are present in this interval of core.
56	591-599.5	588-598	10	591-599.5	Interval consists of more debris flow breccia - probably of the same unit as above. Heterolithologic clasts of volcanic rock and fine-grained sedimentary rock constitute approximately 45 - 50% of the rock but are still matrix supported. Very fine-grained, equigranular, plagioclase + pyrobole (plagioclase to .5 mm) bearing andesite lithic clasts are perhaps more common in this interval. Only trace hairline calcite and calcite + smectite veins are present in this interval of core.
				599.5-607.5	More of the same debris flow breccia. A 1.6 ft andesite boulder occurs at about 604 ft. near the base of this debris flow. Subvertical, narrow (1 - 2 mm) calcite +/- smectite veins may constitute .5% of this interval. The debris flow unit is in irregular contact (channel cut) with an underlying fine - medium-grained, silty and pebbly sandstone.
57	599.5-607.5	598-608	10	599.5-605	More of the same debris flow breccia. A 1.6 ft andesite boulder occurs at about 604 ft. near the base of this debris flow. Subvertical, narrow (1 - 2 mm) calcite +/- smectite veins may constitute .5% of this interval. The debris flow unit is in irregular contact (channel cut) with an underlying fine - medium-grained, silty and pebbly sandstone.

**LAKE CITY GEOTHERMAL, LLC**  
**Lake City Observation Hole No. 1**

Sheet No. 20

Log By: R.F. Hardyman

Date: 3/16/02

(Int = interval, Rec = recovery)

Box No.	Int in box	Rod Int (Depth) (ft)	Rec for rod Int (ft)	Core Int (ft)	Lithologic Description
58	607.5-616.5			605-608	Core interval consists of dark - very dark grey, pebbly (5 - 6% light colored, rounded lithic pebbles up to 4 mm in size), silty, fine-grained sandstone containing black, carbonized plant debris. Carbonized plant fragments (up to 2 cm long by 4 mm thick) constitute perhaps 3 - 5% of the top few centimeters of this sandstone and reflect faint bedding that dips approximately 25 degrees from horizontal (to the core). Carbonized plant fragments fall off in abundance and size downward in the sandstone but are present throughout. A couple of these carbonized plant fragments resemble flattened pumice lapilli with fiamme textured ends. Trace calcite veining is present in this interval and on minor slickensided surfaces observed. This sandstone is not appreciably magnetic.
				608-616.5	Interval consists of another sedimentary debris flow breccia unit. This debris flow breccia is dark grey, medium - coarse-grained (rounded and subrounded clasts up to 7 cm in size but generally 4 - 5 cm or less) with heterolithic volcanic (dominant) and sedimentary lithic clasts (25 - 35% of rock) supported in a medium - coarse-grained sandy matrix. Subvertical to moderately steeply dipping calcite and calcite + smectite +/- chlorite veins (hairline to 3 - 4 mm wide) constitute < .5% of the core interval. Multicolored volcanic lithic clasts run the gamut of textures from aphanitic to aphyric to fine-grained equigranular to fine-grained porphyritic and appear to be mostly andesitic in composition. This unit is moderately strongly magnetic.
59	616.5-626	608-618	10	616.5-626	Interval consists of more of the same sedimentary debris flow breccia as above but is more dark brown grey in color. Clasts still constitute 25 - 35% of the rock and are up to, but generally less than 5 cm in size. Calcite veining constitutes << .5% of this interval.
60	626-634	618-628	10	626-634	Interval consists of more of the same debris flow breccia unit as above with only trace hairline calcite veinlets except for one 70 degree dipping (from horizontal to core), 2 cm wide calcite + apple green smectite +/- dark green chlorite (?) vein at 629.8 ft. A thin (3 mm) silica band forms most of the hanging wall side of this vein/fracture filling. Smectite forms most of the footwall side of the vein. Trace iron stained interstitial and hairline veinlet chalcedony (?) is also associated with this calcite vein.
61	634-644	628-638	10	634-644	Core consists of the same (as above) debris flow breccia unit. A possible brecciated volcanic boulder (25 cm across) is present at approximately the 638 ft. block and one subhorizontal fluidized breccia vein/dikelet is present just below this boulder. A 15 cm thick medium - coarse-grained sandstone lens/layer is present at approximately 640 ft.
62	644-653	638-648	10	644-653	Interval consists of the same massive debris flow unit as above; unit becomes very dark grey (no distinct color boundary) at approximately 648 ft. One large andesite cobble (20 cm) occurs at approximately 646.5 ft. and contains two of the 8 calcite (hairline to 1 - 2 mm wide) veinlets in this interval.

✓  
631

**LAKE CITY GEOTHERMAL, LLC**  
Lake City Observation Hole No. 1

Sheet No. 21

Log By: R.F. Hardyman

Date: 3/16/02

(Int = interval, Rec = recovery)

Box No.	Int in box	Rod Int (Depth) (ft)	Rec for rod Int (ft)	Core Int (ft)	Lithologic Description
63	653-662	648-658	10	653-662	Core consists of very dark grey, massive, sedimentary debris flow breccia (same unit as above). Hairline to 1 - 2 mm wide, steeply dipping calcite veins constitute < 1% of this core interval. One .5 cm to 4.5 cm wide massive calcite/calcite breccia vein extends essentially near vertical from 655 to almost 657 ft. in the core. Only occasional calcite veins/veinlets are present below this large calcite vein in this interval.
64	662-671	658-668	9	662-671	Same dark - very dark grey debris flow breccia as above; clasts still constitute 35 to perhaps 45% of the rock and are up to 7 cm but are generally 2 - 3 cm or less in size. Only trace calcite veining (hairline to 1 - 2 mm wide) is present in this core interval.
65	671-680.5	668-678	10	671-680.5	Same dark - very dark grey debris flow unit as above; clasts may be falling off in abundance to 25% of the rock but are still rounded - subrounded, heterolithic, and up to 8 cm but generally 3 cm or less in size. Only an occasional hairline to 1 - 3 mm wide calcite vein is present in this interval.
66	680.5-689	678-688	10	680.5-689	Interval consists of the same dark - very dark grey debris flow unit as above; lithic clasts still up to 10 cm (one large cobble/small boulder is 23 cm across) in size but are falling off in abundance downward in the interval to about 15 - 20% of the rock. Calcite veining (one vein is .5 cm wide) constitutes < 1 - 2 % of the rock in this interval.
67	689-697			689-695.3	Same dark grey - grading downward to medium grey debris flow unit as above. Lithic clast abundance falls off downward to about 15% of the rock and the rounded lithic clasts are generally 1 - 2 cm or less in size. This debris flow breccia grades downward within 2 - 3 inches into dark grey, fine-grained, pebbly sandstone. Carbonized plant debris fragments start occurring in the debris flow unit at about 693 ft. and continue in the rock downward into the underlying sandstone. Calcite veins constitute << .5% of the rock in this interval.
				695.3-697	Interval consists of medium grey - "battleship" grey, "salty"/spotted appearing (due to presence of white - light grey, fine-grained lithic and feldspar grains up to 4 mm but generally 1 mm or less in size) fine-grained sandstone containing perhaps .5 - .7% scattered black carbonized plant fragments .5 cm or less long by 1 mm or less thick.
68	697-706	688-698	10	697-698	Same medium grey sandstone unit as above; clay "pellets" up to 4 mm in size increase in abundance downward in this sandstone. At 698 ft. carbonized plant fragments (two up to 1 cm long) are enclosed in and partially replaced by extremely fine-grained pyrite (diagenetic pyrite ?).

✓ 655.5

✓ 679

**LAKE CITY GEOTHERMAL, LLC**  
**Lake City Observation Hole No. 1**

Sheet No. 22

Log By: R.F. Hardyman

Date: 3/16/02

(Int = interval, Rec = recovery)

Box No.	Int in box	Rod Int (Depth) (ft)	Rec for rod Int (ft)	Core Int (ft)	Lithologic Description
				698-706	Same basic sandstone interval as above but with interlayered "zones" (as at 698-698.6 ft.) containing 20 -30% rounded - subangular, pale green clay "pellets" (4 mm or less), reworked feldspar grains (1 mm or less), and dark green volcanic pumice fragments (upto 4 mm). These reworked andesitic (?) pumice fragments are irregular to lenticular in shape and display occasional "flame" (fiamme texture) ends and contain occasional feldspar micro phenocrysts. These fragments appear altered to green clay (?) or soft altered cryptocrystalline silica. This sandstone interval varies from fine-grained sandstone with interlayered "chippy" mud pellet rich "zones" (no well defined contacts) devoid of pumice fragments (as at approximately 699.3 ft.) to "zones" 3 - 4 inches thick containing moderately abundant dark green pumice fragments (as at 703 ft.). This sandstone interval contains scattered small carbonized plant fragments and becomes coarse to very coarse-grained in the lower part.
		698-708	10		Calcite (with/without smectite selvages on margins) veins may constitute 1% of this rock interval and range from hairline to 1 cm wide (as at 706 +/- ft.). These veins/some fracture fillings dip 50 - 70 degrees from horizontal (to the core) and are inclined both ways to the core axis but only one direction appears to be the preferred dip direction.
69	706-715			706-715	Same medium grey sandstone sequence as above with alternating zones/layers (but no well defined sharp contacts) of very fine-grained sandstone (706-708 ft.), coarse-grained sandstone (16 +/- cm thick) and medium-grained sandstone. Medium to coarse-grained sandstone zones are "spotted" and contain abundant (30 - 40%) white feldspar grains (1 mm), occasional lithic grains and dark green reworked pumice fragments. 7 to 16 cm thick zones (as at 712 and 713 ft.) contain abundant (10 - 15%) reworked pumice fragments and what may be intact "rafted in" pumice lapilli (to 1 cm). The bottom of this interval is again a very fine-grained sandstone "zone"/layer. Calcite veins/fracture fillings (thinly banded - up to .5 cm wide) and hairline calcite veins make up 1% or less of this interval.
70	715-723	708-716.5	8.5	715-723	Interval consists of fine - very fine-grained sandstone that is somewhat "salty" in appearance due to the presence of moderately abundant (up to 25 - 30% in some "zones") reworked feldspar grains (< 1 mm in size). The matrix of this massive sandstone sequence is calcium carbonate rich (probable matrix cement). At approximately 721 ft. there is a 10 inch thick zone containing moderately abundant round to ovoid, light grey - lighter than the matrix, accretionary lapilli. Some of these lapilli display faint accretionary "rinds". These lapilli are matrix supported. Hairline calcite/calcite + smectite and quartz veins constitute < .5% of the rock in this interval.
		716.5-725	8.5		

**LAKE CITY GEOTHERMAL, LLC**  
**Lake City Observation Hole No. 1**

Sheet No. 23

Log By: R.F. Hardyman

Date: 3/16/02

(Int = interval, Rec = recovery)

Box No.	Int in box	Rod Int (Depth) (ft)	Rec for rod Int (ft)	Core Int (ft)	Lithologic Description
71	723-732			723-732	Interval consists of the same massive fine - very fine-grained sandstone unit as above; some "zones" are more "salty" appearing due to more abundant reworked white feldspar grains (< 1 mm in size). Hairline quartz veins and calcite veinlets and calcite + smectite planar fracture fillings constitute < .5% of this rock interval. Some fractures (all moderately dipping to high-angle) are coated with dark green chlorite (?) / smectite and occasionally display slickensides.
		725-734.5	9.5		
72	732-740.5			732-740.5	Same medium grey, fine - very fine-grained sandstone unit as above; plant fragments (only partially carbonized) become more abundant (up to 1%) in the rock from approximately 733 to 734.5 ft. At 734.5 ft. down to 737.5 ft. this fine-grained sedimentary sequence displays well defined 1 - 2 cm thick bedding consisting of alternating fine - medium-grained sandstone and siltstone beds and an occasional rip up clast "breccia" bed. Bedding dips 30 degrees from horizontal (to the core). The bedded interval grades downward into massive, grey - lavender colored, very fine-grained sandstone - siltstone which grades downward at about 740.5 ft. into more grey - medium grey very fine-grained sandstone. Calcite veining constitutes about 1 - 2% of this bedded rock interval but constitutes < 1% in the rest of this core interval.
		734.5-745	10.5		
73	740.5-749	745-750.5		740.5-749	Interval consists of medium grey, massive fine-grained sandstone grading down section at about 745 ft. into medium-grained, salty appearing sandstone. Most of this core interval is highly broken; no slickensided surfaces on core pieces were observed however. Calcite veining constitutes < .5% of this interval except for the interval from 745 to 747 ft. where calcite veining constitutes perhaps 3% of the rock
74	749-757	750.5-758	7.5	749-776	Interval consists of the same fine - medium grained sandstone sequence as in the above two core intervals. This sequence is massive with no discerable bedding and consists of alternating fine - very fine-grained sandstone - silty sandstone grading downward into medium - coarse-grained sandstone which in turn grades downward into more fine-grained sandstone. The "salty" / white speckled appearance in this sequence is due to the variable abundance of rounded - subangular feldspar grains. Feldspar grain abundance varies from 5 - 10% in fine - very fine-grained sandstone horizons to 15 - 20% in medium-grained sandstone to 60 - 80% in coarse - very coarse grained horizons. Feldspar grain size varies from 2 mm to generally less than 1 mm. Grain size (< 2 mm) mudstone "chips", rounded - subangular aphanitic and aphyric volcanic lithic grains, reworked pumice (probably) fragments and scattered plant debris fragments are also present in variable amounts. The fine-grained rock matrix supporting these sand -sized grains is high in calcium carbonate. Most of this sedimentary sequence is weakly magnetic.

✓ 73-6.5

**LAKE CITY GEOTHERMAL, LLC**  
**Lake City Observation Hole No. 1**

Sheet No. 24

Log By: R.F. Hardyman

Date: 3/16/02

(Int = interval, Rec = recovery)

Box No.	Int in box	Rod Int (Depth) (ft)	Rec for rod Int (ft)	Core Int (ft)	Lithologic Description
75 76	757-767	758-768	10		(continued from Sheet No. 23) Hairline to 1 - 3 mm wide calcite veins (occasionally - one in this interval - to 1 cm wide) and calcite plus dark green smectite +/- chlorite (?) sealed fractures range in orientation from subhorizontal to subvertical. Occasional slickensided surfaces are present on both subhorizontal and high-angle calcite + smectite filled fractures. The lower 2 ft. of this interval consists of slightly brownish grey, very fine-grained sandstone - siltstone.
	767-776	768-773	4.6		
77	776-785	773-778	5		
		778-783	5	776-777	Brownish grey siltstone - very fine-grained sandstone in this interval is highly brecciated/crushed; rock fragments are cemented in calcite; the core in this 1 ft. thick zone is highly broken up. This zone probably represents a small fault.
				777-778	Brownish grey siltstone grades into medium grey - greenish grey siltstone containing minor calcite veining.
				778-779	Medium grey - brownish grey siltstone is highly fractured/crackle brecciated with calcite cement and then highly brecciated again in a 4 - 5 inch zone at 779 ft.
78	785-794	783-788	5	779-783	Interval consists of medium grey siltstone - clayey siltstone that is only moderately fractured with 1 - 2% calcite cement/veining. Trace fine-grained pyrite is present. Locally core is highly broken.
				783-786	Greenish siltstone - highly fractured - overlies a 2 inch thick light brownish grey siltstone layer (moderately cracked) that dips 30 - 40 degrees from the horizontal. Below this siltstone layer is more highly fractured and brecciated - some vein breccia (hematite cemented) green siltstone with quartz and calcite cementing the breccia fragments.
				786-790	Medium grey - brownish grey very fine-grained sandstone - moderately fractured constitutes this core interval. Vein and fracture cementing calcite and minor quartz together constitute approximately 5 - 8% of the rock. Trace slickensided surface on one fracture.
				790-792	Interval consists of more grey - dark grey siltstone that is moderately crackle fractured with 3 - 5% crack healing calcite.
				792-796	Interval consists of more grey - brownish grey, very fine - fine-grained sandstone; rock is locally cracked with calcite + quartz healing cracks and veining the rock. Some fracture surfaces are slickensided.
79	794-802				

✓ 763  
New

✓ 786  
vein



# LAKE CITY GEOTHERMAL, LLC

## Lake City Observation Hole No. 1

Sheet No. 25

Log By: R.F. Hardyman

Date: 3/17/02

(Int = interval, Rec = recovery)

Box No.	Int in box	Rod Int (Depth) (ft)	Rec for rod Int (ft)	Core Int (ft)	Lithologic Description
		788-795	7	796-800	Brownish grey, very fine - fine-grained sandstone in this interval is highly crushed - pulverized and massively cemented (75 - 80% of interval) by sugary and somewhat vuggy calcite. Good slickensided surfaces (involving calcite) occur in this interval. Striations on these vertical to subvertical slickensided surfaces rake from subhorizontal to 20 degrees. This interval must represent a major fault zone. The dip of this fault is questionable but a narrow (1 cm +) calcite cemented breccia vein near the bottom of the crushed zone (footwall side), which may reflect the fault attitude, dips 50 degrees from horizontal.
80	802-810	795-805.5	10.5	800-805.5	Interval consists of medium grey - slightly brownish grey, very fine - fine-grained sandstone that is moderately fractured. Hairline to 1 - 3 mm wide (occasionally to .5 cm) calcite +/- chlorite (?) and chlorite only veins and fracture fillings (some slickensided surfaces) constitute perhaps 3 - 5% of this rock interval. Interval contains an occasional rounded lithic clast (up to 9 mm).
81	810-819	805.5-816	10.5	805.5-812.3	The fine - very fine-grained sandstone above grades downward rather abruptly into medium grey and brownish grey, medium-grained sandstone containing 15 - 20% subrounded grains (2 mm to .5 cm) and "chips" of silicified mudstone and andesite lithic fragments and an occasional rounded andesite pebble.
				812.3-826	Rock in this interval consists of dark grey aphanitic to aphyric (phenocrysts up to 2 mm locally constitute 4 - 5% of the rock) plagioclase + scattered pyrobole (generally altered to chlorite) bearing andesite. Plagioclase (locally in glomeroporphyritic clots) and pyrobole phenocrysts are set in an aphanitic matrix of felted plagioclase and granular magnetite and pyroboles. The matrix locally contains abundant micro amygdules of chlorophaeite. Rock is fairly highly magnetic. The upper contact of this andesite dike dips 70 degrees and is quite planar. A calcite + chlorite vein (1 mm wide) parallels this planar contact. Calcite + chlorite and chlorite only veinlets cut the dike rock and sedimentary wall rock but these veinlets and the contact are cut by a 1 cm wide micro crystalline quartz vein that dips about 50 degrees. A 2 cm wide quartz + allophane vein cuts the dike at about 817 ft. Fine-grained disseminated pyrite is common in this dike and locally may be up to .5% of the rock. From 819 - 821 ft. the fine-grained sandstone wall rock reappears then more of the dike rock makes up the interval.
					Another 2 cm wide quartz vein cuts the dike at 50 degrees from horizontal just above the 826 ft. block. The core break at 826 ft. precludes observing the lower contact of this andesite dike.
82	819-830	816-826	8	826-827	Interval consists of medium grey siltstone grading abruptly down hole into brownish grey and medium grey, medium-grained sandstone.
83	830-837			827-831	Interval consists of brownish grey and medium grey, medium-grained sandstone containing 5 - 10% calcite as crack/fracture fillings and as veinlets.
		826-835	10.5		

