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Phase III Drilling Operations at the Long Valley Exploratory Well (LVF 51-20)

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**PHASE III DRILLING OPERATIONS AT THE
LONG VALLEY EXPLORATORY WELL
(LVF 51-20)**

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ABSTRACT

During July-September, 1998, a jointly funded drilling operation deepened the Long Valley Exploratory Well from 7178' to 9832'. This was the third major drilling phase of a project that began in 1989, but had sporadic progress because of discontinuities in funding. Support for Phase III came from the California Energy Commission (CEC), the International Continental Drilling Program (ICDP), the US Geological Survey (USGS), and DOE. Each of these agencies had a somewhat different agenda: the CEC wants to evaluate the energy potential (specifically energy extraction from magma) of Long Valley Caldera; the ICDP is studying the evolution and other characteristics of young, silicic calderas; the USGS will use this hole as an observatory in their Volcano Hazards program; and the DOE, through Sandia, has an opportunity to test new geothermal tools and techniques in a realistic field environment. This report gives a description of the equipment used in drilling and testing; a narrative of the drilling operations; compiled daily drilling reports; cost information on the project; and a brief summary of engineering results related to equipment performance and energy potential. Detailed description of the scientific results will appear in publications by the USGS and other researchers.

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I. INTRODUCTION AND BACKGROUND

The Long Valley Exploratory Well (LVEW), near Mammoth Lakes CA, is the deepest hole extant in a young, silicic caldera. Phase I drilling operations for this well (then called the Magma Energy Exploratory Well) were done in 1989 under the aegis of DOE's Magma Energy Program and reached a depth of 2568' with rotary drilling, which was then cored to 2754' final depth¹. In 1991 the hole was deepened by Phase II drilling to 7130' with rotary, then cored to 7588' final depth². Remedial drilling in 1993 left the hole configuration shown in Figure 1, which was the starting point for Phase III.

Even before Phase III drilling, a large amount of data, including the following, had been collected in this hole:

- Complete lithologic log, from cores and cuttings, from surface to 7588',
- Core - approximately 900' of 2.5" core and 30' of 4" core,
- Sidewall cores - 26 sidewall cores between 3000' and 6700', an interval extending from the Bishop Tuff through the transition zone, and into the Sierran basement hornfels,
- Conventional wireline logs - temperature, oriented caliper, sonic, gamma, dual induction,
- Repeated temperature logs between drilling operations to show changes over time,
- Injection tests and fluid-level monitoring/sampling,
- Borehole gravity surveys,
- Monitoring of an emplaced downhole seismic package over relatively long time (months),
- Borehole televiewer logs - log in 17-1/2" hole from 2558' to 6825'; log in 12-1/4" hole from 6825' to 7188'; log in 3.8" hole from 6825' to 7588',
- Vertical seismic profile,
- Complete survey of hole inclination and azimuth,
- Complete drilling history, including daily drilling reports and cost records.

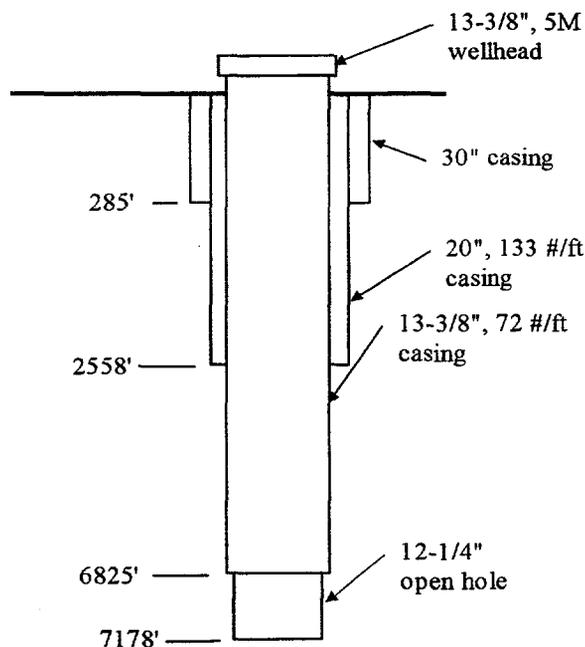


Figure 1 - Well configuration before Phase III drilling

The long hiatus in activity (from 1993 to 1998) was the result of funding decisions by the California Energy Commission and the Department of Energy. In early 1997, we were finally able to assemble a funding package from the International Continental Drilling Program (ICDP), the USGS, and DOE to match the cost-share requirements for a

CEC grant application, and the grant was approved late that year. After extensive planning, discussion, and contracting, actual drilling began in mid-July, 1998.

II. SUMMARY OF OPERATIONS

The hole configuration shown in Figure 1 had existed since 1993 and the bottom of the hole (up to approximately 7055') was filled with a muck that probably comprised remnants of drilling fluid from the last operations here. To clear this, the first step in 1998 procedures was to run in the hole with a 12-1/4" bit and rotate the drill string while circulating first water, and then a mud sweep, until the returns came back fairly clean. Next, the ODP drill pipe that had been standing in the derrick, and which was used for the clean-out, was pulled out and laid down.

The casing-bushing string (described below and shown in Figure 3) was run to TD and the bottom cemented in place; then the casing was stretched approximately 4.5' to allow for thermal expansion. Casing top was set in a slip/seal assembly which holds the preload and seals between the 13-3/8" and 5-1/2" casings, and the BOPE was installed and tested.

After rigging up the top-drive coring package (described below) we drilled out the casing shoe, tested it, and drilled ahead 282' for a televiewer log and an attempted hydro-frac. The log was successful, with well-defined fractures and

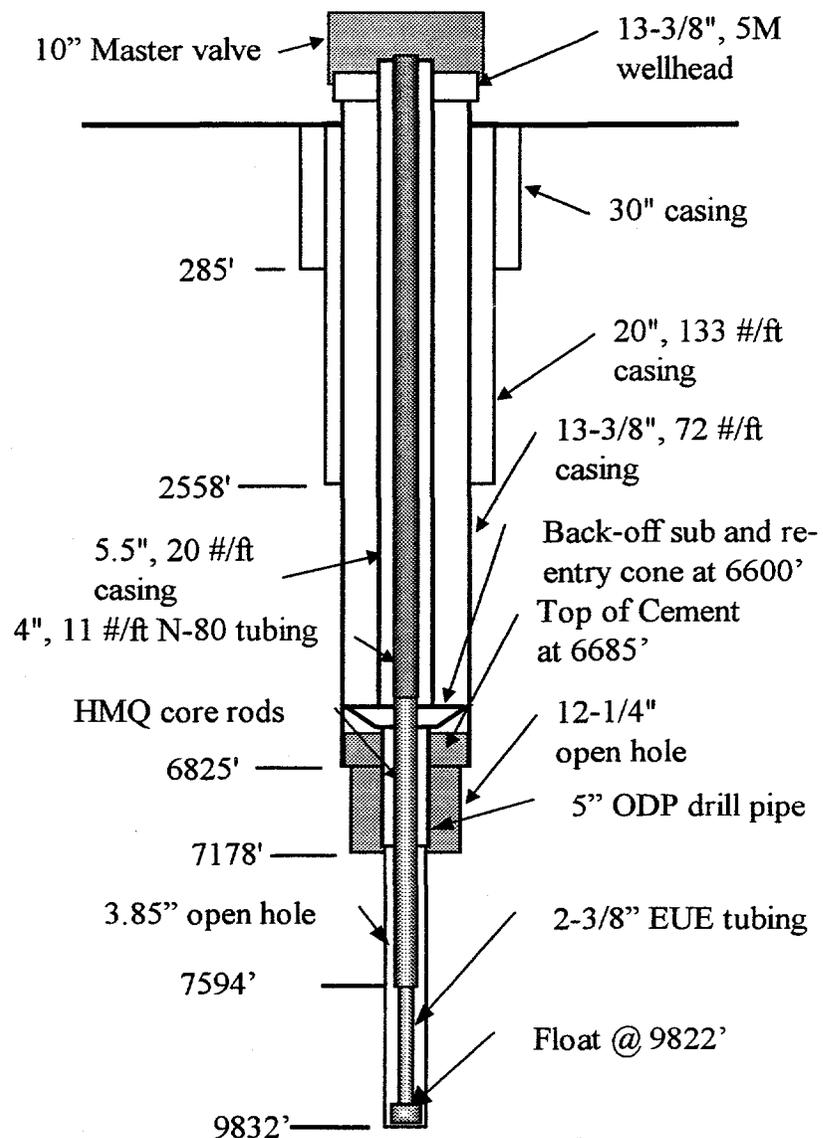


Figure 2 – Completion at end of drilling

possible break-outs, but the hydro-frac didn't fracture. This was surprising, because an earlier mini-frac in 1992 gave a breakdown-pressure gradient of about 0.7 psi/ft. That gradient is equivalent to a surface pressure of about 1990 psi, but pressure for this test reached 3000 psi without formation fracture. The reason for this is unclear, although a possible explanation is that numerous recent earthquakes have relieved enough in-situ stress to make induced fracture more difficult.

With this phase of testing completed, the coring continued in the same banded metapelite which was present at the end of Phase II. Drilling in this formation was reasonably good, in terms of rate-of-penetration, but both bit life and core length were shortened by the broken nature of the very hard rock. In addition, there were intermittent beds of quartzite (up to tens of feet thick) that produced extremely difficult drilling because of its hardness and abrasiveness.

Near the end of drilling there was one episode of stuck and parted pipe at 9707' (described in detail in Appendix A, September 11) but it was successfully fished with a spear on the remaining drillstring.

Drilling then continued until the budget was expended, ending at 9832'. An injection test was run with a pressure-temperature-spinner tool downhole; this comprised a traverse to TD with no flow in the hole, then injection at three rates with the tool parked at the casing shoe, then another traverse to TD with injection at 110 gpm. After that test, the borehole televiewer was successfully run from casing shoe to TD. Once we finished logging, the pre-load on the bushing casing was released (after parting the casing, described in Appendix A, September 17) and the bushing re-hung in the wellhead. A liner string shown in Figure 2 was run into the hole, fluid was circulated to leave mud on the outside of the liner and water inside, and the drill rig was released.

III. DESCRIPTION OF EQUIPMENT AND METHODS

The following descriptions cover the major pieces of equipment used during the project and, where applicable, explanations of their use.

Drillstring/Casing: To meet the scientific goals for this project, and because of budget limitations, it was necessary to design this phase of operation as continuous, wireline-retrievable coring, very similar to the technology used in minerals exploration. With drilling beginning at a depth greater than 7,000 feet and a target depth of approximately 12,000 feet, however, conventional "H" size coring rods were well over their (tensile strength) depth limit. In a change from conventional core-drilling, a composite drillstring (with heavier, coupled tubing in the upper part of the drill string and conventional "H" size tools below that) was used to provide sufficient depth capability. The larger coupled tubing in the upper section also had a significant benefit because of the increased clearance around the core tubes (compared to conventional core rods). This larger annulus allowed the core tubes to travel much faster when pulling or dropping a tube, saving as much as a half-hour on each core trip.

Because existing casing in the hole was 13-3/8" (ID of 12-1/4"), it was necessary to run a "bushing" string of smaller casing inside that to support the smaller diameter, relatively flexible drillstring and to provide an annulus small enough to give the fluid returns a high velocity. This casing was also stepped in diameter, so that the larger,

coupled part of the drillstring would turn inside 5-1/2" casing and the core rods would be inside 5" drill pipe (above the open hole.)