✓ 797  
Fault

817

**LAKE CITY GEOTHERMAL, LLC**  
**Lake City Observation Hole No. 1**

Sheet No. 26

Log By: R.F. Hardyman

Date: 3/17/02

(Int = interval, Rec = recovery)

Box No.	Int in box	Rod Int (Depth) (ft)	Rec for rod Int (ft)	Core Int (ft)	Lithologic Description
				831-837	Interval consists of medium grey grading down section into greenish grey, medium-grained, well sorted, volcanoclastic sandstone consisting of volcanic lithic grains, feldspar grains and fine-grained siltstone/mudstone (silicified?) grains and granular magnetite (rock is weakly magnetic). Rock interval contains < 2% hairline to 1 mm wide calcite veinlets (generally discontinuous) and crosscutting microcrystalline quartz and quartz + hematite veins up to 1 cm wide.
84	837-845.8	835-845.8	10.8	837-845.8	Interval consists of the same medium grey - slightly greenish grey, massive, medium-grained sandstone as above. The medium-grained sandstone grades downward into coarser grained sandstone from about 841 ft. down to 844 ft. then the rock grades back into medium-grained sandstone. Interval from 837 - 839 ft. contains steep to shallow dipping quartz and quartz breccia veins; one breccia vein at 839 ft. is 8 cm thick and dips 70 degrees from horizontal (to the core). Quartz veins constitute perhaps 1 - 2% of this rock interval; occasional narrow 1 - 2 mm calcite veins crosscut quartz veins. This sandstone unit is weakly magnetic.
85	845.8-854.5	845.8-852.5	6.7	845.8-854.5	The medium grey, medium-grained sandstone grades down section (at approximately 847 ft.) into brownish grey "salty"/"spotted" medium-grained sandstone containing 30-40% plagioclase grains (rounded to angular - up to 1 mm) then back into underlying fine-grained sandstone at approximately 850 ft. Core just above the 852.5 block is quite broken up and contains some grey clay which is probably clay gouge from a minor fault. No slickensided surfaces were observed on the core fragments or in the adjacent core. Rock interval contains < .5% hairline to 1 mm wide calcite and trace quartz veins.
86	854.5-863	852.5-863	10.5	854.5-863	Interval consists of more of the same medium grey - brownish grey and greenish grey, medium-grained sandstone grading down section (around 859 ft.) into fine-grained sandstone. Scattered rounded volcanic and pale green mudstone pebbles occur in this sandstone interval. Hairline calcite and chlorite (?) veins constitute < 1% of the rock interval. A couple of .5 - 1 cm wide calcite veins are present. A broken core zone about 1 ft. thick at 859 ft. obviously contained abundant calcite - perhaps in a narrow calcite cemented breccia.
87	863-871			863-871	Core interval consists of more of the same medium dark - brownish grey, medium grained sandstone unit as above. Hairline calcite and calcite + chlorite veins (1 - 3 mm wide) constitute 2% or less of this sandstone interval and have shallow (< 30 degrees) to steep (60 - 80 degrees) dips. Occasional slickensided surfaces are present on high-angle planar fracture filling veins.
88	871-879.5	863-873.8	10.8	871-879.5	Interval consists of more of the same medium - dark grey - brown grey, medium-grained sandstone (grades into a 1 ft. thick coarse-grained sandstone zone at approximately 876 - 877 ft. containing dark green reworked pumice fragments). Interval contains < .5% to 1 - 2% (near bottom) calcite and calcite + chlorite veins/fracture fillings. An occasional banded calcite vein up to .5 cm are present.

839

860.5

**LAKE CITY GEOTHERMAL, LLC**  
**Lake City Observation Hole No. 1**

Sheet No. 27

Log By: R.F. Hardyman

Date: 3/18/02

(Int = interval, Rec = recovery)

Box No.	Int in box	Rod Int (Depth) (ft)	Rec for rod Int (ft)	Core Int (ft)	Lithologic Description
89	879.5-888	873.8-884.5	10.7	879.5-888	<p>Core in this interval consists of more of the same medium-grained sandstone unit as above. At 885.9 ft. this brown grey, medium-grained sandstone grades (within 2 inches) into greenish grey, almost igneous appearing, coarse-grained sandstone containing approximately 80% rounded to angular feldspar (plagioclase) grains (up to 2 mm in size), pale green siltstone chips (up to 2 - 3 mm in size), dark green rounded to subangular microporphyritic andesite +/- andesite pumice fragments up to 4 mm, heterolithologic, rounded to subrounded volcanic lithic grains (1 - 2 mm in size) and moderately abundant granular magnetite. The sand grains are cemented by minor calcite and clay. The sandstone is moderately strongly magnetic. This greenish grey, coarser-grained sandstone zone is 1.5 ft. thick and grades abruptly (within about 2 inches) downward into (and partly inter lensed with) more brown grey medium-grained sandstone. Without the gradational contacts and obvious scattered volcanic lithic grains this 1.5 ft. interval could be mistaken for an igneous rock.</p> <p>Calcite veins (up to 8 mm wide) constitute approximately 2% of this core interval.</p>
90	888-895.5	884.5-895	10.5	888-895.5	<p>Core remains in the medium grey - brown grey, medium-grained sandstone down to approximately 890 ft. (with local horizons slightly finer grained with less abundant and smaller, .5 mm, white feldspar grains) where the brownish sandstone grades downward into fine-grained sandstone. At 891 ft. dark green, rafted in, pumice fragments (up to 1 cm) gradually become more abundant and up to approximately 10 - 20% of the sandstone at 892 ft. then abruptly fall off in abundance to essentially 0% below 892 ft. The unit is composed of fine - very fine-grained sandstone down to approximately 895 ft. where it grades downward into more brown grey, medium-grained sandstone. Calcite +/- chlorite veining (hairline to .5 cm wide) and fracture fillings constitute &lt; 2% of the rock in this interval. Trace slickensided calcite on one fracture surface. Core is fairly broken up from 893 - 895.5 ft.</p>
91	895.5-903.5	895-905.5	10.5	895-912	<p>Interval consists of the same medium brown grey - dark brown grey, medium-grained to fine-grained, moderately well sorted massive sandstone unit as above. Interval contains an occasional rounded lithic pebble up to 4 mm in size. Calcite and calcite + chlorite veining (subhorizontal to 60 - 80 degree dips) rarely up to 2 cm wide but generally .5 cm or less down to hairline width, constitutes 3% or less of this interval. Trace slickensides on some vein filled fracture surfaces.</p>
92	903.5-912				
93	912-921	905.5-915.5	10	912-921	<p>Core consists of the same dark grey - brown grey, fine - medium-grained sandstone unit as above. Core is well broken up from 912.5 ft. to 915.5 ft. but essentially lacks calcite veining. At 915.5 ft. to 919.5 ft. the core is also highly broken up but contains a modest (perhaps 5 - 10%) amount of calcite +/- chlorite veins and a probable breccia cementing calcite zone may contain a minor fault. The sandstone rock below 919.6 ft. is fairly intact.</p>

895.5

**LAKE CITY GEOTHERMAL, LLC**  
**Lake City Observation Hole No. 1**

Sheet No. 28

Log By: R.F. Hardyman

Date: 3/18/02

(Int = interval, Rec = recovery)

Box No.	Int in box	Rod Int (Depth) (ft)	Rec for rod Int (ft)	Core Int (ft)	Lithologic Description
94	921-930	915.5-919.6 919.6-928	4.1 8.4	921-930	Interval consists of the same fine - medium-grained (locally coarse-grained) sandstone unit as above. Shallow to 50 degree dipping calcite veins and minor calcite + smectite/chlorite veins/fracture fillings (hairline to 4 mm wide) constitute perhaps 2% of this rock interval. A minor silica (microcrystalline quartz) cemented breccia vein occurs at 926 ft.
95	930-939	938-948	9	930-939	Same dark brown - "chocolate" brown, medium-grained sandstone unit as in the above interval. Rock contains 2 - 4% calcite and calcite + chlorite veins/fracture fillings up to .5 cm wide. Fractures dip anywhere from subhorizontal to subvertical. A fairly flat lying, calcite cemented breccia zone 5 inches thick is present at 934.5 ft.
96	939-949			939-941.5	Same massive brown - grey brown sandstone unit containing 1 - 2% hairline - 1 - 2 mm calcite veins and occasional calcite + chlorite veins to 1.5 cm.
				941.5-945.5	Same sandstone unit as above but dominant calcite and calcite + chlorite + trace allophane veins (< .5 cm to 1.5 cm wide) that are generally unidirectional dipping at 50 - 70 degrees (from horizontal to the core) increase in abundance to 10 - 20% of the core. Calcite veins are slightly vuggy and vugs are lined/filled with pyramidal quartz crystals.
				945.5-951	The host medium-grained sandstone becomes bleached to tan brown and becomes highly brecciated and cemented with massive microcrystalline to vuggy drusy quartz. Colloform drusy quartz (tiny crystals) lined vugs/open cavities range in size from 1 cm to 10 cm long by .5 to 1 cm wide. This vuggy drusy quartz cemented breccia zone contains highly brecciated, green grey, microvesicular andesite which may have been an approximately 1 ft. wide narrow intact dike in this subsequent breccia zone. Traces of fine-grained pyrite occurs in this breccia zone.
97	949-959	948-950.5	2	951-953.5	Interval consists of medium dark grey, fine - very fine-grained sandstone containing abundant fine-grained granular magnetite (sandstone is strongly magnetic) and at the bottom, round black pellets/grains (perhaps up to .5 mm in size) of an unidentified mineral. The fine-grained sandstone is highly crackle brecciated and calcite cemented in the interval from 951 to 953 ft. Traces of granular pyrite are also present in this sandstone. This magnetite sand unit is underlain by relatively fine-grained to medium-grained sedimentary debris flow breccia.
		950.5-958	8		

✓934.5

✓950.5\*

950.5

# LAKE CITY GEOTHERMAL, LLC

## Lake City Observation Hole No. 1

Sheet No. 29

Log By: R.F. Hardyman

Date: 3/18/02

(Int = interval, Rec = recovery)

Box No.	Int in box	Rod Int (Depth) (ft)	Rec for rod Int (ft)	Core Int (ft)	Lithologic Description
98	959-968	958-968	10	953.5-968	Rock interval consists of medium grey - dark grey, lithic rich (50 -60% of rock) sedimentary debris flow or mudflow breccia , relatively fine-grained at the top (rounded - subrounded lithic clasts up to 2 cm across) grading downward within 2+ ft. into coarse-grained (clasts up to 7 cm across) mudflow breccia. Heterolithic clasts of volcanic rock of a variety of textures and colors dominate the clast population but fine-grained sedimentary lithologies (mainly siltstone and sandstone) may constitute 5 - 8% of the clast population. Lithic clasts are matrix supported in coarse-grained sandstone. Calcite veins (up to 4 mm wide) in this interval are either subhorizontal or dip unidirectionally at 50 degrees (from horizontal to the core). and constitute < .5% of the massive mudflow breccia unit. This rock unit is moderately to weakly magnetic. One drusy - vuggy quartz "vein" (rock broken up) about 2 - 4 inches wide occurs at the 958 ft. block.
99	968-977	968-978	10	968-986	Same debris flow sedimentary breccia unit as above. Clasts are up to 7 - 10 cm in size but generally are < 4 cm in size. Calcite veins (hairline to occasionally 1 cm wide) constitute < .3% of this interval and are either subhorizontal to the core or dip 50 degrees.
100	977-986	978-988	10		
101	986-996	988-998	10		
102	996-1005			986-1005	Interval consists of the same massive sedimentary mudflow breccia lithology and appearance as in the above interval. Occasional clasts are up to 13 cm but generally clasts are 4 cm or less in size. Calcite veining (hairline to .5 cm wide) constitute << .3% of this interval. Traces of partially carbonized wood fragments occur scattered in the 990 - 992 ft. interval and in the 103 - 104 ft. interval.
		998-1008-	10		
103	1005-1014				
104	1014-1023	1008-1018	10	1005-1023	Same lithologic unit and appearance as above interval. Only trace hairline calcite veins are present. One subvertical, 4 mm wide, calcite + chlorite vein is present at 1020.5 ft.
105	1023-1031	1018-1028	10		
106	1031-1039.5	1028-1038	10	1023-1039.5	Same sedimentary mudflow breccia as above. Rounded and subrounded volcanic lithic clasts are up to 8 - 12 cm across but generally are < 3 - 4 cm in size. Crystalline to banded calcite + chlorite veins constitute < .5% of the rock interval, are hairline to occasionally 1 cm wide, and generally dip unidirectionally 40 - 70 degrees.
107	1039.5-1047			1039.5-1047	Same mudflow breccia unit as above but calcite + chlorite veins and fracture fillings constitute 2.5% of the interval. Trace slickensided surfaces are present on planar calcite + chlorite filled fractures; striations rake from subvertical to subhorizontal.
		1038-1048	10		
108	1047-1056				
109	1056-1064	1048-1058	10		
110	1064-1073	1058-1068	10		

1000

1062

**LAKE CITY GEOTHERMAL, LLC**  
**Lake City Observation Hole No. 1**

Sheet No. 30

Log By: R.F. Hardyman

Date: 3/18/02

(Int = interval, Rec = recovery)

Box No.	Int in box	Rod Int (Depth) (ft)	Rec for rod Int (ft)	Core Int (ft)	Lithologic Description
				1047-1073	Same medium grey - brownish grey mudflow breccia unit as above but the breccia is becoming less coarse-grained down section; maximum lithic (predominantly volcanic lithologies) clast size is 4 - 5 cm but generally they are 2 cm or less in size. Calcite veins become wider generally (.5 - 1 cm) in the 1047 - 1061 ft. interval and dip sub horizontally to approximately 40 - 50 degrees from horizontal (to the core). These veins constitute < .5% to perhaps 3 - 5% of the rock from approximately 1056 - 1062 ft. Below 1062 ft., calcite veins fall off in size and abundance to << .5% at around 1068 ft. Core is highly broken up at approximately 1059 - 1060 ft. and contains calcite vein material and chlorite fracture coatings.
111	1073-1082	1068-1078	10		
112	1082-1090	1078-1082.5	4.5		
		1082.5-1088	5.5		
113	1090-1099	1088-1098	10	1073-1099	Same medium grey mudflow breccia unit as above. Clast size still occasionally gets up to 5 - 7 cm but the majority of the clasts are 2 cm or less in size. Calcite and calcite + chlorite veins/fracture coatings in this interval are essentially hairline width to only occasionally 1 mm; are shallow dipping to vertical (mostly) and constitute << .5% of the rock. Just below the 1082.5 ft. block (where some core loss must have occurred) the recovered "core" consists only of medium - dark brown clay which, although it does not display slickensided surfaces, most likely represents clay gouge from a minor fault.
114	1099-1107.5	1098-1108	10		
115	1107.5-1116				
116	1116-1125	1108-1118	10	1099-1118.5	Core is still in medium grey mudflow breccia as above with maximum clast size still in the 5 - 7 cm range. Rock is grades gradually downward into distal (?) mudflow breccia or pebbly coarse-grained sandstone with rounded - subrounded, pebble sized lithic clasts occasionally up to 2 - 4 cm but generally 1 cm or less and these falling off in abundance to only 5 - 15% of the rock. Calcite and calcite + chlorite hairline to 1 mm wide veins constitute << .5% of the rock down to the 1118 ft. block. At 1118.5 ft. an approximate 12 cm wide vuggy calcite cemented breccia zone cuts the core at a dip of about 50 degrees from horizontal. Open vugs (.5 - 1 cm wide and up to 3 - 4 cm long) in this breccia zone contain pyramidal quartz crystals up to .5 cm across.
				1118.5-1125	Core below the above breccia zone is fairly well cracked/fractured pebbly coarse-grained sandstone containing perhaps 3% calcite and calcite + chlorite fracture fillings up to 1 - 2 mm wide.
117	1125-1134	1118-1128	10	1125-1134	Interval consists of medium grey, coarse-grained to medium-grained, pebbly sandstone that is still well fractured down to 1131.5 ft. This fractured interval (1125 - 1131.5 ft.) contains 3 - 6% calcite and calcite + chlorite veins/fracture fillings up to 1 cm wide. Below 1131.5 ft. the sandstone is coarse-grained and "pebbles" are 3 - 4 mm or less with a flood of pale green, rounded - subrounded, microporphyrritic andesite and mudstone (?) "chips" down to about 1132 ft then essentially devoid in the coarse-grained sandstone below.