Once this casing string was run into the hole, the bottom interval (up to ~ 6685') was cemented in place to provide a fluid seal and a mechanical anchor. The casing was then stretched approximately 4.5' to provide a preload that would accommodate the thermal expansion caused by drilling fluid becoming warmer. The casing string also includes, at 6600' depth, a back-off sub and bit guide with left-hand threads so that the 5-1/2" casing can later be removed from the well and a large-diameter seismometer emplaced in the 13-3/8' casing.

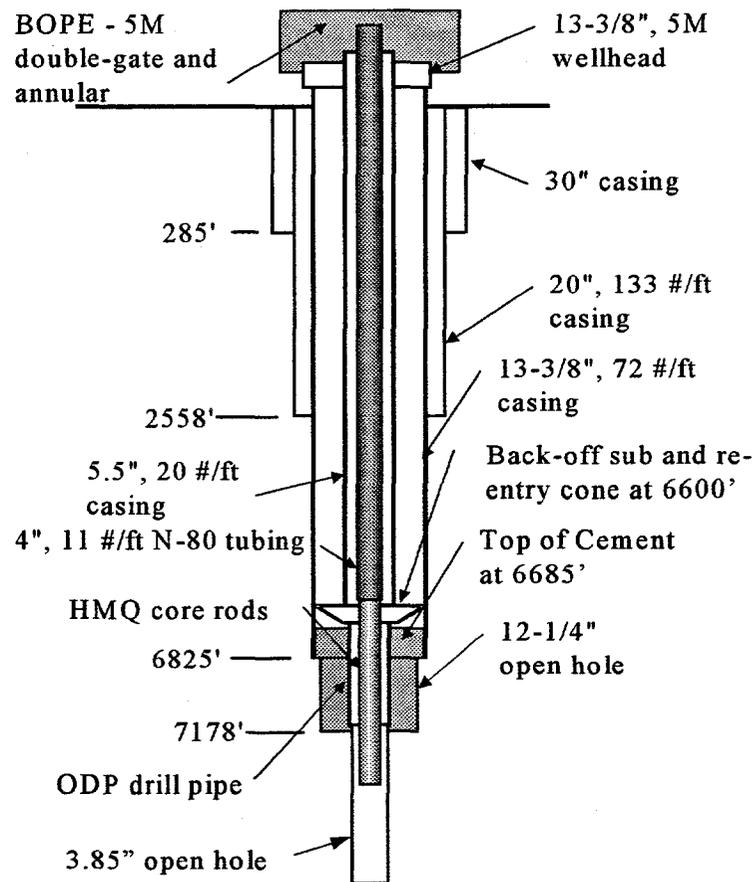


Figure 3 – Drilling configuration for Phase III

Drill rig: A hybrid drilling system, comprising the Nabors Rig 202 which has been at this location since the beginning of the project and a top-drive coring package built for DOSECC (Drilling, Observation, and Sampling of the Earth's Continental Crust), was used for the Phase III drilling. After cleaning out the hole with conventional rotary tools, the big rig served as a platform to suspend the DOSECC Hybrid Coring System (DHCS) for core drilling and provided use of the drawworks for tripping the core rods. (See photo of rig with DHCS suspended, Figure 4, and close-up of top-drive, Figure 5)

The DHCS is a self-contained package, all hydraulically powered, that includes a top-drive coring head, a feed cylinder to control the weight on bit and to advance the drill rods, a hydraulic power package, mud pumps, wireline winch, power tongs, and control console.

During drilling operations, the rig was operated by a three-man crew (driller, derrick man, and motorman) from Nabors plus a core driller from Tonto Drilling. The core driller operated the DHCS, while the Nabors crew was available for tripping pipe, mixing mud, handling core, and other operations involving the big rig.

Surface instrumentation: Several instruments, with continuous data recording, to collect drilling-related data were placed at or near the wellhead. The data set was shared and displayed over a local network. These measurements comprised the following:

- Drilling fluid inflow – Flow rate was measured directly by a magnetic flow meter (magmeter) mounted on the suction side of the mud pumps and indirectly by volume calculated from mud pump speed, obtained by a shaft encoder on the pump's crankshaft. When these readings were compared, the pump-stroke value was usually higher, because inefficiencies in the pump led to less-than-theoretical fluid delivery.
- Drilling fluid outflow – Return flow was measured by a rolling-float meter and by a magmeter on the line from the pitcher nipple back to the mud pits. When outflow becomes significantly less than inflow, this is usually an indication of