*2 fracture events  
early stage  
late overthrust cc*

✓ 118

✓ 1137

**LAKE CITY GEOTHERMAL, LLC**  
**Lake City Observation Hole No. 1**

Sheet No. 31

Log By: R.F. Hardyman

Date: 3/18/02

(Int = interval, Rec = recovery)

Box No.	Int in box	Rod Int (Depth) (ft)	Rec for rod Int (ft)	Core Int (ft)	Lithologic Description
118	1134-1143	1128-1136	8	1134-1136	The sandstone unit is coarse to very coarse-grained with abundant lithic grains (1 - 2 mm in size) set in a finer grained sandstone matrix. At the 1136 ft. block there is probably missing core and just a bit of clay gouge material from a probable minor fault plane.
				1136-1143	
		1136-1146.5	10.5		The above coarse - very coarse - grained sandstone gradually picks up more rounded -
119	1143-1153			1143-1146	Core interval consists of relatively fine-grained debris flow lens (?) with clasts up to 2 cm but mainly about 1 cm or less that grades abruptly down section into medium dark grey, coarse-grained sandstone at approximately 1146 ft. Five hairline to 1 mm wide chlorite + minor calcite filled/coated fractures occur in this interval; one at approximately 1143.1 ft. displays a slickensided surface dipping 50 degrees from horizontal and displays purely down dip oriented striations.
				1146-1153	Interval consists of medium grey - medium dark grey, massive, moderately well sorted, coarse-grained sandstone grading into dark grey, massive, coarse-grained sandstone at 1149 ft. Rock is slightly "salted" in appearance and contains moderately abundant feldspar grains and scattered tiny (up to 4 mm) pebbles. Rock is moderately strongly magnetic. Only trace calcite + chlorite and chlorite only fracture fillings/coatings are present in this interval. This sandstone becomes more "chippy"/pebbly at about 1153 ft.
		1146.5-1156.5	10		
120	1153-1162.5				
121	1162.5-1171	1156.5-1166.5	10	1153-1171	Interval consists of medium-grained, "chippy"/pebbly sandstone containing approximately 20 - 25% subangular chips and rounded pebbles of pale green, medium brown and black - dark grey lithic fragments up to 5 mm. At about 1159 ft. this rock grades downward into brownish grey, medium to slightly coarse-grained sandstone that is less chippy/pebbly then grades back into more chippy/pebbly medium-grained sandstone at approximately 1164 - 1170 ft. then grades downward into only slightly chippy/pebbly lithic bearing, salty appearing medium-grained sandstone. Hairline to 1 - 2 mm wide calcite + chlorite and chlorite only filled fractures occur only occasionally (<< .5%) in this interval except for multiple fractures at approximately 1160 ft. Fractures generally dip about 50 degrees from horizontal - occasionally to 70 degrees and occasionally display slickensided surfaces with down dip striations.
122	1171-1180	1166.5-1176.5	10	1171-1180	Core in this interval consists of medium brown grey, massive, "salty" appearing (due to moderately abundant feldspar grains), medium--grained sandstone containing an occasional rounded fine-grained sandstone lithic pebble (up to 1.7 cm). At 1172 - 1174 ft. the interval contains 3 chlorite + minor calcite filled fractures (one up to 1.3 cm wide) that dip 70 - 80 degrees from horizontal; all of these fractures display striated slickensided surfaces with down dip to nearly down dip oriented striations.
		1176.5-1187	10.5		

# LAKE CITY GEOTHERMAL, LLC

## Lake City Observation Hole No. 1

Sheet No. 32

Log By: R.F. Hardyman

Date: 3/19/02

(Int = interval, Rec = recovery)

Box No.	Int in box	Rod Int (Depth) (ft)	Rec for Rod Int (ft)	Core Int (ft)	Lithologic Description
123	1180-1190				<p>The medium - dark grey, medium-grained sandstone unit grades down section into less "salty" (white feldspar grains) appearing more chippy/pebbly appearing medium-grained sandstone (1183-1187 ft.) with rounded - subangular, pale green fine-grained sedimentary lithic fragments then downward into a more lithic rich pebbly - slightly debris flow-like - zone (1189 - 1194 ft.) then back down into brownish grey, chippy, medium-grained sandstone then downward into medium grey, coarse-grained sandstone (1197 - 1199 ft.) then back into medium grey, medium-grained, slightly "salty" appearing sandstone (1199 - 1204 ft.) then down section into medium brown, fine-grained sandstone (1204 - 1207 ft) then back into more medium brown grey, medium-grained sandstone at the bottom of the interval. Only an occasional calcite + chlorite vein and filled fracture (.5 - 1.2 cm wide) occurs in the interval from 1180 to 1188 ft.; these dip unidirectionally only 25 - 30 degrees from horizontal. Bidirectional 30 degree dipping calcite veins constitute approximately 4 - 8% of the rock in the From 1194 to 1196 ft. vuggy calcite and minor quartz vein material cements cracked to slightly brecciated rock and together constitute perhaps 10 - 15% of this rock interval. At approximately 1194.4 ft. a narrow (2 inches wide) crushed zone containing minor brown clay gouge and slickensided surfaces marks a minor shear zone that perhaps dips 20 - 30 degrees from horizontal. Below this zone, foliated - shear zone-like calcite + chlorite + minor hematite cement fracture/shear planes (.5 cm up to 1.5 cm wide) that are subhorizontal, contain slickensided surfaces, and are spaced about 5 - 6 inches apart down to about 1200 ft. Below 1200 ft. only occasional calcite veins are present.</p>
124	1190-1199	1187-1197	10		
125	1199-1208	1197-1207 1207-1217	10 10	1180-1208	
126	1208-1217				<p>This interval consists of medium brown - dark brown grey, massive, slightly salty to chippy appearing, medium-grained sandstone with a coarse-grained zone from approximately 1216 to 1218 ft.. Scattered hairline and a couple of 1.5 cm wide laminated calcite + chlorite veins (at approximately 1215 ft.) dipping 40 degrees from horizontal occur in this interval. The base of the coarse-grained sandstone zone at about 1218 ft. is marked by a narrow (1 cm wide) foliated calcite + brown clay gouge filled shear plane that dips 50 - 55 degrees from horizontal and contains slickensided surfaces with down dip striations.</p>
127	1217-1225	1217-1227.5	10.5	1208-1222.5	
128	1225-1235			1222.5-1235	<p>The medium-grained sandstone unit above grades (apparently - contact confused somewhat by a 1.5 cm wide calcite vein) down section into massive sedimentary mudflow (debris flow) breccia. The mudflow breccia is relatively finer grained in the top 1+ ft. (rounded - subrounded lithic clasts 2 cm or less in size) and grades downward into coarser grained mudflow breccia with clasts up to 6 - 10 cm across. Except for a couple of 1 - 2 cm wide calcite veins at the top this sedimentary breccia unit contains only an occasional calcite vein.</p>

✓ 1196



**LAKE CITY GEOTHERMAL, LLC**  
**Lake City Observation Hole No. 1**

Sheet No. 33

Log By: R.F. Hardyman

Date: 3/19/02

(Int = interval, Rec = recovery)

Box No.	Int in box	Rod Int (Depth) (ft)	Rec for rod Int (ft)	Core Int (ft)	Lithologic Description
129	1235-1244	1227.5-1238			
130	1244-1254	1238-1248	10		
131	1254-1263	1248-1258	10	1235-1263	This interval consists of the same dark brown grey mudflow breccia unit as above. Rounded - subrounded to occasional subangular, heterolithologic clasts constitute 45 - 60% of the rock; range in size from small pebbles (< .5 cm) to large cobbles (13 cm across). Clasts consist predominantly of volcanic rock (80 - 85% of total clasts) in various shades of grey and brown - reddish brown. Sedimentary lithic clasts (15 - 20% of total clasts) are generally light grey, mostly consist of fine - medium-grained sandstone and siltstone, and are generally in the smaller clast size range. Volcanic clasts include various textural types (aphanitic, aphyric - micro phenocrystic, fine and medium-grained porphyritic, and fine - medium-grained equigranular) and are of andesitic and basaltic (minor) compositions. Hairline to mm scale and occasional 1 - 1.5 cm wide calcite veins and calcite + chlorite filled planar fractures/shear planes are not abundant (<< .5%) in this core interval.
132	1263-1271	1258-1268	10		
133	1271-1280	1268-1278	10		
134	1280-1288.5	1278-1288	10	1263-1288.5	Interval consists of the same sedimentary mudflow breccia unit as above but is finer grained; clast size occasionally to 4 cm, rarely 12 cm, and is generally 1 - 2 cm or less. Calcite + vuggy calcite veining is relatively heavy (3 - 5%) in the interval from 1264 to 1267 ft. but otherwise is minor (<< .5%) in the rest of the interval. A 5.5 cm wide quartz + calcite cemented breccia zone/vein cuts the debris flow unit at 1281 ft. and dips 60 degrees (from horizontal to the core). Slickensided chlorite marks the base (footwall) of this breccia vein. Minor slickensided fractures occur above this breccia vein.
135	1288.5-1297.5	1288-1298		1288.5-1296.5	Same massive, medium dark grey, relatively fine-grained sedimentary mudflow breccia as above. Clasts mostly in the < 2 cm size range but occasionally they are up to 3 - 4 cm and rarely to 15 cm. Clasts are still matrix supported in med - coarse grained sand.
136	1297.5-1306.5	1298-1308	10		
137	1306.5-1315			1296.5-1315	The sedimentary mudflow breccia above grades downward into chippy, coarse-grained sandstone (1295 - 1297 ft.) containing fairly abundant medium brown andesite "chips"/tiny pebbles (4 mm or less) then down section into approximately 8 inches of coarse-grained sandstone then down into dark grey, medium-grained sandstone (slightly salty with scattered lithic "chips"/pebbles < 5 mm) from 1298 to 1302 ft. This medium-grained interval grades down into a more lithic rich coarse-grained sandstone (channel fill lens ?) from approximately 1304 to 1312.5 ft. This lithic flooded lens (?) containing lithic clasts 5 - 13 cm in size in turn grades downward into more dark grey, coarse-grained sandstone. Calcite veins (hairline to 3 - 4 mm wide, one at 1 cm) in this interval constitute .5 - 1% of the rock.
		1308-1318	10		

✓ 1267

✓ 1281.5

# LAKE CITY GEOTHERMAL, LLC

## Lake City Observation Hole No. 1

Sheet No. 34

Log By: R.F. Hardyman

Date: 3/19/02

(Int = interval, Rec = recovery)

Box No.	Int in box	Rod Int (Depth) (ft)	Rec for rod-Int (ft)	Core Int (ft)	Lithologic Description
138	1315-1323.5			1315-1319.5 1319-1324	Interval consists of dark grey - very dark grey, coarse to very coarse-grained (at bottom) volcanoclastic sandstone. This sandstone is moderately magnetic. Calcite veins in this sandstone interval are 4 mm to 1 cm wide, dip 50 - 60 degrees from horizontal (to the core) and in aggregate may constitute 1 - 2% of the rock. Rock in this interval consists of more relatively fine-grained debris flow sedimentary breccia (clasts occasionally up to 4 cm but most are 1.5 cm or less). The sedimentary breccia in this interval is locally modestly brecciated and strongly veined/breccia veined and cemented by calcite and less abundant microcrystalline quartz and trace allophane. A 12 cm wide calcite cemented breccia zone at the top of this interval dips 45 - 50 degrees from horizontal. Below this zone the rock in this interval is more randomly veined and locally silica flooded.
139	1323.5-1333	1318-1328	10		
140	1333-1342.5	1328-1338	10	1324-1342.5	Rock in this interval consists of more relatively fine-grained sedimentary debris flow breccia as in the interval above. Calcite veining in this interval generally constitutes < 2% of the rock but from 1331 - 1333 ft. calcite veins may constitute 4 - 5% of the rock. At 1339 ft. the rock is cut by a massive to vuggy quartz + calcite vein perhaps 15 - 20 cm wide (some probable core loss here). Open vugs are at least 2 inches by .25 - .5 inches wide and contain late rhombic calcite crystal up to 1 cm across and prismatic crystals (up to 5 mm) and crystal aggregates of a white mineral that does not effervesce in HCl and splinters into fine needles (gypsum?).
141	1342.5-1351	1338-1348	10	1342.5-1349	Another massive quartz + calcite (minor) vein (not obviously vuggy) cuts the fine-grained sedimentary debris flow rock at 1342 - 1343 ft. The relatively fine-grained debris flow breccia unit grades downward into chippy/pebbly (pebbles up to .5 cm) lithic rich coarse-grained volcanoclastic sandstone at approximately 1348 - 1349 ft.
142	1351-1360	1348-1358	10		
143	1360-1369	1358-1368	10	1349-1364 1364-1369	This interval consists of medium grey, massive, medium-grained sandstone containing 1 - 2 ft. thick zones that are more pebbly with volcanic lithic clasts 2 - 3 mm to 8 mm in size. At 1364 ft. the medium-grained sandstone grades downward into coarse to very coarse-grained sandstone containing abundant lithic chips/pebbles. Calcite veining (mm to .5 cm scale) constitutes < 1% of this interval except from 1358 - 1360 ft. where wispy to horsetail braided calcite veins/vein "zones" (7 cm thick) constitute perhaps 4 - 6% of the rock. Interval consists of medium grey, massive, coarse - very coarse-grained sandstone grading downward into fine-grained then into medium-grained sedimentary mudflow breccia. Laminated calcite veins/vein zones (up to 2 cm wide) constitute 3 - 6% of this interval with one 7 cm wide vein zone at 1368.2 ft. that dips 45 degrees for horizontal (to the core).

✓1342.5

**LAKE CITY GEOTHERMAL, LLC**  
**Lake City Observation Hole No. 1**

Sheet No. 35

Log By: R.F. Hardyman

Date: 3/19/02

(Int = interval, Rec = recovery)

Box No.	Int in box	Rod Int (Depth), (ft)	Rec for rod Int (ft)	Core Int (ft)	Lithologic Description
144	1369-1378	1368-1378	10	1369-1378	Interval consists of fine-grained - medium-grained mudflow breccia (clasts up to 5 cm but mostly 2 cm or less in size). One obvious porphyritic volcanic rock cored from about 1371.2 to 1373 ft. containing calcite + chlorite altered pyrobole (probably pyroxene) phenocrysts (up to .5 cm) in a fine-grained plagioclase rich matrix is probably a large boulder. This volcanic rock displays no chilled margins and does not "bake" or otherwise alter the enclosing mudflow breccia unit. Other porphyritic volcanic clasts farther down section in this unit are up to 17 cm across. Wispy to slightly laminated calcite veins constitute approximately 4% of this rock interval. Traces of slickensided fracture surfaces are also present.
145	1378-1387	1378-1388	10	1378-1387	Interval consists of more of the same medium dark grey, massive mudflow breccia unit as above; interval contains < .5% calcite veins.
146	1387-1397			1387-1390	More medium - dark grey mudflow breccia constitutes this interval and contains a couple of hairline calcite veins and one vein 2 cm wide that dips 30 degrees from horizontal (to the core). At 1390 ft. a large (16 cm) cobble (apparently) consists of porphyritic plagioclase (up to 3 mm; altered to calcite) + altered (to chlorite) pyrobole bearing andesite is cut by the core. The upper contact of this apparent cobble is obscured by fractures and the lower contact is obscured by a 6 - 7 cm wide quartz + calcite vein/slight breccia vein that dips 30 degrees from horizontal.
				1390-1393	This core interval consists of another igneous (volcanic) rock. This rock is a medium-grained equigranular plagioclase (slightly altered to calcite) + intergranular to interstitial pyrobole (relatively fresh) bearing andesitic rock. Whether this andesitic rock is a large boulder or a narrow dike/sill in the debris flow is uncertain. The upper contact is obscured by the 6 - 7 cm wide quartz + calcite vein mentioned above and the lower contact is obscured by fractured core. Below this boulder/dike/sill the rock consists of more of the debris flow breccia unit. Three 1 - 2.5 cm wide calcite veins dipping unidirectionally at 20 degrees cut this volcanic boulder/dike/sill and are spaced 10 - 12 cm apart.
147	1397-1406	1388-1398	10	1393-1415	Core consists of more of the same medium dark grey, massive, medium grained mudflow breccia unit as above; rounded to subangular, heterolithic lithic clasts (45 - 65% of rock - mainly volcanic lithologies and less abundant fine-grained sedimentary lithologies) are up to 6 cm but generally are < 2 cm in size and are matrix supported in medium-grained sand. Hairline to 1 - 2 mm scale calcite veins (irregular veins and planar fracture fillings) constitute < 1% of this rock interval except for the lower 4 ft. where .5 - 2 cm planar calcite veins constitute 3 - 4% of the rock.
148	1406-1415	1398-1408 1408-1418	10 10		

✓ 1391

1412

# LAKE CITY GEOTHERMAL, LLC

## Lake City Observation Hole No. 1

Sheet No. 36

Log By: R.F. Hardyman

Date: 3/20/02

(Int = interval, Rec = recovery)

Box No.	Int in box	Rod Int (Depth) (ft)	Rec for rod Int (ft)	Core Int (ft)	Lithologic Description
149	1415-1424			1415-1417	Core consists of the same medium grey, medium-grained mudflow breccia as above; calcite veining constitutes approximately 4% of the rock in this interval. At 1417 ft. a narrow (.5 cm) 60 degree dipping calcite + minor smectite/chlorite filled shear plane (faint slickensided surface) separates the debris flow unit above from fine - medium-grained sandstone below.
				1417-1418	Interval consists of light - medium grey, fine-grained sandstone that grades downward into medium grey - slightly green grey, medium - coarse-grained sandstone.
				1418-1421	Medium - dark grey, coarse-grained sandstone contains a lithic chip flooded "zone" (about 10 inches thick) at about 1421 ft. This sandstone interval grades downward into more fine - medium-grained mudflow breccia. Calcite veining constitutes approximately 3% of this interval.
150	1424-1433	1418-1428	10	1421-1427	Medium grey - dark grey, fine - medium-grained mudflow breccia (apparently same unit as in the 1415-1417 ft. interval above. Interval contains only approximately 2% calcite veins except in the 1424-1426 ft. interval where complex calcite veins constitute 20 - 25% of the rock.
				1427-1432	Medium grey - dark grey, fine - grained sandstone constitutes this interval and grades downward into medium grey, medium - coarse-grained sandstone (at approximately the 1428 ft. block) which grades downward into more fine - medium-grained mudflow breccia at 1432 ft. Calcite veins and crackle breccia (10 cm wide zone) cementing calcite constitute perhaps 5 -6% of the rock in this interval.
151	1433-1442	1428-1438	10	1432-1442	Rock in this interval consists of more medium-grained mudflow breccia unit. From 1432.5 ft. to 1435 ft. the mudflow breccia rock is cut by an extensive near vertical (with moderately down hole dipping splay veins) calcite vein that somewhat brecciates the host mudflow breccia rock. This calcite vein is somewhat vuggy with 3.5 cm by .5 cm wide open vugs containing late calcite crystals (up to .5 cm) or locally vug lining drussy quartz crystals. From 1435 to 1437 ft. the mudflow breccia unit is fairly extensively crackle brecciated and calcite cemented (calcite constitutes approximately 10% of this interval). From 1438 - 1441 ft. the mudflow breccia unit is extremely brecciated and cemented with 40 - 60% vuggy calcite and minor quartz. From 1441 to 1442 ft. the rock consists of a massive calcite + minor microcrystalline quartz vein with a breccia vein zone (6 - 8 cm wide) at the top and a shear zone (3 cm wide) at the bottom indicating this massive vein (containing wall rock fragments) cemented fault zone dips approximately 50 - 60 degrees. No real good slickensided
				1438-1441	3

1434  
0

**LAKE CITY GEOTHERMAL, LLC**  
**Lake City Observation Hole No. 1**

Sheet No. 37

Log By: R.F. Hardyman

Date: 3/20/02

(Int = interval, Rec = recovery)