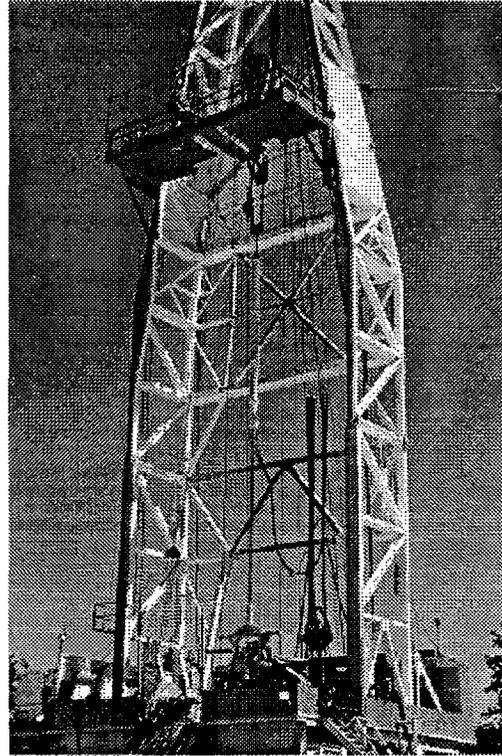


Figure 4 – Rig 202 with DHCS suspended in derrick

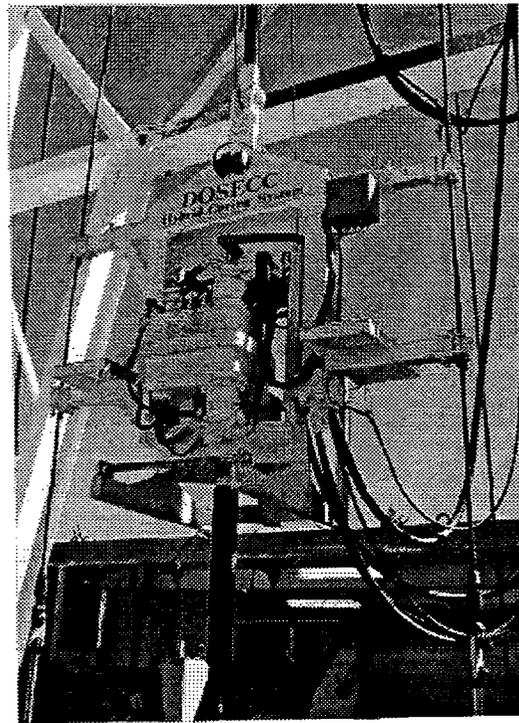


Figure 5 – DOSECC Hybrid Coring System

lost circulation; when outflow is greater, this can signify a kick.

- Drilling fluid temperatures – Temperature transducers were placed in the flow lines into and out of the wellbore.
- Standpipe pressure – Pressure delivered to the drillpipe is measured. This pressure is not only important as an insight on drilling performance, but sudden

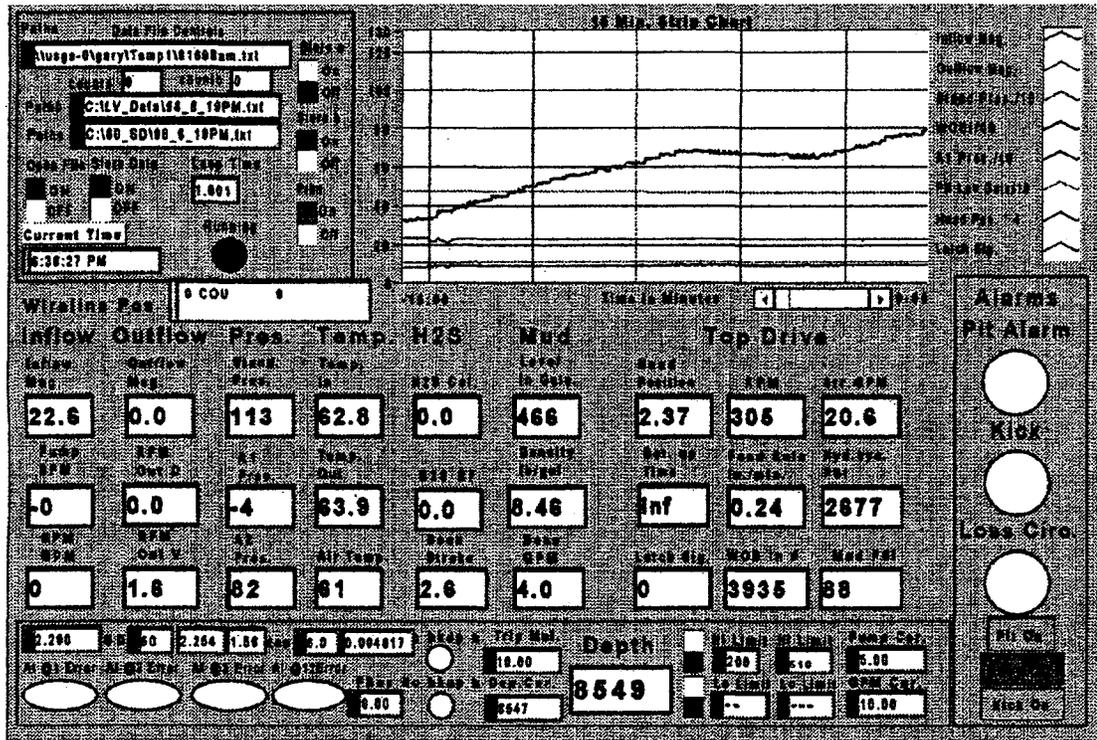


Figure 6 – Drilling-data display

drops in this pressure can indicate a hole or washout in the drillpipe. For this project, standpipe pressure was among the signals displayed on a monitor at the driller’s console and was also used as a latch signal to know when the inner tube was latched into the core barrel.

- Rotary speed and torque – Drill string rotary speed was recorded from data provided by the DHCS instrumentation; the data pickoff was a magnetic pulse counter in the top-drive head. Drill string torque measurement came from the hydraulic pressure in the top-drive motor.
- Head height and ROP – A cable-line encoder located on the hydraulic feed cylinder gave an indication of the top-drive head height, relative to hole depth, entered by the driller at the start of the core run. Head height versus time gives rate of penetration, which is sometimes useful to identify different lithologies, and gives an indication of how well the bit is cutting. The weight-on-bit was also measured and displayed on the monitor.

All transducers were connected to a signal-processing station on the drill rig, and from there to a data acquisition and analysis computer in Sandia’s Winnebago mobile office. A software package called “LabVIEW” recorded data once per second, saved it to hard

disk, and drove display monitors in the Winnebago, the Sandia office, the USGS core trailers, the rig superintendent's office, and the driller's console. A sample of the drilling-data display is shown in Figure 6. Every 12 hours, drilling data were transferred from LabVIEW to USGS's Drilling Information System (supplied by the ICDP), where it was augmented by data from X-ray diffraction, a digital core scanner, a gas chromatograph, and other core/lithology information. Once a day this combined data set was transferred to a compact disc for a permanent archive.

Downhole instrumentation: Downhole data collection during this operation primarily comprised temperature and hole-inclination measurements, with some pressure data. The temperature logs were taken either with Sandia's platinum-resistance-thermometer (PRT), surface-readout tool, with a wireline memory tool (that could also be configured to give surface readout), or with a core-tube data logger that fit inside the inner core tube and measured temperature, pressure, and hole inclination. Each of these tools, along with a Sandia logging truck, remained on-site for the entire project. The PRT tool uses a simple resistance bridge, with changes in resistance measured from the surface through a four-conductor cable. Since there are no downhole electronics, temperature drift with time is negligible and the PRT temperature measurements are considered a reference standard for this kind of drilling.

As the name implies, a memory tool records data (generally pressure and temperature, sometimes gamma radiation or spinner) downhole and stores it in an on-board electronic memory, which can be downloaded into a computer when the tool is retrieved to the surface³. Memory tools have several advantages: 1) Because there is no conductor-carrying wireline, that is no longer a limitation on high-temperature logging; 2) A specialized logging truck is not needed, because the memory tool can be run into and out of the hole on the rig's sand line or with a simple "slickline" winch; 3) Assuming a relatively low first cost, an operator can own one of these tools and acquire temperature/pressure logs whenever it is desirable, without incurring expensive service-company logging operations. There are corresponding disadvantages associated with the delay in getting data and with the lack of any surface indication if the tool fails during a test, but this is an accurate and cost-effective technology.

An additional temperature/pressure/inclination tool was also run as part of its development program⁴. This tool rode in the inner core tube, measured temperatures (within a few feet of the bit), pressure, and hole inclination as a function of time while drilling, and stored this data in an on-board memory. When the core tube was pulled out of the hole to retrieve core, data from the "core-tube data logger" (CTDL) was downloaded into a computer for plotting and analysis. Letting the CTDL ride in the core tube while drilling gave temperatures in that drilled interval, but the tool was also used to temperature log the entire well when the pipe was tripped for bit changes. Using the CTL as part of the normal drilling operation also meant that no additional rig time was consumed in satisfying regulatory requirements for temperature and inclination measurements at regular well depth increments.

The acoustic borehole televiewer (BHTV) was successfully run from the casing shoe at 7178' to almost TD after drilling operations concluded. Data analysis is still under way on the borehole images, but preliminary evaluation is that the log contains good detail and shows many fractures, breakouts, and other wellbore features.

Drilling Fluids: Because of the relatively low temperatures in this hole, the drilling fluid (mud) for this well was straightforward. Down to approximately 8530', there were full fluid returns and the mud formulation was designed to give good viscosity and lubricity with reasonable cost. Once circulation was totally lost, the fluid flow was separated into two circuits: the main pump circulated approximately 20 gpm down the drill pipe, and a smaller pump put approximately 2-3 gpm down the annulus between the drill pipe and the bushing string of casing. In the lost-circulation case, the main fluid flow used a higher proportion of bentonite (with fine-ground walnut shells for lubricity and some lost-circulation control) while the annulus flow had mostly (the more expensive) liquid polymer for lubricity. For annular flow, the liquid polymer was mixed with water from the drilling sump, which already had a fairly high viscosity, and which helped reduce the amount of fluid needing disposal at the end of the project. After most of the sump water was disposed, a simple mixture of bentonite, dry polymer, and soda ash was used for the next phase of drilling, until a problem with stuck pipe that might have been caused by too much bentonite in the fluid. Mud mixtures used at various stages of drilling were the following:

Full Returns -	Bentonite	3 lb/bbl
	Dry Polymer (EZ Mud DP)	0.2 lb/bbl
	Dry Polymer (Drispac Plus, Regular)	0.1 lb/bbl
	Soda Ash	0.5 lb/bbl
Lost circulation -		
	Drill pipe flow -	
	Bentonite	7 lb/bbl
	Soda Ash	0.5 lb/bbl
	Fine Walnut shell (Glufil)	1.5 lb/bbl
	Dry Polymer (EZ Mud DP/Drispac, in a 2:1 Ratio)	as required for 60 sec viscosity
Annulus flow -	Dry Polymer (EZ Mud DP) in sump water	as req'd for lubricity
Final stages -	Bentonite	10 lb/bbl
	Dry Polymer (EZ Mud DP)	0.4 lb/bbl
	Soda Ash	0.5 lb/bbl
After stuck pipe -	Bentonite	3 lb/bbl
	Dry Polymer (EZ Mud DP)	0.25-0.3 lb/bbl
	Soda Ash	0.5 lb/bbl

[NOTE: Use of brand names does not imply an endorsement of that specific product, but only serves to better identify the type of material used.]

IV. ANALYSIS OF DATA

Two principal kinds of data were collected from this project: conventional downhole logs (temperature, inclination, injection/spinner, pressure, and televiewer) that are informative about the hole, and continuous recording of the parameters which determine the drilling conditions and performance.

Downhole data were collected with the tools described in the previous section. Temperature did not increase significantly during drilling, as measured by the surface-readout PRT tool and by both of the core-tube data loggers. Comparison of readings between different tools run at the same time (suspended in parallel from the wireline) gave consistent agreement, although there was almost always a difference, caused by drilling fluid circulation, between the temperature measured in the wellbore and the "natural" formation temperature. Temperature logs after drilling, however, gave a progression of formation temperature profiles shown in Figure 7.