Box No.	Int in box	Rod Int (Depth) (ft)	Rec for rod Int (ft)	Core Int (ft)	Lithologic Description
152	1442-1452	1441-1448	6.4	1442-1454	Abruptly, the rock in this interval consists of medium grey - dark grey, slightly pebbly, coarse-grained sandstone. This suggests that there was at least some displacement across the fault zone represented in the interval above. Calcite veins in this interval constitute 2 - 4% of the rock and consist of 2 mm to .5 cm wide veins and laminated to wispy vein "zones" up to 1 cm wide. This coarse-grained sandstone unit grades downward around 1454 ft. into more medium - coarse-grained mudflow breccia rock.
153	1452-1461	1448-1458	10.5		
154	1461-1470	1458-1468	10		
155	1470-1479	1468-1478	10		
156	1479-1488	1478-1488	10	1454-1488	Interval consists of dark - medium grey, medium - coarse-grained sedimentary mudflow breccia containing rounded to subangular heterolithologic volcanic (mostly) + sedimentary (including an occasional mudflow breccia fragment) clasts up to 6 - 12 cm but generally less than 2 - 4 cm in size. Clasts are matrix supported in medium-grained sand. This mudflow breccia unit contains variable amounts of interstitial calcite cement in the sandstone matrix (perhaps locally up to 10%). Calcite veins constitute << .5% of this rock interval.
157	1488-1497				
158	1497-1506	1488-1498	10		
159	1506-1515	1498-1508	10		
160	1515-1524	1508-1518	10	1488-1524	Interval consists of the same sedimentary debris flow (mudflow) breccia as above. Clasts occasionally up to 6 - 15 cm but generally 2 - 4 cm or less in size. Some zones (i.e. 1511 to 1517 ft.) are somewhat finer grained with clasts averaging 1.5 cm or less in size. Calcite veining in this interval is rare with only an occasional wispy vein or hairline to 2 mm wide vein.
161	1524-1533.5	1518-1528	10		
162	1533.5-1543	1528-1538	10		
163	1543-1552.5	1538-1548	10		
164	1552.5-1562	1548-1558	10	1524-1558.5	Interval consists of more of the same medium grey, medium-grained, massive mudflow breccia as above; clasts are generally 2 - 4 cm or less in size. Interval includes one fine-grained, microporphyratic volcanic cobble (14 cm across) at 1526.5 ft. and another at 1531 ft.; one coarse-grained equigranular, plagioclase + interstitial pyrobole bearing boulder (16 inches across) at 1531.5 - 1533 ft. and one 10 inch porphyritic volcanic boulder at 1535 ft. One nice 3 inch thick fine-grained sandstone layer at 1549 ft. displays irregular channel cut and fill contacts at top and bottom. This interval is nearly devoid of calcite veining. This mudflow breccia unit grades downward into medium grey, pebbly, coarse-grained sandstone at about 1558.5 ft.
				1558.5-1562	Interval consists of lithic pebble (rounded - subrounded, generally .5 cm in size) rich (35 - 40% of sandstone), medium grey, coarse-grained sandstone that grades downward into essentially pebble free medium-grained sandstone. Interval is essentially devoid of calcite veining (trace hairline calcite veins).

✓ 1447

**LAKE CITY GEOTHERMAL, LLC**  
**Lake City Observation Hole No. 1**

Sheet No. 38

Log By: R.F. Hardyman

Date: 3/20/02

(Int = interval, Rec = recovery)

Box No.	Int in box	Rod Int (Depth) (ft)	Rec for rod Int (ft)	Core Int (ft)	Lithologic Description
1571 165	1562-1573	1558-1568	8	1562-1568	(Some core loss - probably at approximately 1568 ft.) Rock in this interval consists of medium grey, well sorted, medium-grained sandstone with locally (bottom 6 inches of sandstone) abundant interstitial pinkish calcite cement. Interval is essentially devoid of calcite veins.
166	1573-1579	1568-1577	10.8	1568-1577	The above sandstone unit is underlain by medium brown, massive siltstone that also is essentially devoid of calcite veins. Core is highly broken but rock does not appear to be sheared.
167	1579-1588	1577-1587.5	10.5	1577-1588	The above siltstone is underlain by medium grey, massive, coarse-grained, fairly lithic pebble rich (25 - 35% lithic pebbles up to 1 cm and occasionally 4 - 5 cm but generally < .5 cm) sandstone. This interval is also nearly devoid of calcite veins. Trace hairline to 1 - 2 mm wide calcite/calcite + chlorite filled fractures (dipping 40 - 70 degrees), however, display slickensided surfaces with down dip and subhorizontal striations.
168	1588-1597	1587.5-1598	10.5		
169	1597-1606.5				
170	1606.5-1616	1598-1608	10		
171	1616-1626	1608-1618	10		
172	1626-1635	1618-1628	10	1588-1635	Interval consists of the same massive, pebbly, coarse-grained sandstone unit as above; rounded - subrounded pebbles are < .5 cm but occasionally up to 2 cm and rarely 4 - 6 cm in size. Interval from 1604 to 1610 ft. is fairly lithic pebble poor. Interstitial pinkish-red cryptocrystalline silica (?) is present in this sandstone from 1588 to 1595 ft. and again from 1603 - 1604 ft. Three hairline calcite veins and one 4 mm wide, 60 degree dipping, calcite vein constitute the only veins or fractures in this interval of rock. This sandstone unit contains an occasional carbonized plant fragment. Probable faint bedding observed at approximately 1629 ft. dips 30 degrees from horizontal.
173	1635-1645	1628-1638	10		
174	1645-1654	1638-1648	10		
175	1654-1663	1648-1658	10	1635-1663	Interval consists of the same medium grey, massive, pebbly, coarse-grained sandstone unit as above. Rounded pebbles, generally .5 cm or less with scattered cobbles 2 - 6 cm - rarely to 15 cm, are matrix supported in coarse - medium-grained sand. Interval contains scattered carbonized wood/plant fragments (up to 4.5 cm by .5 cm). This sandstone unit is weakly to moderately magnetic. Three calcite + chlorite veins (up to 1.5 cm; one at 3 cm wide) occur in this interval. These veins dip 20 - 40 degrees; slickensided surface observed on one vein and one hairline calcite + chlorite filled fracture is slickensided.
176	1663-1672.5	1658-1668	10	1663-1672.5	Interval consists of the same medium grey, massive, coarse-grained, pebbly lithic sandstone containing an occasional rounded volcanic lithic clast (up to 3.5 cm; one up to 15 cm) and abundant pale green aphyric volcanic and sedimentary lithic "chips" and rounded pebbles. Interval contains an occasional carbonized plant fragment and displays bedding at approximately 1669 ft. that dips 30 degrees from horizontal (to the core). Interval contains one minor hairline chlorite vein.

# LAKE CITY GEOTHERMAL, LLC

## Lake City Observation Hole No. 1

Sheet No. 39

Log By: R.F. Hardyman

Date: 3/20/02

(Int = interval, Rec = recovery)

Box No.	Int in box	Rod Int (Depth) (ft)	Rec for rod Int (ft)	Core Int (ft)	Lithologic Description.
475 ✓ 1679	1672.5-1682	1668-1678	10	1672.5-1682	Interval consists of the same lithic pebble rich, medium grey, coarse-grained sandstone unit as above. Three fairly planar calcite ± chlorite veins 1-3 mm to 1 cm wide cut the rock in this interval along with one complex calcite + chlorite + quartz vein zone 4 cm wide. These veins dip about 70 degrees from horizontal. One 14 cm across porphyritic volcanic cobble contains altered pyroxene (replaced by cryptocrystalline silica) and chloritized amphibole.
	1682-1691	1678-1688	10	1682-1691	Interval consists of the same massive, medium grey, pebbly, lithic rich, coarse-grained volcanoclastic sandstone unit as above. Rock contains 25 - 35% heterolithic pebbles (volcanic + sedimentary) 1 cm or less in size and occasional rounded to subangular volcanic cobbles 2 - 3 cm up to 9 - 14 cm and one pebbly, coarse-grained sandstone clast (9 cm across). Clasts are matrix supported in coarse-grained sandstone. The bottom 6 inches of this interval consists of a medium greenish grey, medium-grained sandstone lens/layer that displays faint bedding that dips 30 degrees from horizontal; one fracture contains slickensided chlorite displaying down dip striations.
	1691-1700	1688-1698	10		
	1700-1709.5	1698-1708	10		
	1709.5-1719	1708-1718	10	1691-1719	Interval consists of the same massive, medium grey, lithic pebble rich, coarse-grained volcanoclastic sandstone unit as above. Thin zones (5 - 12 cm thick) within this unit are more lithic rich (lithic fragments up to 80% of the rock). Faint bedding associated with these lithic rich zones dips approximately 30 degrees from horizontal. Occasional chlorite + minor calcite filled fractures (< 2 - 3 mm wide) in this interval display slickensided chlorite surfaces with striations raking 30 - 40 degrees from horizontal. Only two hairline calcite veins are present in this interval. Heterolithic lithic clasts (rounded - subangular) generally constitute 35 - 45% of this unit and are generally .5 - 1 cm or less in size but occasionally are up to 2 cm and rarely 6 - 8 cm in size.
1730	1719-1728	1718-1728	10		
	1728-1737	1728-1738	10		
	1737-1746			1719-1746	Interval consists of the same unit as above and contains lithic rich zones (8 - 12 cm thick) alternating with lithic pebble poor, medium-grained sandstone zones (up to 50 cm thick). Lithic pebble size appears to be getting smaller (< 8 - 10 mm) down section. Shallow dipping calcite + chlorite veins/fracture fillings constitute < 1% of this rock interval.
1762	1746-1755	1738-1748	10		
	1755-1764	1748-1758	10		
	1764-1773.5	1758-1768	10	1746-1773.5	Cored interval consists of the same rock unit as above; still with alternating/interbedded lithic rich and lithic poor "zones" 5 - 25 inches thick. One coarse-grained (angular - subrounded lithic fragments up to 2 cm) lithic choked zone at 1760 - 1762.5 ft. contains abundant interstitial cryptocrystalline silica (some faintly pinkish) and minor calcite cement. Calcite and calcite + chlorite veining constitutes << .5% of this rock interval.

**LAKE CITY GEOTHERMAL, LLC**  
**Lake City Observation Hole No. 1**

Sheet No. 40

Log By: R.F. Hardyman

Date: 3/21/02

(Int = interval, Rec = recovery)

Box No.	Int in box	Rod Int (Depth) (ft)	Rec for rod Int (ft)	Core Int (ft)	Lithologic Description
188	1773.5-1785	1768-1778	10		
189	1785-1792	1778-1788	10		
190	1792-1801	1788-1798	10	1773.5-1801	Core consists of the same medium grey to brownish grey (bottom of interval), lithic rich, coarse-grained sandstone as above and contains zones/layers up to 1 ft. thick of lithic free, medium-grained sandstone and fine-grained sandstone and siltstone "partings"/layers up to 2 cm thick. Discernable bedding associated with these finer grained layers dips 30 degrees. Lithic fragments (rounded to subangular) in the coarser grained sandstone horizons are 1 cm or less in size but interval contains an occasional 2 cm sized pebble and a rare 12 cm sized volcanic cobble. Calcite and calcite + chlorite veins constitute < 1% of the rock in this interval and are 1 mm to 1 cm thick. At 1787 - 1789 ft. a vertical complex quartz + hematite + minor pale brown calcite/ankerite(?) vein cuts and brecciates the pebbly sandstone wall rock.
191	1801-1810.5	1798-1808	10	1801-1810.5	Core consists of the same medium grey - brown grey, massive, coarse-grained to medium-grained sandstone unit as in the above interval but is more uniform in grain size overall. Rounded lithic pebbles have fallen off in abundance (10% of rock or less) and in size (generally < .5 cm). Calcite + chlorite veins constitute approximately 5 - 6% of the rock in this interval; are 1 - 2 mm to 1.5 cm wide and dip from subhorizontal to 60 - 70 degrees from horizontal. A couple of the high-angle veins/fractures display slickensided surfaces containing near down dip striations.
192	1810.5-1820	1808-1818	10	1810.5-1820	Rock interval consists of the same lithology (pebbly, coarse-grained sandstone) as interval above. Rock is cut by a slightly vuggy complex vein/breccia vein "zone" approximately 8 - 10 inches wide at about 1811 ft. consisting of calcite and minor chlorite + hematite. Fine-grained prismatic gypsum crystal line some open spaces in this vein zone. the rest of the interval contains < 1% calcite + chlorite veins. Interval contains traces of carbonized plant fragments.
193	1820-1829	1818-1828	10		
194	1829-1838	1828-1838	10	1820-1838	More massive, medium grey, medium - coarse-grained, pebbly (rounded pebbles up to 2 cm) sandstone (same unit as above) in this interval grades downward into more lithic rich (but finer grained - lithic fragments 1 cm or less), coarse-grained sandstone (approximately 5 ft thick zone around 1829 - 1834 ft.) and overlies (2 cm wide, 40 degree dipping calcite + chlorite vein - slickensided with down dip striations - masks the contact) medium grey - medium - dark grey, massive, well sorted, lithic free, fine-grained sandstone that grades back (downward) into more moderately pebbly, medium grained sandstone at about 1836.5 ft. Calcite +/- chlorite veins constitute << .5% of the rock in this interval. Sandstone in this interval contains altered (calcite + chlorite) pyrobole sand grains.

✓.1788

1811



**LAKE CITY GEOTHERMAL, LLC**  
**Lake City Observation Hole No. 1**

Sheet No. 41

Log By: R.F. Hardyman

Date: 3/21/02

(Int = interval, Rec = recovery)

Box No.	Int in box	Rod Int (Depth) (ft)	Rec for rod Int (ft)	Core Int (ft)	Lithologic Description
195	1838-1847	1838-1848	10	1838-1857	More massive, medium grey - dark grey, medium-grained, moderately pebbly (rounded heterolithologic volcanic + sedimentary pebbles up to 1 cm but generally .5 cm or less) sandstone containing reworked altered pyrobole sand grains. Pebbles in most of this sandstone interval constitute 5 - 15% of the rock. Pebble rich zones/layers 2 inches to 1 ft. thick alternate with pebble poor, medium-grained sandstone zones/layers. Contacts associated with these alternating layers dip about 30 degrees - some contacts are small channel fill contacts. Calcite veining constitutes < 1% of this interval. This sandstone - pebbly sandstone unit is moderately magnetic.
196	1847-1857				
197	1857-1866	1848-1858	10	1857-1875.5	Interval consists of fairly uniform, massive, medium grey, pebbly (lithic pebbles approximately 15 - 20% of rock and generally < .5 cm in size but occasional 2 - 4 cm and rare 10 cm size cobbles are scattered throughout), medium-grained sandstone. One zone of complex anastomosing calcite veining is present from 1857 - 1858 ft. The rest of this interval contains 4 calcite + chlorite veins/fracture fillings that dip 50 to 70 degrees from horizontal; two of these display slickensided surfaces containing striations that rake from 30 degrees to 90 degrees (purely down dip).
198	1866-1875.5	1858-1868	10		
199	1875.5-1884	1868-1878	10	1875.5-1903	Interval consists of more massive, medium grey, pebbly, medium-grained sandstone. Rounded - subrounded - occasionally subangular heterolithologic pebbles are mostly .5 cm or less in size but 1 - 2 cm size pebbles occur sporadically throughout. One lithic pebble rich zone (approximately 2 ft. thick) occurs at 1889 - 1891 ft. Calcite veining is nearly absent in this rock interval; one 1 cm wide calcite + chlorite filled planar fracture (50 degree dip) displays a slickensided surface containing down dip striations. Interval contains occasional carbonized plant fragments.
200	1884-1893.5	1878-1888	10		
201	1893.5-1903	1888-1898	10		
202	1903-1912	1898-1908	10	1903-1930	Lithology of this interval is the same as the above interval; medium grey, massive, pebbly (some zones up to 2 - 4 ft. thick are more lithic rich), medium-grained sandstone. One irregular calcite vein and two planar 1 - 3 mm wide calcite + chlorite filled fractures occur in this interval. These planar fractures dip 50 degrees and display slickensided surfaces containing down dip striations.
203	1912-1921	1908-1918	10		
204	1921-1930	1918-1928	10		
205	1930-1939	1928-1938	10		
206	1939-1948.5	1938-1948	10		

✓ 1857

✓ 1912

**LAKE CITY GEOTHERMAL, LLC**  
**Lake City Observation Hole No. 1**

Sheet No. 42

Log By: R.F. Hardyman

Date: 3/22/02

(Int = interval, Rec = recovery)

Box No.	Int in box	Rod Int (Depth) (ft)	Rec for rod Int (ft)	Core Int (ft)	Lithologic Description
207	1948.5-1958	1948-1958	10	1930-1958	Rock unit remains the same massive, fine-grained pebbly, medium-grained sandstone as above. One alternating more lithic rich layer (12 cm thick) and lithic free, fine-grained sandstone layer at approximately 1942 ft. defines bedding that dips 25 degrees. Another more lithic rich layer, 6.5 cm thick and one 7 cm across rounded cobble contain moderately abundant interstitial pinkish-red cryptocrystalline silica (?) cement. Interval contains one 6 cm wide complex calcite + minor hematite vein and two calcite + chlorite filled planar fractures 3 - 8 mm thick that display slickensided surfaces containing striations that rake 40 - 90 degrees. Otherwise this entire interval is devoid of calcite veins/fractures.
208	1958-1967				
209	1967-1976	1958-1968	10		
210	1976-1985	1968-1978	10	1958-1985	Interval consists of the same medium grey - medium dark grey, massive, fine-grained pebbly, medium-grained sandstone unit as above. Interval contains a couple of dark brown/black siltstone rip up clasts (one up to 12 cm across). Rare bedding planes dip 30 degrees from horizontal. The entire interval contains only 6 calcite veins; one dips 40 degrees and is 1 cm wide.
211	1985-1994	1978-1988	10		
212	1994-2003.5	1988-1998	10		
213	2003.5-2013	1998-2008	10	1985-2013	Interval consists of the same unit as above; massive, medium grey, fine-grained pebbly, medium-grained sandstone grading down section (at approximately 1998 ft.) into medium-grained pebbly, medium-grained sandstone with pebbles (perhaps more abundant) up to 2 cm in size. Interval is essentially devoid of calcite veining but contains three chlorite + minor calcite veins (hairline to .5 cm wide); one displays slickensided surfaces.
214	2013-2022.5	2008-2018	10		
215	2022.5-2032	2018-2028	10		
216	2032-2041	2028-2038	10	2013-2041	The medium-grained pebbly, medium-grained sandstone unit above grades abruptly downward into coarse-grained mudflow breccia containing pebble to small boulder sized (up to 15 cm), heterolithologic volcanic clasts. This interval contains a couple of medium brown siltstone layers/lenses 3 inches to 1 ft. thick. White and pinkish matrix cementing silica is abundant in the mudflow breccia below approximately 2028 ft. The mudflow breccia contains occasional hairline calcite veins and three 1 - 8 mm wide calcite filled fractures; one containing slickensided surfaces. At 2039 ft. the sedimentary mudflow breccia is cut by a medium dark grey, very fine-grained porphyritic andesite dike. The upper contact of this dike is somewhat irregular and brecciated but a vertical irregular contact is present at the 2041 ft. level. This dike rock contains approximately 20% phenocrysts of pyrobole (< 1 mm in size) and less abundant scattered plagioclase phenocrysts (up to 1.5 mm). This dike displays a faint darker grey chilled margin