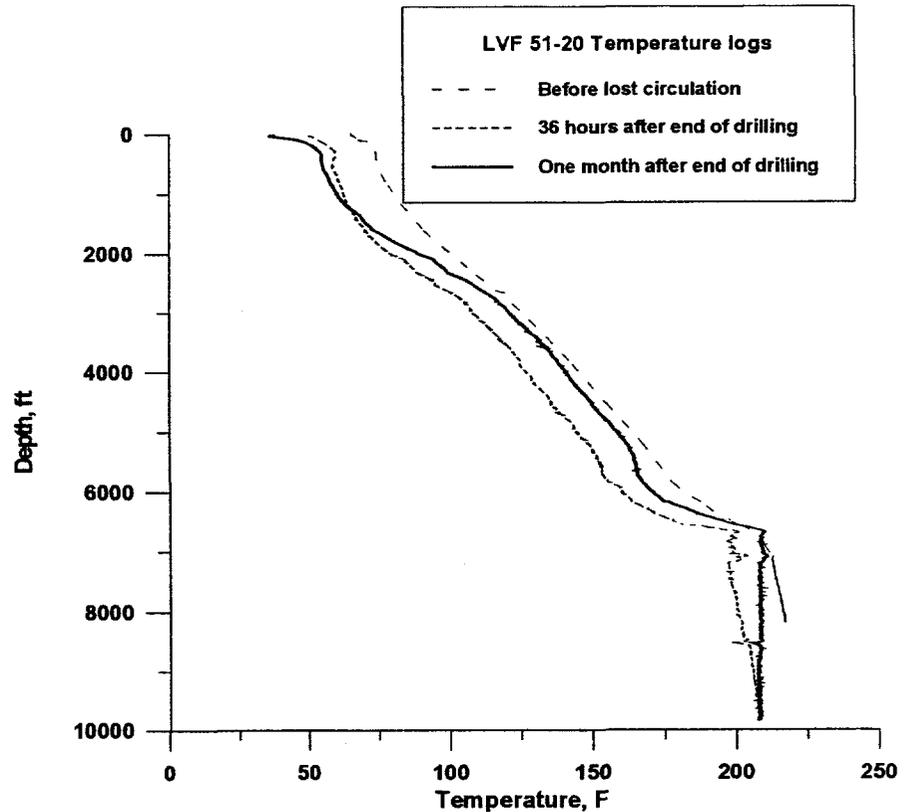


Figure 7 – Temperature profiles in well

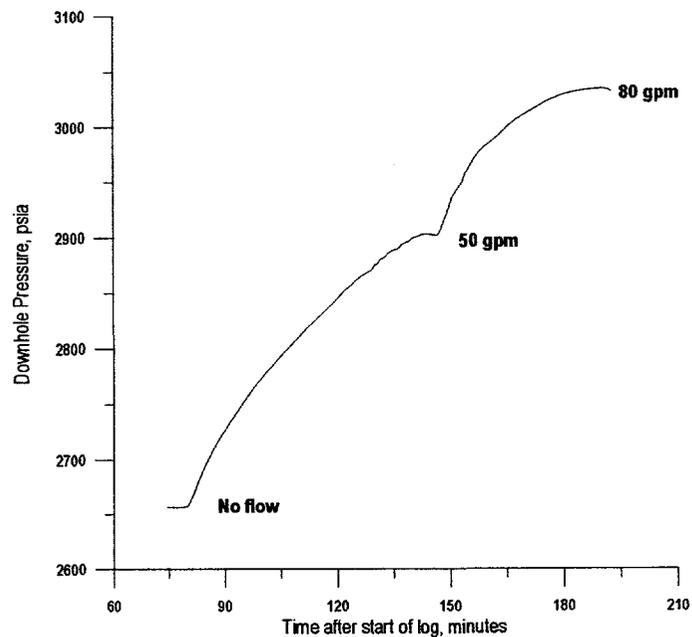


Figure 8 – Pressure during injection test

Pressure data were taken in the hole but were not especially meaningful, except for those readings during the attempted hydro-frac and the injection test at the end of drilling. The injection was done at three different flow rates, with downhole pressure plotted against time in Figure 8. Because the pump plugged up during the test, the last flow rate is not included in the curve. Injectivity, based on the two flow rates, is approximately 0.215 gpm/psi, or 0.197 kg-sec/bar. Although low for a well of this

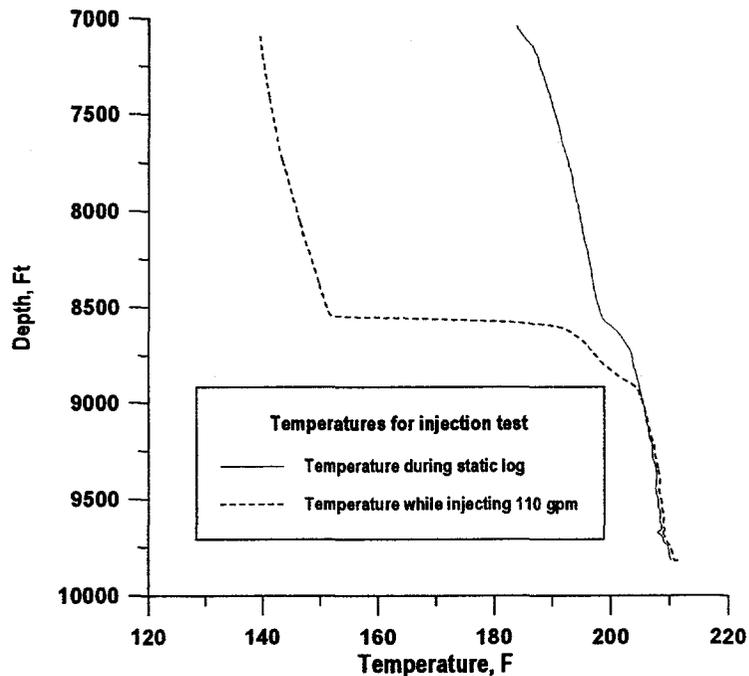


Figure 9 – Temperature during injection test

diameter, this value is consistent with injectivity indices recorded⁵ in a few Japanese slimholes. The spinner on the PTS tool was jammed by a rock during this test, but the temperature traverse while still injecting (Figure 9) shows clearly that almost all the water was leaving the wellbore just below 8500', which is the location where complete lost circulation occurred when drilling reached that depth.

Most of the inclination data was collected with the CTDL, because its use was essentially "free" in terms of rig time. Single-shot surveys were taken as required by regulation. The inclination built sharply just out of the casing shoe, reaching approximately 4° in less than 300'. At that point, the bottom-hole assembly was changed to a stabilized core barrel and the rate of angle build for the hole decreased, ending at a total deviation of 15.6° at a depth of 9790'.

Drilling performance parameters (rotary speed, weight on bit, flow rate, standpipe pressure, etc. – see Figure 4) were recorded continuously at a rate of once per second. Each day's data were downloaded onto a compact disc, from which working and archival copies were made. The one-second data will be stored in a drilling database maintained by the ICDP, and will be available to researchers, but because these are very large files (each day's performance record was ~ 5 MB), one-minute-interval data files were also created and used for reviewing events of interest.

Much of this instrumentation and display was developed for Sandia's work in lost circulation; measuring a difference between inflow and outflow is critical in diagnosing a loss zone. The associated data collection that has evolved around this system, however, has proven to be extremely useful in evaluating general drilling performance and is a platform for further development as other rig data are identified as useful. At present, a sampling of the system's uses includes:

- **Lost (or gained) circulation:** This was the original purpose of the measurement system. When non-transient outflow rate falls below inflow, then drilling fluid is being lost to the formation. Conversely, when outflow rate is higher, the formation is producing fluid into the wellbore.
- **Pump pressure:** Sudden drop in pump pressure at a constant flow rate frequently indicates a washout in the drillstring. Increased pressure is often a sign of a worn bit.
- **Pump efficiency:** If flow rate measured by non-intrusive flow sensors decreases relative to the calculated flow rate based on pump strokes, this indicates that pump efficiency is declining.
- **Temperature difference between inflow and outflow:** Bottomhole temperature cannot be inferred directly from an increase in flow line (outflow) temperature, because there are many different temperature gradients in the formation that will produce the same outflow temperature or ΔT between inflow and outflow, but rapid variations are a signal that something has changed downhole. For example, in a known lost circulation zone, where outflow is a variable fraction of inflow, a change in outflow temperature while the inflow temperature remains constant can mean that the wellbore has penetrated a producing formation with water hotter or colder than the drilling fluid.
- **Drilling optimization:** Having all readings available on one monitor makes it easier for the driller to optimize the combination of drilling parameters such as rotary speed and circulation rate.

A great deal of scientific/geologic data collection (gas chromatography, X-ray diffraction, digital core scans, etc.) was also done by USGS and university personnel, using instrumentation provided by the ICDP. This information is also collected on CDs and is available through the ICDP. Much information is already available through:

<http://icdp.gfz-potsdam.de/ch/search/html/search.html>

Click once on Long Valley on the world map, then click on "data". This requires a username and password for the internal databank, and those are available by sending an email to: conze@gfz-potsdam.de

An open-file CD containing:

- 1) A summary lithologic log
- 2) All core-box images
- 3) Compressed versions of core scan images.
- 4) All temperature logs to date

and possibly other downhole information will be available through the USGS Information Services in Denver, for a nominal price. It will contain instructions and suggestions for preparing core requests. The 55 archive CD's produced on site will also be copied, and will be distributed to:

USGS Flagstaff
DOSECC Inc, Salt Lake City
USGS Core Research Center, Denver
ICDP Data Clearing House, Potsdam

V. DISCUSSION

Some features of the drilling deserve further discussion, because their importance may not be obvious from the daily reports.

All drill string rotation and circulation was done with the DHCS, which performed very well, but the capability to turn the string and circulate through it without using the top-drive would have been useful. The pipe could be rotated by hanging it in the slips on the rotary table, but there was no convenient swivel for pumping at the same time.

Although the mud program was relatively simple, the drilling fluid quality was sometimes not repeatable. Better coordination among the derrick hands, drillers, and mud engineer could probably have improved this.

The drilling fluid did, however, stay free of contamination. This was unlike the drilling fluid left in the hole at the end of drilling operations in 1993, which accumulated the "muck" described in Section II. The reason for this was the cemented interval at the bottom of the casing/bushing string. It provided a positive seal and prevented any formation clays or previous fluids from entering the newly drilled interval.

It is possible that using a 10' core barrel would have improved the length of core runs. We used a 20' barrel and filled the tube just often enough to be tantalizing. Overall, though, the average core run was approximately 6', so a great deal of time was spent tripping the inner tubes. Because the shorter barrel is stiffer, it might have given better performance (fewer blocks) in the highly fractured rock that made up the great majority of formation drilled.

The latch detectors were extremely helpful in saving time on core tube trips. If they had not given a reliable indication of the inner tube latching, the driller would have waited considerably longer to make sure the tube was latched, which would have added up to much more time spent waiting for a latch on the hundreds of core runs described above.

VI. CONCLUSIONS

Four agencies provided support for this project: the California Energy Commission, the International Continental Drilling Program, the US Geological Survey, and, through Sandia National Laboratories, the US Department of Energy. Each of these entities had a somewhat different agenda – the CEC is interested in the concept of magma energy, which was the original purpose of this well; the ICDP studies the structure and evolution of young calderas and is developing an integrated Drilling Information System; the USGS will install seismometers and other instruments in the hole as part of a volcanological observatory; and Sandia uses this and similar projects to gather data on drilling technology and to test new hardware and instrumentation under development by the Geothermal Research Department. Because of these different objectives, the success of the project must be evaluated with respect to each one.

In considering the concept of energy extraction from magma, the paramount criteria are the existence of a resource, and its accessibility. In general, if drilling into it does not prove a resource, extrapolating a temperature gradient to indicate its depth is the primary support for belief in its existence. Another method, which has been used in Long Valley

Caldera, is to place heat-flux gauges over a large area and integrate the total heat being conducted through the earth. The total heat flux here still implies a very large heat source under the caldera, but the local temperature gradient in this hole is ambiguous with respect to inferring the depth to a postulated magma chamber.