# LAKE CITY GEOTHERMAL, LLC

## - Lake City Observation Hole No. 1

Sheet No. 43

Log By: R.F. Hardyman

Date: 3/22-23/02

(Int = interval, Rec = recovery)

Box No.	Int in box	Rod Int (Depth) (ft)	Rec for rod Int (ft)	Core Int (ft)	Lithologic Description
217	2041-2051	2038-2048	10		
218	2051-2060.5	2048-2058	10	2041-2060.5	Interval consists of the same medium grey, coarse-grained mudflow breccia as above. Unit grades downward from matrix-supported pebble to cobble sized clasts to more boulder rich nearly clast supported mudflow breccia with rounded clasts commonly 8 - 16 cm across constituting 80 - 85% of the rock. The fine-grained porphyritic andesite dike cuts this mudflow breccia in an irregular vertical contact down to 2042.5 ft; comes in again at 2043 ft. and again at 2050 to 2051.3 ft. One calcite vein (3 mm wide) cuts the rock in this interval. Heterolithic volcanic cobbles - boulders in this mudflow breccia include aphanitic to aphyric and porphyritic andesite. Pyroxene phenocrysts (up to .5 cm in some porphyritic clasts) are generally moderately chlorite altered.
219	2060.5-2070	2058-2068	10		
220	2070-2079	2068-2078	10		
221	2079-2088	2078-2088	10	2060.5-2088	Interval consists of more bouldery, near clast supported, mudflow breccia with zones 1 - 1.5 ft. thick of less bouldery - more pebble - cobble rich, matrix supported mudflow breccia. Interval from 2078 to 2080.5 ft appears to be one large boulder. At approximately 2084.4 ft. the mudflow breccia is cut by a fine-grained porphyritic andesite dike/sill (?). This is the same andesite that occurs in the dike cutting this unit in two intervals above. This dike/sill is approximately 32 inches wide and is slightly brecciated and calcite cemented at its lower contact. A carbonized plant fragment containing trace fine-grained pyrite occurs at approximately 2087 ft. This interval contains only traces of calcite + chlorite hairline veins and fracture coatings.
222	2088-2098	2088-2098	10		
223	2098-2107.5	2098-2108	10		
224	2107.5-2117	2108-2118	10		
225	2117-2126.5			2088-2126.5	Rock in this interval consists of the same cobble rich, nearly clast supported coarse-grained mudflow breccia as above. Rounded and occasional subangular heterolithic volcanic clasts range in size from 4 - 10 cm and are set in a fine-grained sandy matrix. The coarser grained mudflow breccia grades downward into finer grained more pebbly (rounded to subangular lithic pebbles 2 - 4 cm or less in size) lithic rich (60 - 80% lithic clasts) mudflow breccia rock containing one probable boulder (21 cm across) at approximately 2104.5 ft. Below this probable boulder, the finer grained mudflow breccia grades abruptly downward into finer grained mudflow breccia containing rounded lithic pebbles 1 cm or less in size generally but with scattered to moderately abundant well rounded small cobbles 4 - 8 cm in size. Below 2103 ft. the mudflow breccia becomes again much coarser grained and contains one 2 ft. across boulder at 2105.5 - 2107.5 ft. of faintly pilotaxitic, medium-grained equigranular andesite. Three other boulders 1.6 ft. to 2 ft. in size occur at 2112 to Below 2115 ft the mudflow breccia is coarse-grained with rounded cobbles and small boulders ranging in size from 5 inches to 1 ft. A couple of well rounded lithic pebbles in this lower part appear to be aphyric, sanidine bearing rhyolite. Interval contains an occasional hairline to 2 mm wide calcite vein; minor but variable amounts of pinkish interstitial silica cement and one 2 cm wide vuggy calcite vein that dips 50 degrees from horizontal.

✓ 2041

✓ 2123

**LAKE CITY GEOTHERMAL, LLC**  
**Lake City Observation Hole No. 1**

Sheet No. 44

Log By: R.F. Hardyman

Date: 3/23-24/02

(Int = interval, Rec = recovery)

Box No.	Int in box	Rod Int (Depth) (ft)	Rec for rod Int (ft)	Core Int (ft)	Lithologic Description
226	2126.5-2136	2118-2128	10	2126.5-2136	Interval consists of the same coarse-grained mudflow breccia unit as above. Heterolithic volcanic clasts are well rounded and range in size from 2 - 3 cm to 18 cm. Unit grades down hole into finer grained lithic choked mudflow breccia at approximately 2132 ft. Interval contains one hairline calcite vein but contains abundant matrix cementing white to pinkish-red silica down to about 2132 ft.
227	2136-2145	2128-2138	10		
228	2145-2155	2138-2148	10		
229	2155-2164	2148-2158	10	2136-2164	Rock in this interval is of the same mudflow breccia unit as above. The mudflow breccia in this interval is predominantly pebble (2 - 3 cm or less) and cobble (4 - 8 cm) bearing with well rounded and subrounded lithic clasts constituting 40 to locally 60% of the rock; clasts are matrix supported in medium - coarse-grained volcanoclastic sand. The mudflow breccia in this interval contains three boulders ranging in size from 7 inches to 1.4 ft. across. This interval contains only an occasional hairline calcite, calcite + chlorite, and pinkish red silica veins/fracture coatings except in the interval from approximately 2149 ft. to 2155 ft. where 60 - 70 degree dipping calcite veins 2 - 5 mm side and one somewhat horsetail interlaced calcite + hematite vein 2 - 3 cm wide constitute approximately 5 - 6% of the rock
230	2164-2173	2158-2168	10	2164-2173	Interval consists of the same pebble - cobble bearing mudflow breccia unit as above that is becoming much finer grained down section with lithic fragments generally .5 cm or less in size and only occasionally up to 2 - 2.5 cm. Hairline and two 8 mm wide, 60 - 70 degree dipping calcite veins constitute approximately .5 - 1% of this rock interval.
231	2173-2182	2168-2178	10		
232	2182-2191	2178-2188	10	2173-2191	The fine-grained mudflow breccia above overlies (at approximately 2173.2 ft.) in a sharp, irregular, channel scour contact, medium grey, well sorted, fine-grained sandstone that grades downward into medium-grained sandstone which, in turn, grades downward into very fine-grained sandstone alternating with siltstone at the bottom of this interval. Unidirectional 50 - 60 degree dipping calcite veins (hairline to .5 cm wide and two vuggy calcite veins 1 and 1.5 cm wide) constitute approximately 2% of this fine-grained sandstone interval. Faint bedding in this sandstone dips 30 degrees.
233	2191-2200	2188-2198	10		
234	2200-2209	2198-2208	10	2191-2208.5	The fine-grained sandstone unit above grades downward into well bedded (varve bedded), alternating fine-grained sandstone, very fine-grained sandstone, and siltstone layers 3 mm to 1 cm thick. Well defined bedding dips 25 degrees from horizontal. Planar to wispy 20 - 50 degree dipping calcite veins 3 mm to .5 cm wide (one slightly braided vein zone is 6 cm wide) constitute approximately 1% of this rock interval. At 2204.5 ft. the varve bedded finer-grained sedimentary rock interval depositionally overlies less distinctly bedded, alternating (beds .5 cm to 2 cm thick) fine-grained and medium-grained sandstone.

2186

**LAKE CITY GEOTHERMAL, LLC**  
**Lake City Observation Hole No. 1**

Sheet No. 45

Log By: R.F. Hardyman

Date: 3/24/02

(Int = interval, Rec = recovery)

Box No.	Int in box	Rod Int (Depth) (ft)	Rec for rod Int (ft)	Core Int (ft)	Lithologic Description
235	2209-2218	2208-2218	10		
236	2218-2227	2218-2228	10	2208.5-2225.5	The fine-grained sandstone unit above depositionally overlies a good pebble and cobble conglomerate consisting of very well rounded, round and elliptical, heterolithologic volcanic and rare fine-grained sedimentary, pebbles and cobbles (.5 cm to 7 cm in size) set in a nearly clast supported coarse-grained sandstone matrix containing minor interstitial silica cement. Hairline calcite veins and occasional planar vuggy calcite vein .5 cm to 1.5 cm wide constitute perhaps 2% of this rock interval. One 50 degree dipping vuggy calcite vein at 22225 ft. may be 15 cm wide (calcite mostly rubble in core). Calcite in the vuggy calcite vein is somewhat tan brown iron stained.
237	2227-2236				
238	2236-2245	2228-2238	10	2225.5-2241	At approximately 2225.5 ft. the pebble - cobble conglomerate gradationally overlies light to medium grey, faintly bedded (30 degree dipping), coarse-grained volcanoclastic sandstone containing conglomerate layers 3 - 8 inches thick that contain matrix supported well rounded heterolithologic volcanic and trace sedimentary lithic pebbles. These conglomerate layers/lenses(?) are generally space 1 - 1.5 ft apart and are absent below 2235.5 ft.
239	2245-2254	2238-2248	10		
240	2254-2264	2248-2258	10	2241-2261.5	The coarse-grained sandstone unit above overlies (in planar depositional contact) a fine-grained porphyritic andesite boulder (8 inches across) that marks the top of a medium grey, pebble and cobble to small boulder (11 - 15 cm) bearing mudflow breccia containing matrix (coarse-grained sand) supported, rounded to subangular, heterolithologic andesite clasts. This mudflow breccia unit contains < 1% calcite veins (hairline to rarely 8 mm side) and one complex 4 - 8 cm wide, 70 degree dipping, calcite (with iron stain) vein at approximately 2251.5 to 2253 ft.
241	2264-2274	2258-2268	10		
242	2274-2284	2268-2278	10	2261.5-2279	The above mudflow breccia depositionally overlies slightly fine-grained pebbly, fine-grained sandstone that grades downward (except for one 6 - 8 inch wide zone of debris flow) into chocolate brown colored, massive siltstone containing scattered small (.5 cm or less) rounded lithic pebbles and moderately abundant (20 %) sand sized lithic grains. The siltstone in this interval contains occasional slickensided allophane coated fractures (moderately to steeply dipping) and one planar clastic pebbly sandstone "dike" 8 mm wide. The lower 5 ft. of this siltstone contains abundant rounded to subangular volcanic lithic clasts 1 - 2 cm to occasionally 1.0 cm in size. This pebble and cobble, matrix supported, siltstone grades downward into mudflow breccia.

✓ 221615

✓ 22284  
 ✓ 2227

# LAKE CITY GEOTHERMAL, LLC

## Lake City Observation Hole No. 1

Sheet No. 46

Log By: R.F. Hardyman

Date: 3/24/02

(Int = interval, Rec = recovery)

Box No.	Int in box	Rod Int (Depth) (ft)	Rec for rod Int (ft)	Core Int (ft)	Lithologic Description
				2279-2281	Interval consists of dark grey - brownish grey, lithic clast rich (45 - 55% of rock) sedimentary mudflow breccia containing rounded to subangular, heterolithic volcanic lithic clasts ranging in size from .5 cm or less up to 7 cm. Clasts are matrix supported in a fine - medium-grained sand matrix. Interval is devoid of calcite or other veins but contains an occasional slickensided high-angle fracture displaying near down dip striations. Volcanic lithic clasts are dark brown and black - darker than the matrix sandstone and medium grey - light grey and greenish grey - lighter than the matrix sandstone, and consist of aphanitic, aphyric, and fine-grained and coarse-grained porphyritic, plagioclase + pyrobole bearing andesite.
243	2284-2293	2278-2288	10		
244	2293-2302	2288-2298	10	2281-2302	Interval consists of the same medium - dark brown grey, medium - coarse-grained, sedimentary mudflow breccia as above. Rounded to subangular, heterolithic andesite (trace fine-grained sedimentary rock pebbles) clasts constitute 45 - 65% of the rock, range in size from .5 cm or less up to 15 cm - occasionally to 25 cm, and are matrix supported in medium - coarse-grained lithified sand. Interval is devoid of calcite (or other) veins and only one allophane coated slickensided fracture was observed. Pinkish red cryptocrystalline silica occurs as modestly abundant interstitial cement in the sand matrix and as vesicle-like intergrowths in lithic clasts.
245	2302-2311	2298-2308	10		
246	2311-2320	2308-2318	10	2302-2320	Interval consists of the same sedimentary mudflow breccia unit as above. Clasts are generally 10 cm or less in size but occasional small boulders 25 - 30 cm across are present in this interval. Interstitial pinkish to white cryptocrystalline silica cement is present in the medium - coarse-grained sandy matrix of this hard, well lithified rock and also occurs in lithic clasts as irregular intergrowths and amygdale-like patches up to 1.5 cm long by 3 - 5 mm wide. Chlorite filled round - elliptical vesicles (?) also occur in these same clasts. Fine-grained, dark brownish grey calcite also occurs in similar amygdale-like intergrowths in some clasts along with the silica intergrowths. Otherwise, this rock interval is devoid of any calcite +/- quartz veins or fractures. One carbonized plant fragment containing extremely fine-grained intergrown diagenetic pyrite was observed in this rock interval.
247	2320-2328	2318-2328	10	2320-2328	Core in this interval is of the same mudflow breccia unit as above. Two 10 inch boulders and one 18 inch across boulder occur in this interval. The large boulder contains rounded to ovoid and occasional irregular shape amygdale-like infillings of calcite, chlorite only, and one large (4 cm) patch of intergrown chlorite + quartz + minor calcite. Trace carbonized wood (?) fragments are present in this rock. Interval is devoid of any veins or fractures.

✓ 2322.5

# LAKE CITY GEOTHERMAL, LLC

## Lake City Observation Hole No. 1

Sheet No. 47

Log By: R.F. Hardyman

Date: 3/25/02

(Int = interval, Rec = recovery)

Box No.	Int in box	Rod Int (Depth) (ft)	Rec for rod Int (ft)	Core Int (ft)	Lithologic Description
248	2328-2339	2328-2338	10		
249	2339-2348	2338-2348	10		
250	2348-2357				
251	2357-2364	2348-2358	10	2328-2361.2	Rock in this interval consists of the same medium grey - dark grey, coarse-grained mudflow breccia unit as above. Heterolithic volcanic lithic clasts are rounded to subangular and range in size from pebbles (.5 cm) to cobbles (2 - 10 cm) and boulders (up to 37 cm) and are matrix supported in a medium to coarse-grained volcaniclastic sand matrix. As in this unit above, some cobbles and boulders contain ovoid amygdules (up to 2 cm by .5 cm) filled with "dirty" appearing brownish grey, fine-grained calcite, smaller amygdules filled with chlorite, and occasional irregular intergrowths of white to pinkish, cryptocrystalline quartz with or without chlorite. These amygdules appear to be associated with one specific porphyritic andesite lithology that contains plagioclase laths up to 8 mm and altered pyroxene phenocrysts up to 5 mm. As above, this hard, well lithified mudflow unit in this interval is devoid of any veins or fractures.
252	2364-2376	2358-2368	10	2361.2-2373.5	Rock in this interval consists of dark grey, medium-grained andesite porphyry containing 60 - 70% euhedral plagioclase laths up to 6 mm and moderately altered (chloritized) pyroxene phenocrysts up to 1 cm. Both the upper and lower contacts of this andesite are not very distinct and appear to be irregular, slightly auto-brecciated, and partially incorporate mudflow breccia rock. This andesite interval probably represents a sill or possibly a flow (?) or dike (?). This rock lacks amygdules as in the andesite clasts in the mudflow unit above and is more crystal rich than those andesite clasts. This sill (?) is also devoid of any veins or fractures.
253	2376-2385	2368-2378	10	2373.5-2379.5	This interval consists of more of the mudflow breccia unit as is present above the 12.3 ft thick andesite sill (?) interval above.
				2379.5-2381.3	Rock in this interval is a light grey - greenish grey, aphanitic andesite containing microphenocrysts of unaltered pyroxene and microamygdules of chlorite in an aphanitic matrix. This rock displays very irregular contacts with the mudflow breccia wall rock and appears to be a good crosscutting - probably steeply dipping (?) dike. This dike contains one 1 mm wide planar calcite + chlorite vein that dips 75 degrees from horizontal (to the core).
				2381.3-2383.5	Interval consists of more mudflow breccia and is again cut by more of the above dike rock.
				2383.5-2384.5	Rock in this interval is more of the same aphanitic andesite dike rock.

**LAKE CITY GEOTHERMAL, LLC**  
**Lake City Observation Hole No. 1**

Sheet No. 48

Log By: R.F. Hardyman

Date: 3/25/02

(Int = interval, Rec = recovery)

Box No.	Int in box	Rod Int (Depth) (ft)	Rec for rod Int (ft)	Core Int (ft)	Lithologic Description
254	2385-2394	2378-2388	10		
255	2394-2403	2388-2398	10		
256	2403-2412.5	2398-2408	10	2384.5-2408.5	This interval consists of more of the same mudflow breccia unit that forms the wall rock to the andesite dike above. Volcanic lithic clasts are pebble to cobble (up to 15 cm) size and contain amygdaloidal + lathy plagioclase bearing andesite clasts as are present higher up in the unit. Unit is devoid of veins and fractures down to 2396 ft. where a 2 cm wide, 75 - 80 degree dipping, vuggy quartz + calcite (late vug lining crystals) vein cuts the unit. Occasional hairline quartz and hairline calcite veins are present below this vein.
				2408.5-2410.5	Interval consists of medium grey, fine-grained (lithic fragments < 1 cm), uniform, moderately well sorted, pebbly, very distal mudflow or very coarse-grained, pebbly volcanoclastic sandstone that underlies the mudflow breccia above.
257	2412.5-2422	2408-2418	10	2410.5-2416	The pebbly, coarse-grained sandstone or fine-grained debris flow rock in the above interval grades downward into a coarse-grained, lithic rich, pebble - cobble (lithic fragments < 1 cm up to 7 cm) clast supported debris flow (packstone-like rock) containing perhaps 3 - 5% interstitial clast cementing white to pinkish silica. This pebble - cobble, clast supported debris flow grades downward into coarser grained, bouldery debris flow.
258	2422-2431	2418-2428	10	2416-2427	Interval consists of medium grey - dark grey, coarse-grained, essentially clast supported bouldery mudflow breccia or bouldery conglomerate containing well rounded to subrounded heterolithic andesitic boulders 15 cm to 33 cm in size. One highly cracked (hematite +/- goethite crack fillings) probable boulder is 37 inches across. Interval is devoid of veins.
259	2431-2440.5	2428-2438	10		
260	2440.5-2450	2438-2448	10	2427-2450	Interval consists of medium grey to slightly greenish grey, fine-grained porphyritic andesite containing approximately 35 - 40% euhedral plagioclase phenocrysts (up to 1 mm) and 15 - 20% generally chloritized, euhedral - subhedral pyroxene phenocrysts (up to 4 mm) in an aphanitic matrix. The upper "contact" of this andesite (probable lava flow) unit is not distinct in core. The rock is autobrecciated at the "contact" which appears irregular with some intermixing of sandy material from the underlying mudflow horizon. The andesite contains autobreccia zones and local hydrofractured breccia zones containing hematitic iron and chlorite cement around angular - closely spaced lava fragments. Some irregular intermixing of darker and lighter colored andesite appears to be due to intermingling of slightly less crystal rich aphanitic lava and the fine-grained phenocrystic lava. In the lower part of this interval, plagioclase phenocrysts appear larger in size (up to 1.5 mm) and irregular zones and patches contain abundant amygdules (2-3 mm or less) of chlorophaeite +/- calcite. Some irregular vesicles - vuggy patches contain chlorite rims and silica infillings. Calcite veins (hairline to 4 mm), calcite + chlorite, and trace quartz + calcite veins constitute < 1% of this interval. Two 50 degree dipping planar calcite veins (one slightly vuggy) are present at 2442 ft. (4 cm wide) and at 2447 ft. (2 cm wide).

✓ 2396



**LAKE CITY GEOTHERMAL, LLC**  
**Lake City Observation Hole No. 1**

Sheet No. 49

Log By: R.F. Hardyman

Date: 3/25/02

(Int = interval, Rec = recovery)

Box No.	Int in box	Rod Int (Depth) (ft)	Rec for rod Int (ft)	Core Int (ft)	Lithologic Description
261	2450-2459	2448-2458	10		
262	2459-2468	2458-2468	10	2450-2463.5	Interval consists of more of the same andesite unit as above and contains zones to rounded patches (cognate autoclasts) of coarser plagioclase crystals surrounded by more aphanitic andesite. Some irregular hematite stained vein-like zones locally pervade the andesite and impart a somewhat breccia appearance. The andesite overlies (moderately distinct but irregular contact) another medium-grained pebble-cobble mudflow breccia unit. Interval contains an occasional hairline to 1 - 3 mm wide calcite vein.
263	2468-2477				
264	2477-2486	2468-2478	10		
265	2486-2495.5	2478-2488	10		
266	2495.5-2505	2488-2498	10	2463.5-2495	Interval consists of more of medium grey - dark grey, massive, medium - coarse-grained mudflow breccia containing rounded to subangular, heterolithic, matrix supported, andesite lithic clasts ranging in size from < 2cm to 12 cm and occasionally up to 22 cm set in a medium-grained sandstone matrix. Clasts are multicolored in greys (lighter colored than matrix sand), reds and browns (darker than the matrix sand). Interval contains one 1 mm wide calcite vein and two 3 - 5 cm wide vuggy calcite veins (dipping 40 - 60 degrees from horizontal) at 2470 and 2472 ft.
				2495-2498.5	Interval consists of light grey, fine-grained porphyritic andesite containing stubby plagioclase and pyrobole phenocrysts up to 2 mm and with irregular contacts (top and bottom) with the mudflow breccia wall rock. This andesite is probably a dike. Rock is fairly well autobrecciated with minor chlorite and hematite material cementing around breccia clasts.
				2498.5-2500.5	Interval consists of more of the mudflow breccia unit as present above the possible andesite dike rock.
267	2505-2514	2498-2508	10		
268	2514-2523	2508-2518	10		
269	2523-2532	2518-2528	10		
270	2532-2542	2528-2538	10		
271	2542-2551	2538-2548	10	2500.5-2547.5	Rock in this interval consists of medium grey - weakly greenish grey, fine-grained porphyritic, euhedral plagioclase ( 1 mm) and generally altered (to chlorite and calcite) pyroxene (up to 2 mm) bearing andesite. This andesite also displays zones ( 2 ft. wide) of hydrofract-like brecciation containing more aphanitic textured andesite + some chlorite and hematite (locally) cement, and zones a few inches to 1 ft. across containing coarser grained (up to 2 - 3 mm) plagioclase. Down section in this interval the andesite appears quite "blothy" with equal amounts of intermingled aphanitic and fine-grained porphyritic andesite. Even so, the slightly aphanitic darker grey "matrix" andesite contain plagioclase + pyroxene microphenocrysts. This andesite unit is moderately magnetic and contains perhaps 1 - 2% wispy to horsetail calcite +/- chlorite veins generally unidirectionally dipping at 60 - 70 degrees from horizontal.

2470  
Missing

2511

**LAKE CITY GEOTHERMAL, LLC**  
**Lake City Observation Hole No. 1**

Sheet No. 50

Log By: R.F. Hardyman

Date: 3/25/02

(Int = interval, Rec = recovery)

Box No.	Int in box	Rod Int (Depth) (ft)	Rec for rod Int (ft)	Core Int (ft)	Lithologic Description
272	2551-2560	2548-2559	10	2547.5-2574.5	<p>Rock in this interval consists of light grey, very aphanitic andesite with a subvertical to 60 degree dipping irregular contact at 2547.5 ft. that displays a chilled margin. This andesite contains an occasional euhedral plagioclase phenocryst (1 mm in size); the rest of the rock appears to microcrystalline and plagioclase dominant. (These rocks are a tough call without field relations or thin section work). Rock contains scattered tiny amygdules (chlorite filled) up to 2 mm in size. Rock in this interval contains perhaps 1% hairline to wispy calcite veins and quartz + chlorite + minor calcite veins. At 2556 to 2559 ft. the core consists of a 1.5 ft. wide, 65 degree dipping, vuggy quartz + calcite + minor chlorite vein - breccia vein that contains a slickensided surface near the hanging wall contact that displays down dip striations. Open vugs in this quartz vein are up to 4 cm by 7 cm in size and contain prismatic to acicular gypsum crystals up to 1 cm long. Breccia fragments of wall rock in this vein generally are chloritized, soft, and nondescript.</p> <p>Calcite +/- chlorite veins (hairline to 4 mm wide) constitute perhaps 2 - 3% of the rock below this 1.5 ft. wide vuggy vein. The lower irregular contact of this very aphanitic andesite resembles the upper contact (with 1 - 3 mm wide chilled margin) and dips overall 60 degrees from horizontal. I think this very aphanitic andesite interval represents a dike that crosscuts the section. More mudflow breccia constitutes the core below this lower contact at 2574.5 ft.</p>
273	2560-2568	2559-2568	10		
274	2568-2577	2568-2578	10		
275	2577-2586				
276	2586-2595	2578-2588	10	2574.5-2631	<p>Core in this interval consists of medium grey, medium-grained, pebble + cobble bearing mudflow sedimentary breccia containing 45 - 60% matrix supported, heterolithologic, rounded to subrounded volcanic + minor sedimentary lithic pebbles 2 cm or less in size and volcanic cobbles 2 - 10 cm in size. Volcanic clasts are multi colored (light and dark grey, red, and green) and multi textured but mostly are fine-grained, granular to aphanitic and fine-grained porphyritic. Occasional boulders 21 - 32 cm in size are present in this mudflow breccia unit. This entire 56.5 ft. interval of this mudflow breccia unit contains only three hairline to 1 mm wide calcite veins and one slightly banded - wispy calcite + chlorite vein . 7 cm wide. One of the hairline calcite veins dips 40 degrees and displays a slickensided surface containing down dip striations.</p>
277	2595-2604	2588-2598	10		
278	2604-2613	2598-2608	10		
279	2613-2622	2608-2618	10		
280	2622-2631	2618-2628	10		

✓2559

# LAKE CITY GEOTHERMAL, LLC

## Lake City Observation Hole No. 1

Sheet No. 51

Log By: R.F. Hardyman

Date: 3/26/02

(Int = interval, Rec = recovery)

Box No.	Int in box	Rod Int (Depth) (ft)	Rec for rod Int (ft)	Core Int (ft)	Lithologic Description
281	2631-2640	2628-2638	10		This interval of core consists of the same sedimentary mudflow breccia rock unit as the interval above. Volcanic lithic clasts are predominantly 2 cm or less in size but clasts 8 - 15 cm in size are moderately abundant and one boulder 33 cm across occurs at about 2659 ft. This 35 ft. thick interval of this mudflow breccia contains 5 hairline calcite veins, two planar, 60 degree dipping calcite + chlorite veins containing slickensided surfaces and one 2 cm wide, 50 degree dipping, slightly vuggy quartz + minor calcite vein at 2633 ft.
282	2640-2650	2638-2648	10		
283	2650-2659	2648-2658	10		
284	2659-2668			2631-2666	
285	2668-2677	2658-2668	10		Core in this interval consists of medium grey - dark grey, fine-grained porphyritic andesite containing abundant (40 - 45%) plagioclase (up to 3 mm but generally < 2 mm) and less abundant (15 - 20%) slightly altered (chlorite + calcite) pyroxene phenocrysts (up to 5 mm) set in an aphanitic matrix. Both the upper contact (at approximately 2666 ft. and the lower contact (at approximately 2696 ft.) of this andesite are not very distinct - very irregular and appear to slightly incorporate the mudflow breccia wall rock/layers (?) above and below. The upper contact is hematitically oxidized in an irregular "zone" 1 - 3 cm wide. This andesite unit displays some autobrecciation and is locally "blotchy" with monolithologic patches of fine-grained porphyritic rock incorporated in more aphanitic andesite of the same lithology. Whether this 20 ft. thick andesite is a flow or sill is uncertain. This andesite contains 5 calcite veins (2 - 3 mm to one .5 cm wide).
286	2677-2686	2668-2678	10	2666-2686	
287	2686-2695	2678-2688	10		This interval consists of yet another sedimentary mudflow breccia unit containing heterolithologic volcanic and minor sedimentary, rounded to subangular lithic clasts (40 - 45% of rock) ranging in size from < 1 cm to 15 - 30 cm. Clasts are supported in a well lithified, medium-grained sandstone matrix. Amygdaloidal, fine-grained to medium - coarse-grained porphyritic andesite (plagioclase only and plagioclase + pyroxene bearing) are common in this unit. Amygdules are filled with chlorite or, white and pinkish cryptocrystalline silica, and some with silica + chlorite. Hairline silica veins, amygdule fillings and interstitial patches of white to pinkish silica are common in the unit from 2698 to 2702 ft., otherwise the rock is devoid of any veining or fracturing. A hairline quartz vein occurs at approximately 2717 ft., one at 2718 ft. and a 1 cm wide, 40 degree dipping quartz + minor calcite vein is present at approximately 2722.2 ft.
288	2695-2707	2688-2698	10		
289	2707-2714	2698-2708	10		
290	2714-2723	2708-2718	10		
291	2723-2733	2718-2728	10		
292	2733-2742	2728-2738	10		
293	2742-2751	2738-2748	10		
294	2751-2761	2748-2758	10		
295	2761-2770	2758-2768	10	2686-2770	

2703

**LAKE CITY GEOTHERMAL, LLC**  
**Lake City Observation Hole No. 1**

Sheet No. 52

Log By: R.F. Hardyman

Date: 3/27/02

(Int = interval, Rec = recovery)

Box No.	Int in box	Rod Int (Depth) (ft)	Rec for rod Int (ft)	Core Int (ft)	Lithologic Description
296	2770-2779	2768-2778	10	2770-2771.5	This core interval consists of more mudflow breccia as in the interval above.
				2771.5-2773.5	Rock in this interval is a medium grey - greenish grey, aphanitic andesite that cuts the mudflow breccia at a slightly irregular upper contact that dips 50 degrees from horizontal. The mudflow breccia is mildly oxidized to a brown - faintly reddish brown at this upper contact. The andesite does not display a chilled margin at this contact, however. Regardless, this andesite appears to be a dike. Scattered round to ovoid amygdules (up to 8 mm) of chlorite and chlorite + minor calcite occur in this andesite dike.
297	2779-2788	2778-2788	10	2773.5-2776.5	This interval consists of dark brownish grey - reddish brown, medium-grained porphyritic, plagioclase + pyroxene (both phenocrystic minerals up to 4 mm) bearing andesite that probably also is a dike. The upper contact of this rock and the aphanitic dike rock above is irregular (on the scale of the core) and dips 40 - 65 degrees from horizontal. The lower contact with mudflow breccia wall rock is similar in appearance, dips approximately 70 degrees and appears to contain a faint chilled margin. This porphyritic andesite is "blotchy" with coarser grained, somewhat rounded to irregular, patches surrounded by more oxidized, finer grained rock of the same mineralogy. Whether this dike is younger than the greenish aphanitic andesite dike rock or visa - versa is uncertain.
				2776.5-2785.5	Rock in this interval consists of more of the same sedimentary mudflow breccia unit as above the andesite dike couplet in the interval above. Maximum clast size in this mudflow breccia in this interval is 22 cm.
298	2788-2797.5	2788-2798	10	2785.5-2787.5	This interval consists of the same greenish grey, aphanitic, amygdule bearing (amygdules 4 mm or less in size) andesite dike rock that is present in the 2771.5 - 2773.5 ft. interval above. The upper contact of this dike segment is planar, dips 45 degrees from horizontal (to the core) and cuts cleanly across a 9 cm size cobble in the mudflow breccia wall rock and is finer grained and faintly flow laminated at its margin. The lower contact of the dike is more irregular, dips approximately 30 degrees, and also displays a finer grained - slightly flow laminated margin.
				2787.5-2796	Interval consists of more of the mudflow breccia unit but is darker grey in color and has become a nearly clast supported sedimentary breccia. Interval contains two 2 mm wide quartz veins that dip subvertical and 60 degrees respectively. Interstitial white to pinkish silica cementing irregular patches are occasionally present in the rock matrix.
299	2797.5-2807	2788-2798	10	2796-2800.5	Interval consists of the same porphyritic, plagioclase + pyroxene (phenocrysts up to 7 mm) bearing andesite dike rock as is present in the 2773.5 - 2776.5 ft. interval approximately 20 ft. higher in the core. Either this rock is part of that same dike or is a sill-like hypophysis from it. Rock contains moderately abundant interstitial white and pinkish white silica and three hairline white - pinkish white quartz veins. The lower contact of this sill is irregular and steeply inclined.
				2800.5-2802	Interval consists of the same pebbly mudflow breccia as above and contains two hairline pinkish, irregular steeply dipping quartz veins.

✓2794

**LAKE CITY GEOTHERMAL, LLC**  
**Lake City Observation Hole No. 1**

Sheet No. 53

Log By: R.F. Hardyman

Date: 3/27/02

(Int = interval, Rec = recovery)

Box No.	Int in box	Rod Int. (Depth) (ft)	Rec for rod Int (ft)	Core Int (ft)	Lithologic Description
300	2807-2816	2798-2808	10	2802-2806	Interval consists of medium grey, medium-grained "blotchy" to fine-grained porphyritic andesite as in the 2796 - 2800.5 ft. interval above but overall this rock is finer-grained. This interval probably represents another sill hypophysis off a feeder dike.
				2806-2809.5	Rock in this interval is more of the mudflow breccia unit (as above) but is more fine-grained with maximum clast size only up to 6 cm.
				2809.5-2812.3	This interval consists of medium grey, small lithic fragment rich (pebbles < 5 mm down to grain size), moderately crystal rich (plagioclase + trace altered pyrobole, both < 1 mm in size), pumice rich, densely welded andesitic (probably) ash-flow tuff. Tiny lithic fragments may constitute 15 - 20% of this tuff and dark green, darker than the matrix, chloritized, highly collapsed delicate pumice lapilli may constitute 30 - 35% of the rock. Pumice lapilli range in size from 6 - 8 mm down to 2 mm or less long by 2 mm wide and commonly display fiamme (flame) textures. The prominent compaction foliation in this rock as well as the upper sharp contact of the unit dips 45 - 50 degrees from horizontal (to the core). The lower contact is not visible in the core (price of core missing ?). The steeply dipping, sharp - planar upper contact of this ash-flow tuff could be a channel cut/fill contact with the overlying debris flow rock. The steeply dipping compaction foliation, however, is harder to explain.
301 302 303	2816-2825 2825-2834 2834-2843	2808-2818 2818-2828 2828-2838	10 10 10	2812.5-2816	Either the drill hole is way off from being vertical at this depth (doubtful) or the ash-flow tuff interval represented is near the margin of a channel itself and welded and sagged against this channel wall to produce the steeply dipping compaction foliation (very possible), or this compaction foliation attitude and that of the contact is due to faulting and tilt of the entire section (also a possibility !). The thin andesitic ash-flow tuff layer is underlain by medium grey, lithic rich (tiny pebbles - chips), very coarse-grained volcanoclastic sandstone that grades downward into medium-grained, moderately lithic rich, pebbly sandstone containing a couple of coarser grained pebble layers (1 - 2 cm thick) alternating with fine-grained sandstone that defines bedding which dips about 35 degrees from horizontal.
				2816-2837	This interval consists of medium - dark grey, pebbly (rounded - subrounded pebbles are < .5 cm in size and constitute 15 - 20% of the rock), medium-grained sandstone that grades downward into dark brown, pebbly, fine-grained sandstone (around 2818 ft.) that in turn grades gradually down section into pebbly very fine-grained sandstone then into siltstone and then downward into dark brown, pebbly mudstone by about 2828 ft. A 6 - 8 inch thick "chippy" zone containing elongate flat lithic fragments at about 2829 ft. reflects weak bedding that dips 30 - 35 degrees from horizontal. Another zone in this mudstone at about 2834 ft. contains reworked siltstone "lumps" up to 3 cm and occasional reworked pumice lapilli/ fragments and volcanic pebbles.

**LAKE CITY GEOTHERMAL, LLC**  
**Lake City Observation Hole No. 1**

Sheet No. 54

Log By: R.F. Hardyman

Date: 3/27/02

(Int = interval, Rec = recovery)

Box No.	Int in box	Rod Int (Depth) (ft)	Rec for rod Int (ft)	Core Int. (ft)	Lithologic Description	
304	2843-2852	2838-2848	10		<p>The 25 ft. thick brown, pebbly sandstone to mudstone horizon of above is underlain by a medium grey, coarse-grained porphyritic, plagioclase + scattered altered pyroxene bearing, amygdaloidal andesite. The mudstone - silty mudstone - andesite contact is irregular at the scale of the core and dips overall about 60 degrees. A thin (6 inches) layer and two discontinuous lens-like bodies of pebbly siltstone are incorporated in this andesite at around 2838 ft. Whether the andesite is a sill or other intrusive body is unclear. It is hard to conceive that this contact zone represents a depositional contact. The andesite contains perhaps 45 - 55% euhedral plagioclase phenocrysts up to 1 cm and an occasional altered pyroxene phenocryst up to 4 mm set in an aphanitic matrix. Amygdules in this rock are not evenly distributed and very in abundance form not present to locally up to 15% of the rock. Amygdules range in size from 1 mm to 1 cm generally but occasionally are up to 3 - 5 cm across.</p> <p>Amygdules are infilled with chlorite only, zeolite (not effervescent and too soft to be silica; possibly chabazite ?) only, zeolite with chlorite rims or less commonly, pinkish white silica. Pinkish silica also occurs as veinlets and veinlet to irregular intergrowths in the aphanitic matrix and locally (2887 - 2890 ft.) may constitute 10 - 12% of the rock matrix. Some zeolite amygdules contain open vugs lined with drusy quartz and or gypsum (?) needles.</p> <p>Cryptocrystalline silica + hematite veins/branching veins up to 2 cm wide and irregular silica + hematite patchy replacement intergrowths occur occasionally in this andesite and form extensive veins at 2852 - 2853 ft., at 2860 - 2862 ft., and at 2868 - 2869 ft. Two planar 60 degree dipping, slightly banded, silica - quartz veins/stringer veins 6 - 8 mm wide occur at approximately 2903 ft. and two planar quartz veins at approximately 2905 ft. and 9 hairline to 1 mm wide quartz veins and one 1 mm wide calcite vein are present in the 2911 - 2915 ft. interval. The lower contact of this porphyritic andesite unit is irregular, dips 30 degrees overall, and the andesite overlies a dark brown siltstone.</p>	
305	2852-2862	2848-2858	10			
306	2862-2871	2858-2868	10			
307	2871-2880	2868-2878	10			
308	2880-2889.5	2878-2888	10			
309	2889.5-2899	2888-2898	10			
310	2899-2908	2898-2908	10			
311	2908-2917.5	2908-2918	10	2837-2915		
312	2917.5-2927	2918-2928	10	2915-2926		<p>Core in this interval consists of dark brown sandy siltstone. One minor slickensided shear plane is present just below the contact with the overlying andesite otherwise the siltstone is massive and only broken up due to drilling. The brown -dark brown siltstone contains scattered lithic grains 1 - 2 mm in size. This siltstone grades downward into dark grey, medium to coarse-grained, muddy, pebbly sandstone. Interval contains trace hairline quartz veinlets and one bedding plane (?) vug containing tiny gypsum crystals. Trace slickensided surfaces on probable bedding planes are present.</p>

✓ 2857  
 ✓ 2786?  
 ✓ 2880

# LAKE CITY GEOTHERMAL, LLC

## Lake City Observation Hole No. 1

Sheet No. 55

Log By: R.F. Hardyman

Date: 3/28/02

(Int = interval, Rec = recovery)

Box No.	Int in box	Rod Int (Depth) (ft)	Rec for rod Int (ft)	Core Int (ft)	Lithologic Description
313	2927-2936			2926-2928 2928-2929.5	Interval consists of dark grey, medium- coarse-grained, pebbly, muddy sandstone containing 15 - 40% rounded - subrounded volcanic lithic pebbles up to 1 cm but generally < 7 mm. Matrix of this sandstone consists of interstitial clay. The 2 ft. pebbly sandstone layer (above) is underlain by very lithic rich, clast supported, fine-grained sandy conglomerate (containing rounded to subangular, heterolithologic volcanic pebbles < .5 cm to 1.5 cm in size) grading downward into coarse-grained conglomeratic sandstone approximately 6 inches thick containing clasts 1 - 2 cm in size. This 1.5 ft. thick sandy conglomerate is underlain by more coarse-grained, pebbly sandstone. Interval is devoid of veins/fractures.
314	2936-2946	2928-2938	10	2929.5-2942.5	Interval consists of medium grey - dark grey, very lithic rich, coarse-grained volcaniclastic sandstone containing lithics < 4 mm generally but with a 6 - 8 inch zone containing lithic fragments up to 2 cm. This coarse-grained sandstone grades downward into medium-grained, lithic free sandstone containing bedding that dips 25 degrees that overlies another clast supported conglomerate layer about 19 inches thick. This sandstone interval is moderately magnetic whereas the overlying siltstone is not magnetic. The conglomeratic layer is underlain by very coarse-grained, lithic rich, volcaniclastic sandstone alternating with lithic poor, medium-grained sandstone and more coarse-grained, coarser grained lithic rich layers up to 1 ft. thick. Well defined bedding dips 25 degrees.
315	2946-2955	2938-2948	10		
316	2955-2964	2948-2958	10		
317	2964-2973	2958-2968	10		
318	2973-2982	2968-2978	10	2942.5-2978	Core in this interval consists of medium-grey, medium-grained porphyritic amygdaloidal andesite containing 15-20% stubby and lath shaped euhedral plagioclase phenocrysts (slightly altered to calcite) up to 6 mm in size, set in an aphanitic amygdule bearing matrix. Amygdules are primarily round to ovoid shaped (.5 cm or less in size) and filled with chlorite and occasionally chlorite + calcite. Irregular patches and intergrowths (up to 2 - 6 cm) of white zeolite and minor quartz constitute perhaps 2 - 3% of this rock in local 2 - 4 ft. zones. An occasional hairline quartz vein and calcite only vein ( up to 2 mm wide) are present in this andesite unit. Zeolite and zeolite + intergrown quartz also fill rounded to ovoid amygdules in the andesite. Amygdules fall off in abundance below about 2962 ft. The upper contact of this andesite is slightly irregular and the overlying sandstone - siltstone sequence appears to be depositional on this andesite. The lower contact of the andesite is also irregular with irregular siltstone clots - patches (from underlying unit) incorporated in the base of the andesite. This andesite could be a lava flow.
319	2982-2993	2978-2988	8		

✓ 2982

**LAKE CITY GEOTHERMAL, LLC**  
**Lake City Observation Hole No. 1**

Sheet No. 56

Log By: R.F. Hardyman

Date: 3/28/02

(Int = interval, Rec = recovery)

Box No.	Int in box	Rod Int (Depth) (ft)	Rec for rod Int (ft)	Core Int (ft)	Lithologic Description
				2978-2990.5	This interval consists of dark grey siltstone (4 - 5 inch thick layer) at the top grading down into mudstone containing scattered lithic pebbles 6 mm or less in size. This mudstone interval contains subhorizontal veins and wispy vein "zones" 1.5 - 3 cm wide that contain 2 - 4 mm wide to generally hairline width veins of white zeolite (?). This white vein material does not effervesce in HCl and is too soft to be silica. The zone from 2981.5 ft. to 2983 ft. contains abundant wispy to spider web-like crisscrossing hairline to 1 mm wide veins/veinlets that, in total, may constitute 50% of this mudstone interval. This vein zone is moderately vuggy (open spaces are 2 - 3 cm by .5 cm wide) with open drusy cavities containing tiny euhedral prismatic crystals of gypsum (?). The mudstone grades down section into siltstone.
320	2993-3000	2988-2997	10.8		
321	3000-3008	2997-3002.5	3		
322	3008-3017	3002.5-3010	10.5		
323	3017-3026	3010-3018	8		
324	3026-3036	3018-3028	10		
325	3036-3046	3028-3038	10		
326	3046-3055	3038-3048	10		
327	3055-3064	3048-3058	10		
328	3064-3073	3058-3068	10		
329	3073-3082	3068-3078	10		
330	3082-3092	3078-3085	7		
331	3029-3101.5	3085-3095	10		
332	3101.5-3111	3095-3105	10		
333	3111-3120	3105-3115	10		
334	3120-3129	3115-3125.5	10.5		
335	3129-3138.5	3125.5-3136	10.5		
336	3138.5-3147	3136-3146.5	10.5		
337	3147-3157	3146.5-3157	10.5		
338	3157-3166				
339	3166-3175	3157-3167.5	10.5		
340	3175-3184	3167.5-3178	10.5		
341	3184-3193.5	3178-3188	10		
342	3193.5-3203	3188-3198	10		
343	3203-3212	3198-3208	10	2990.5-3211	Interval consists of a few centimeters of dark grey siltstone at the top that grades downward into dark grey, fine-grained sandstone containing scattered sand grains 2 mm or less in size. These sand grains and tiny (< 3 mm but occasionally to 5 mm) pebbles range in abundance from < 1% to 10 - 12% in some 2 - 4 ft thick horizons in this fine-grained sandstone unit. This fine-grained sandstone unit contains only an occasional hairline to 1 - 2 mm wide silica, or quartz + calcite or zeolite (?), or quartz + chlorite + hematite vein.

✓ 3058



# LAKE CITY GEOTHERMAL, LLC

## Lake City Observation Hole No. I

Sheet No. 57

Log By: R.F. Hardyman

Date: 3/29-4/1/02

(Int = interval, Rec = recovery)

Box No.	Int in box	Rod Int (Depth) (ft)	Rec for rod Int (ft)	Core Int (ft)	Lithologic Description
				2990.5-3211 cont.	<p>These veins generally are steeply (60 - 70 degrees) dipping but occasionally they dip &lt; 40 degrees. The interval from 3033 to 3036 ft. is more pebbly - lithic rich (35% lithic fragments) otherwise this massive fine-grained sandstone unit is quite uniform. This sandstone unit is weakly magnetic. The interval from 3046 to 3051 contains several hairline to 3 mm wide, subvertical to subhorizontal veins of chlorite + calcite +/- hematite and chlorite + quartz + hematite that together constitute &lt; 1% of the rock. Three chlorite smeared slickenside planar fractures just below this interval display down dip to subhorizontal striations. This sandstone is a tight, well indurated, well lithified rock. Eight more planar, chlorite smeared, slickensided surfaces containing subhorizontal striations, one 2 mm wide quartz + chlorite vein, and one 2 ft. vertical chlorite + minor quartz vein that is slickensided and contains 60 degree raking striations are present in the 3055 - 3064 interval.</p> <p>Other slickenside fracture surfaces (50 degree dip) containing horizontal +/- striations are present at 3073 and 3080 ft. At 3095 ft. this fine-grained, pebbly sandstone unit changes very gradually into a medium grey colored rock and then downward into slightly greenish medium grey colored rock. From about 3095 ft. to 3106 ft. this sandstone unit contains several hairline zeolite (?) veinlets dipping 35 - 70 degrees from horizontal. One planar, 1 ft long - 8 mm wide chlorite + hematite + zeolite (?) + minor calcite vein occurs at 3101.5 ft. and contains a minor slickensided surface. A "zone" from about 3103.5 ft. to 3105 ft. contains a few zeolite (?) + chlorite veins and cracks with minor open spaces. From 3105 ft. to 3136 ft. this massive, uniform, well indurated and lithified sandstone unit contains only an occasional hairline vein or slickensided surface.</p> <p>At about 3136 ft. this sandstone unit becomes dark brown in color. This color may be due to hematitic oxidation of the matrix. The brown oxidized (somewhat mottled oxidation) sandstone passes downward at approximately 3143 ft. into medium grey, unoxidized, pebbly, fine-grained volcanoclastic sandstone. One hairline to 3 mm wide subhorizontal chlorite + zeolite (?) vein triplet at approximately 3145 ft. displays slickensided and striated surfaces. At approximately 3157 ft. the sandstone again becomes mottled brown and hematitically oxidized.</p> <p>At approximately 3177.9 ft. this fine-grained, pebbly sandstone grades downward into very fine-grained pebbly sandstone. From 3184 ft. to 3186 ft. this massive sandstone unit displays distinct bedding defined by very fine-grained sandstone layers 1.5 cm or less thick alternating with coarser grained, medium-grained sandstone layers 3 - 4 mm to 1 cm thick. Bedding dips 25 degrees from horizontal. A zone from 3191 ft. to 3193.5 ft. in this very fine-grained sandstone horizon is more lithic rich with rounded to subangular lithic fragments up to .5 cm constituting 20 - 40% of the rock.</p>

**LAKE CITY GEOTHERMAL, LLC**  
**Lake City Observation Hole No. 1**

Sheet No. 58

Log By: R.F. Hardyman

Date: 3/29-4/1/02

(Int = interval, Rec = recovery)

Box No.	Int in box	Rod Int (Depth) (ft)	Rec for rod Int (ft)	Core Int (ft)	Lithologic Description
				2990.5-3211 cont.	At 3200.8 to 3201.5 ft this very fine-grained sandstone is cut by a medium grey extremely aphanitic andesite dike rock containing faint chilled margins. This dike cuts the core at 30 degrees at the top and subhorizontal at the bottom. Another 8 inches of this dike rock cuts the core again at 3203.2 ft. and just barely again at 3208.4 ft. and again for 5 inches at 3211.3 ft. at approximately where the very fine-grained sandstone grades downward into mudstone. The fine-grained sandstone unit is 220.5 feet thick.
344	3212-3223	3208-3218 3218-3218.5	8 1		
345	3223-3232	3218.5-3228	10		
346	3232-3241	3228-3238	10		
347	3241-3252	3238-3248	7		
348	3252-3261	3248-3253 3253-3258	5 5		
349	3261-3270	3258-3266.5	8.5		
350	3270-3279	3266.5-3276	9		
351	3279-3287	3276-3286	10		
352	3287-3296	3286-3295	9		
353	3296-3305	3295-3305	10		
354	3305-3314				
355	3314-3323	3305-3315	10		
356	3323-3331	3315-3325.5	10.5		
357	3331-3337	3325.5-3334.2	8.7		
358	3337-3346	3334.2-3338	3.8		
359	3346-3355	3338-3348	10		
360	3355-3364	3348-3358 3358-3363.5	10 5.5		
361	3364-3373	3363.5-3368	4.5		
362	3373-3383	3368-3378 3378-3388	10 10		
363	3383-3392	3388-3398	10	3211-3388	Interval consists of massive dark brown - chocolate brown, sandy (coarse sand grains up to 1.5 mm constitute approximately 5 - 10% of this rock) mudstone. Rock contains a rare hairline to 1 mm wide cryptocrystalline quartz veinlet. Rock readily breaks into 1 - 4 cm wide "waffers" (probably reflecting bedding that dips approximately 25 degrees from horizontal). This unit contains a coarse-grained muddy sand horizon (8 inches thick) at approximately 3230 ft. Trace slickensided surface at approximately 3250 ft. Core is very broken up at 3253 ft., 3258 ft., and at approximately 3276 ft. but there is no indication that the rock has been sheared. The mudstone contains an occasional slickensided surface - usually allophane coated - in the interval from 3252 to 3276 ft. This mudstone unit display good bedding at 3279.5 ft. defined by alternating mudstone and calcite cemented coarse-grained sandstone layers .5 cm thick; bedding dips 15 degrees from horizontal.

✓ 3242

✓ 3331

**LAKE CITY GEOTHERMAL, LLC**  
**Lake City Observation Hole No. 1**

Sheet No. 59

Log By: R.F. Hardyman

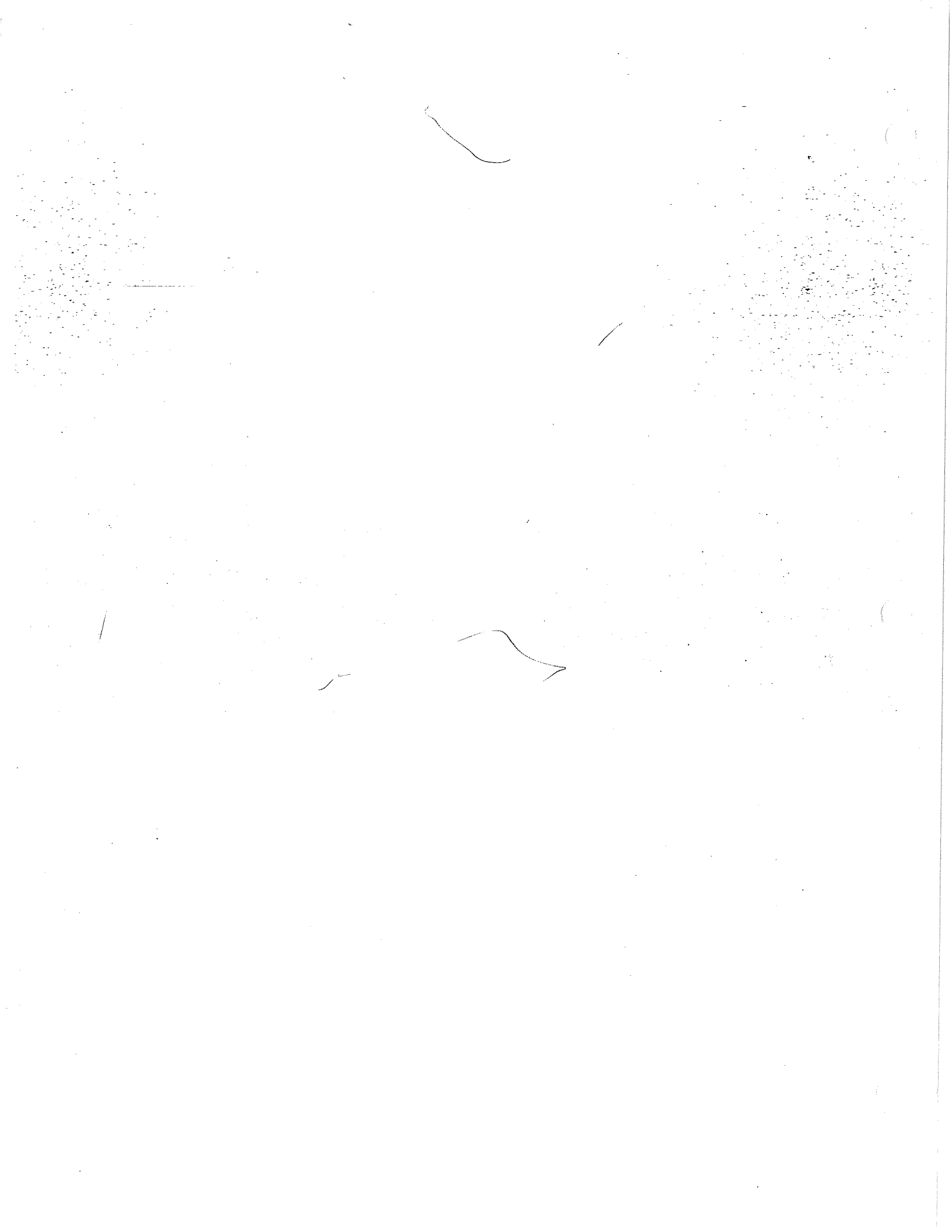
Date: 3/29-4/1/02

(Int = interval, Rec = recovery)

Box No.	Int in box	Rod Int (Depth) (ft)	Rec for rod Int (ft)	Core Int (ft)	Lithologic Description
				3211-3388 cont.	<p>At approximately 3283 ft. the mudstone is quite lithic rich (tiny lithics up to 4 mm); this lithic rich zone extends down to approximately 3294 ft. A pebbly mudstone (pebbles up to 7 mm) horizon is also present at 3296.1 to 3301 ft. in the unit. A rare zeolite (?) vein (subhorizontal) is present at approximately 3315 ft. Unit is devoid of veins from 3305 to 3323 ft. One 5 mm wide subhorizontal calcite vein is present at 3314 ft.</p> <p>At 3325.5 ft. (approximately) the rock grades from essentially lithic free mudstone down into a 20 inch thick zone that is lithic rich (40 - 50% sand grains and 3 - 5% lithic fragments up to 7 mm). This zone grades abruptly downward into lithic free, dark brown mudstone. Core is very broken from 3334.2 ft. to 3335 ft. due to drilling. The mudstone becomes slightly more lithic rich again below 3335 ft. Interval from 3323 ft. to 3346 ft. contains trace hairline quartz veins and one slickensided quartz smeared fracture dipping 30 degrees at 3337 ft. contains horizontal striations.</p> <p>Unit becomes approximately lithic free again at 3348 ft. The mudstone is essentially massive; an occasional hint of bedding dips about 25 degrees from horizontal. Trace (1 - 3) discontinuous low-angle allophane +/- zeolite + hematite veinlets are present in the 3355 - 3364 ft. interval otherwise the unit is devoid of veins. At about the 3364 - 3373 ft. interval the mudstone unit appears to be getting more silty down section but is still essentially a sandy/silty mudstone. Rock unit becomes more lithic rich (15 - 20% rounded to chippy lithic fragments up to 4 mm - occasionally 1 cm) at 3373 ft. Most of these lithic fragments consist of pale blue green aphanitic and microporphyritic andesite. This mudstone unit definitely appears to get more sandy down section and scattered rounded lithic pebbles become larger (up to 2 cm). One 1 mm allophane vein and associated veinlets cut the mudstone at 3386.5 ft. - otherwise the unit is devoid of veins. This sandy mudstone unit is 176.7 feet thick.</p>
364	3392-3401				
365	3401-3410	3398-3408	10		
366	3410-3420	3408-3418	10		
367	3420-3429	3418-3428	10		
368	3429-3435.8	3428-3435.8	7.8	3388-3435.8	<p>At 3588 ft. the dark brown, pebbly mudstone unit overlies and abruptly grades down into dark brown, pebble - cobble bearing, muddy sedimentary mudflow breccia. Rounded heterolithologic volcanic clasts even in the top 2 ft. of this unit are 3 - 7 cm in size, constitute 40 - 45% of the rock, and are matrix supported in a well indurated, mud rich, fine-grained sandstone matrix. The top two feet of the dark brown mudflow breccia are devoid of veins. In the interval from 3392 to 3410 ft. this mudflow breccia unit contains scattered high-angle hairline quartz veinlets. At approximately 3396 ft. a .5 cm wide zeolit (?) + quartz + calcite veinlet containing a flat open vug, is lined with prismatic gypsum (?) crystals. At 3397.5 ft. a 6 inch thick dark grey siltstone layer/lens is interbedded in the mudflow breccia and displays contacts with soft sediment deformation. Clast size may be increasing down section in this mudflow breccia unit and are up to 10 - 24 cm across.</p>

3412

3435.8





Lake City

Stopped at 1700

---

at Fernely OH-1

3600 ft.

2 sections with veins

327° F

---

# OH-1 core

3-9-05

Box	Depth	
1	75	757-767 OH-092
2	76	767-776 093
3	78	785-794 094
4	72	732-740.5 095
5	74	749-757 096
6	80	802-810 097
7	81	810-819 98
8	<del>77</del>	794-802 99 Box #79
9	82	819-830 100
10	83	830-837 101
11	86	854.5-863 102
12	87	863-871 103
13	90	888-895.5 104
14	88	871-879.5 105
15	89	879.5-888 106
16	84	837-845.8 107
17	85	845.8-854.5 108
18	91	895.5-903.5 109
19	93	912-921 110
20	95	930-939 111
21	94	921-930 112
22	97	949-959 113
23	98	959-968 114 ✓
24	99	968-977 001
25	100	977-986 2
26	193	1820-1829 3
27	196	1847-1857 4
28	197	1859-1866 5-1857-1866
29	191	1801-1810.5 6
30	192	1810.5-1820 7
31	159	1506-1515 8
32	152	1442-1452 9

Box

33	168	1588-1597	<del>10</del> 10
34	<del>187</del> 172	1764-1773.5 Box 187	<del>10</del> 12
35	<del>172</del> 187	1626-1635 Box 172	<del>11</del> 11
36	158	1497-1506	<del>12</del> 13
37	183	1728-1737	<del>13</del> 14
38	201	1893.5-1903	<del>14</del> 15
39	176	1663-1672.5	<del>15</del> 16
40	185	1746-1755	<del>16</del> 17
41	162	1533.5-1543	<del>17</del> 18 18
42	169	1597-1606.5	<del>18</del> 19
43	171	1616-1626	<del>19</del> 20
44	160	1515-1524	<del>20</del> 21 21 21
45	173	1635-1645	<del>21</del> 22 22 22
	132	1263-1271	<del>22</del> 23 23
47	175	1654-1663	<del>23</del> 24 24
48	180	1700-1709.5	<del>24</del> 25 25 25
49	154	1461-1470	<del>25</del> 26 26 26
50	167	1579-1588	27
51	142	1351-1360	28
52	155	<del>1470</del> 1470-1479	29
53	166	1573-1579	30
54	130	1244-1254 Box was turn around not facing out	31
55	184	1737-1746	32
56	148	1406-1415	33
57	161	1524-1533.5	34
58	181	1709.5- <del>1719</del> 1719	35
59	182	1719-1728	36
60	186	1755-1764	37
	153	1452-1461	38
62	174	1645-1654	39
63	190	1792-1801	40
64	237	2227-2236	41



Box

65	368	3429-3435.8	TD box	42
66	121	1162.5-1171		43
67	125	1199-1209		44 ↔ 1199-1208
68	127	1217-1225		45
69	128	1225-1235		46
70	105	1023-1031		47
71	119	1143-1153		48
72	147	1397-1406		49
73	<del>147</del>	495-504	Box # 45	50
74	<del>102</del>	996-1005	Box # 102	51
75	146	1387-1397		52
76	107	1039.5-1047		53
77	109	1056-1064.5		54 ↔ 1056-1064
78	122	1171-1180		55
79	113	1090-1099		56
80	134	1280-1288.5		57
81	101	986-996		58
82	120	1153-1162.5		59
83	123	1180-1190		60
84	124	1190-1199		61
85	131	1254-1265		62 ↔ 1254-1263
86	103	1005-1014		63
87	139	1323.5-1333		64
88	179	1691-1700		65
89	110	1064-1073		66
90	149	1415-1424		67
91	129	1235-1244		68
92	137	1306.5-1315		69
93	140	1333-1392.5		70 ↔ 1333-1342.5
94	115	1107-1116		71 ↔ 1107.5-1116
95	118	1134-1143		72
96	116	1116-1125		73

	Box		
97	117	1125-1134	74
98	114	1099-1107.5	75
99	164	1552.5-1562	76
100	70	715-723	77
101	47	512.5-520	78
102	66	680.5-689	79
103	25	315-323.5	80
104	63	653-662	81
105	40	455-462	82
106	50	538-547	83
107	69	706-715	84
108	<del>64</del>	662-671 (Box #64)	85
109	65	671-680.5	86
110	48	520-529	87
111	49	529-538	88
112	67	685-697	89
113	30	<del>375.5-374</del>	90 → 357.5-374
114	39	446-455	91
115	36	420-429	152
116	43	479-487	153
117	57	599.5-607.5	154
118	52	556-565	155
119	44	487-497	156 ← 487-495
120	46	504-512.5	157
121	53	565-574	158
122	56	591- <del>599.5</del>	159
123	54	574-582	160
124	55	582-591	115
125	34	402-410	116
126	35	410-420	117
127	42	471-479	118
128	37	429-437	119

	Box		
129	41	462-471	120
130	27	332-340.5	121
131	28	340.5-349.5	122
132	29	<del>349.5</del> - 357.5	123
133	31	374-383	124
134	38	439-446	125
135	21	280-289	126
136	22	<del>289</del> -297	127
137	23	<del>297-308</del> 297-308	128 → 297-305
138	32	383-393	129
139	33	393-402	130
140	14	180-213	131
141	15	213-228	132
142	19	261-270.5	133
143	24	305-315	134
144	20	270.5-280	135
145	10	142.8-151	136 → 142.5-151
146	13	170-180	137
147	16	228-241	138
148	17	241-251	139
149	18	251-261	140
150	7	101-113	141
151	8	113-133	142
152	9	133-142.5	143
153	11	151-160.5	144
154	12	160.5-170	145
155	2	28-38	146
156	3	38-47.5	147
157	4	47.5-57.5	148
158	5	57.5-92	149
159	6	92-101	150
160	1	0-28	151

3-10-09

Box	Year	Box #	Year	Box #
161	214	2013-2022	5	327
162	230	2164-2173		328
163	298	2788-2797.5		329
164	321	3002.5-3008		330
165	347	3241-3252		331
166	360	3355-3364		332
167	296	2770-2779		333
168	344	3212-3223		334
169	357	3331-3337		335
170	194	1829-1838		336
171	236	2318-2227		337
172	288	2236-2245		338
172	189	1783-1792		339
174	234	2200-2209		340
175	299	2797.5-2808		341
176	145	1479-1488		342
177	156	1378-1387		343
178	364	3392-3401		344
179	138	1315-1323.5		345
180	336	3138-3147.5		346
181	365	3401-3410		347
182	451	547-556	Box # 51	348
183	141	1342.5-1351		349
184	199	1875.5-1884		350
185	200	1884-1893.5		351
186	361	3364-3373		352
187	366	3410-3420		353
188	343	3203-3212		354
189	362	3373-3383		355
190	367	3420-3429		356
191	307	<del>2982-2993</del> 2871-2880		357
192	319	2982-2993		358

Box

193	342	3193.5-3203	359
194	358	3337-3346	360
195	363	3383-3392	361
196	356	3323-3331	362
197	195 175	1838-1847 Box 195	363
198	224	2107.5-2117	364
199	322	3008-3017	365
200	340	3175-3184	366
201	345	3223-3232	367
202	353	3296-3305	368
203	245	2302-2311	369
204	323	3017-3026	370
205	324	3026-3036	371
206	188	1773.5-1783	372
207	318	2973-2982	373
208	338	3157-3166	374
209	326	3046-3055	375
210	341	3184-3193.5	376
211	348	3252-3261	377
212	309	2889.5-2899	378
213	316	2955-2964	379
214	327	3056-3064	380 • 3055-3064
215	288	2695-2704	381
216	350	3270-3279	382
217	317	2964-2973	383
218	320	2993-3000	384
219	328	3064-3073	385
220	294	2751-2761	386
221	295	2761-2770	387
222	297	2779-2788	388
223	303	2834-2843	227
224	304	2843-2852	228

27-01-0

229	308	2852-2861	229
230	311	2861-2870	230
231	314	2870-2879	231
232	317	2879-2888	232
233	320	2888-2897	233
234	323	2897-2906	234
235	326	2906-2915	235
236	329	2915-2924	236
237	332	2924-2933	237
238	335	2933-2942	238
239	338	2942-2951	239
240	341	2951-2960	240
241	344	2960-2969	241
242	347	2969-2978	242
243	350	2978-2987	243
244	353	2987-2996	244
245	356	2996-3005	245
246	359	3005-3014	246
247	362	3014-3023	247
248	365	3023-3032	248
249	368	3032-3041	249
250	371	3041-3050	250
251	374	3050-3059	251
252	377	3059-3068	252
253	380	3068-3077	253
254	383	3077-3086	254
255	386	3086-3095	255
256	389	3095-3104	256
257	392	3104-3113	257
258	395	3113-3122	258
259	398	3122-3131	259
260	401	3131-3140	260
261	404	3140-3149	261
262	407	3149-3158	262
263	410	3158-3167	263
264	413	3167-3176	264
265	416	3176-3185	265
266	419	3185-3194	266
267	422	3194-3203	267
268	425	3203-3212	268
269	428	3212-3221	269
270	431	3221-3230	270
271	434	3230-3239	271
272	437	3239-3248	272
273	440	3248-3257	273
274	443	3257-3266	274
275	446	3266-3275	275
276	449	3275-3284	276
277	452	3284-3293	277
278	455	3293-3302	278
279	458	3302-3311	279
280	461	3311-3320	280
281	464	3320-3329	281
282	467	3329-3338	282
283	470	3338-3347	283
284	473	3347-3356	284
285	476	3356-3365	285
286	479	3365-3374	286
287	482	3374-3383	287
288	485	3383-3392	288
289	488	3392-3401	289
290	491	3401-3410	290
291	494	3410-3419	291
292	497	3419-3428	292
293	500	3428-3437	293
294	503	3437-3446	294
295	506	3446-3455	295
296	509	3455-3464	296
297	512	3464-3473	297
298	515	3473-3482	298
299	518	3482-3491	299
300	521	3491-3500	300

Box

225	239	2245-2254	229
226	246	2311-2320	230
227	232	2182-2191	231
228	261	2450-2459	232
229	<del>329</del>	3073-3082 Box # 329	233
230	202	1903-1912	234
231	203	1912-1921	235
232	233	2191-2000	236 → 2191-2200
233	256	2403-2412.5	237
234	269	2523-2532	238
235	235	2209-2218	239
236	310	2899-2908	240
237	315	2946-2955	241
238	291	2723-2733	242 → 243
239	285	2668-2677	243 → 242
240	216	2032-2041	244
241	255	2394-2403	245
242	352	3287-3296	246
243	252	2367-2376	247
244	313	2927-2936	248
245	221	2079-2088	249
246	259	2431-2440.5	250
247	303	2825-2834	251 → Box # 302
248	250	2348-2357	252
249	257	2422-2431	253 → 2412.5-2422
250	229	<del>2155</del> 2155-2164	254
251	249	2339-2348	255
252	258	2422-2431	256
253	242	2274-2284 Photo # 253 Box # 242	257
254	247	2320-2378	258 → 2320-2328
255	60	626-634	259
256	61	634-644	260

Photo	Box				
<del>257</del>	<del>200</del>	1921-1930	Box #204	Photo #257	261
258	62	644-653			262
259	68	697-706			263
260	59	616.5-626			264
261	126	1208-1217			265
262	208	1958-1967			266
263	210	1976-1985			267
264	58	607.5-616.5			268
265	71	723-732			269
266	73	740.5-749			270
267	209	1967-1976			271
268	213	2003.5-2013			272
269	77	776-785			273
270	96	939-949			274
271	215	2022.5-2032			275
272	241	2264-2274			276
273	330	3082-3092			277
274	96	939-949	This is the 2 <sup>nd</sup> picture	1 foot Void	278
275	163	1543-1552.5			279
276	170	1606.5-1616			280
277	178	1682-1691			281
278	217	2041-2051			282
279	240	2254-2264			283
280	144	1369-1378			284
281	157	1488-1497			285
282	220	2070-2079			286
283	225	2117-2126			287
284	227	2136-2145			288
285	150	1424-1433			289
286	207	1948.5-1958			290
287	211	1985-1994			291
288	228	2145-2155			292

287 → 2117-2126.5

Box

289	292	2733-2742		293
290	26	323.5-332		294
291	151	1433-1442		295
292	212	1994-2003.5		296
293	222	2088-2098		297
294	223	2098-2107.5		298
295	218	2051-2060.5		299
296	231	2173-2187		300
297	248	2328-2339		301
298	293	2742-2751		302
298	306	2862-2871		303
299	205	1930-1939		304
300	219	2060.5-2070		305
301	226	2126.5-2136		306
302	251	2357-2367		307
303	279	2613-2622		308
304	243	2284-2293		309
305	267	2505-2514	2505-2514	310
306	284	2659-2668	Box # 284	311
307	287	2686-2695		312
308	290	2714-2723		313
309	253	2376-2385		314
310	262	2459-2468		315
311	265	2486-2495.5		316
312	282	2640-2650		317
313	301	2816-2825		318
314	244	2293-2302	Box 244	319
315	266	2995.5-2505		320-2495.5-2505
316	278	2604-2613		321
317	300	2708-2816		322
318	305	2852-2862		323
319	260	2440.5-2450		324



Box

320	263	2468-2476	325	→ 2468-2477
321	276	2586-2595	326	
322	280	2622-2631	181	
323	308	2880-2889.5	182	
324	281	2631-2640	183	
325	286	2677-2686	184	
326	312	2917.5-2927	185	
327	254	2385-2394	186	
328	206	1939-1948.5	187	
329	332	3101.5-3111	188	
330	333	3111-3120	189	
331	334	3120-3129	190	
332	311	2908-2917.5	191	
333	264	2477-2486	192	
334	283	2650-2659	193	
335	314	2936-2946	194	
336	335	3129-3138.5	195	
337	337	3147.5-3157	196	
338	268	2514-2523	197	
339	270	2532-2542	198	
340	277	2595-2604	199	
341	331	3092-3101.5	200	
342	334	3166-3175	201	
343	272	2551-2560	202	
344	273	2560-2568	203	
345	275	2577-2586	204	
346	271	2542-2551	205	
347	289	2704-2714	206	
348	104	1014-1023	207	
349	111	1073-1082	208	
350	143	1360-1369	209	
351	198	1866-1875.5	210	

Box

352	214	2568-2577	211	
353	135	1297.5-1306.5	212	
354	165	1562-1573	213	
355	135	1288.5-1297.5	214	
356	346	3232-3241	215	
357	355	3314-3323	216	
358	106	1031-1039.5	217	
359	177	1672.5-1682	218	
360	325	3036-3046	219	
361	354	3305-3314	220	
362	349	3261-3270	221	
363	92	903.5-912 Box # 92	222	
364	108	1047-1056	223	
365	112	1082-1090	224	
366	133	1271-1280 Box # 133	225	
367	359	3346-3353	226	3346-3355

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