Although certain trends are evident, none of the scientific investigations undertaken during this drilling phase is yet complete. Temperature logs will continue until the summer of 1999 to establish the equilibrium pre-drilling thermal regime in the formation. Results of an attempted hydro-fracture and borehole televiewer logs are still being analyzed. A preliminary core description and lithologic log were compiled in real time, but these will not be finalized until laboratory studies have been completed.

Preliminary analyses of results obtained to date do not provide definitive answers as to the status of a hydrothermal resource or the depth to magma. From a depth of 8540' (where circulation was lost) onwards, the temperature regime appears to be controlled by thermal disturbances resulting from loss of drilling fluid. Temperature logs taken over 5 weeks after drilling show an isothermal gradient from approximately 6600' to TD. The top of this interval corresponds with the top of the "basement" metapelite, but it is unclear what, if any, relationship exists between the formation change and the temperature gradient. The observed temperatures favor a model in which there is no massive magma chamber in the upper 10 km, as deduced by Hurter and Pribnow⁶, although their model considers only conduction and the temperature gradient here is classically characteristic of a convection cell. There is no evidence for the small, shallow magma bodies thought to be responsible for the contemporary uplift and seismicity, but their presence cannot be ruled out either.

The Phase 3 science studies to date provide no evidence for a hydrothermal system or magma from which heat can be exploited within the central part of the resurgent dome of the Long Valley caldera. The core studies yield evidence of permeable, recently fractured rock, but early indications are that temperatures are not sufficiently high for economic extraction of fluids.

The highly fractured rock drilled for most of this phase has many open veins containing crystals that show evidence of present or past water flow. This is consistent with the theory that a strong ground-water flow masks heat from a source below, but so far this idea has been neither confirmed nor contradicted. It is not yet clear whether this question can be answered analytically, although the possibility will be investigated if support for that research becomes available.

Also pertinent to the viability of a resource is the question of its accessibility. Our experience of very difficult drilling in this most recent phase argues against drilling a large-diameter hole through the geologic sequence found here. In summary, the existence of a magma resource at this location is still not verified but, if it is there, gaining access to it will be challenging.

The ICDP's prototype Drilling Information System was deployed here for the first time. In addition to the drilling data described in Section III, the system permanently recorded and archived digital-image core scans, mass spectrometer and X-ray diffraction data, and lithologic logs. In general, the system worked well, but the experience here revealed several operational changes that are needed for subsequent projects and so this was a very beneficial exercise. Scientific data collection for caldera study was also successful, although the precise implications of this information are still being analyzed.

After a significant interval to let the wellbore temperature stabilize and then to pull the temporary liner and the upper bushing string, the USGS plans to emplace instruments in the wellbore. This program can be fully accommodated with the hole's final configuration. The tentative instrumentation plan is to have a fiber-optic temperature sensor to TD, a strain meter cemented into the small hole at approximately 7300', a seismometer in the 13-3/8" casing at approximately 6600', all this possibly preceded by perforation of the tubing and fluid sampling at zones of interest. Neither design nor schedule for these measurements is firm at this writing, but a plan for removing the tubulars is in place.

Technology development in this project went very well. The DOSECC coring package gave good performance and reliability, especially for a new piece of equipment on its first hole. This is a powerful, versatile top-drive system that is capable, with an appropriate drill string, of deep coring for geothermal exploration or scientific research down to depths of at least 16,000 feet. Other technology demonstrated on this project included:

- Composite drill string – This string was also successful, combining durability with the considerable advantage of a larger inside diameter, which allowed much faster core-tube trips (drillers estimated approximately half the time, compared to trips with all-HMQ string). The Hydril tubing at the top requires either a removable bushing string as used here or nominal 5-1/2" casing cemented in place, but this would be normal for deep drilling in any case.
- Drilling data system – This system, described in Section III, provided valuable real-time performance data to the driller, the toolpusher, the core lab, and the Sandia office. It was considered indispensable by the driller, and was extremely useful to keep everyone on site informed about current activity.
- Core-tube data logger – This tool, also described in Section III, has been used on earlier projects, but continued its established useful, reliable performance that has stimulated interest in commercialization by a major core-drilling company.
- Latch detector – This is an accelerometer-driven sensor that clamps onto the top-drive head and gives a signal when the inner tube latches into the core barrel. It is important to know this because drilling without a latched tube will probably lead to a trip, and eliminating the need to give the tube extra time to make sure it is down is a significant time saving. This tool is also near being commercialized.
- Pressure-restricting latch head – When drilling with lost circulation, the pressure signal read by the latch detector was reduced essentially to nothing. These latch heads, developed by Boart-Longyear, used restricted flow to create a pressure spike when the head latched, and the detector could see this.

Because this was a high-profile project with international participation, most of these developments will receive considerable exposure that will accelerate the technology transfer.

From an overall perspective, then, the project fulfilled most of its aims, although there is the major remaining uncertainty about the depth and presence of a magma body.

VII. BRIEF GEOLOGIC DESCRIPTION

Long Valley Caldera, measuring approximately 12 by 18 miles across, is the result of a catastrophic eruption 760,000 years ago. The caldera complex remains seismically and volcanically active, with eruptions every few hundred years and as recently as 250 years ago. In 1980 renewed earthquake activity and ground deformation created concern over a possible eruption and led to an extensive monitoring program by USGS scientists. Recurring earthquake swarms and uplift of the resurgent dome, accompanied by increased CO₂ emissions on Mammoth Mountain, continue today (elevation at the drill site is approximately 3' higher now than in 1980.)

The first two phases of drilling (summarized in Section I) penetrated the post-caldera lavas and fill, the syn-caldera Bishop Tuff, and ended in meta-sedimentary basement rock of Paleozoic age. As shown in the theoretical caldera cross-section (Figure 10), the Bishop Tuff was ejected from the caldera-forming eruption through a ring fracture, which then caused the central plug to drop. Below the Bishop Tuff, the basement rock consists

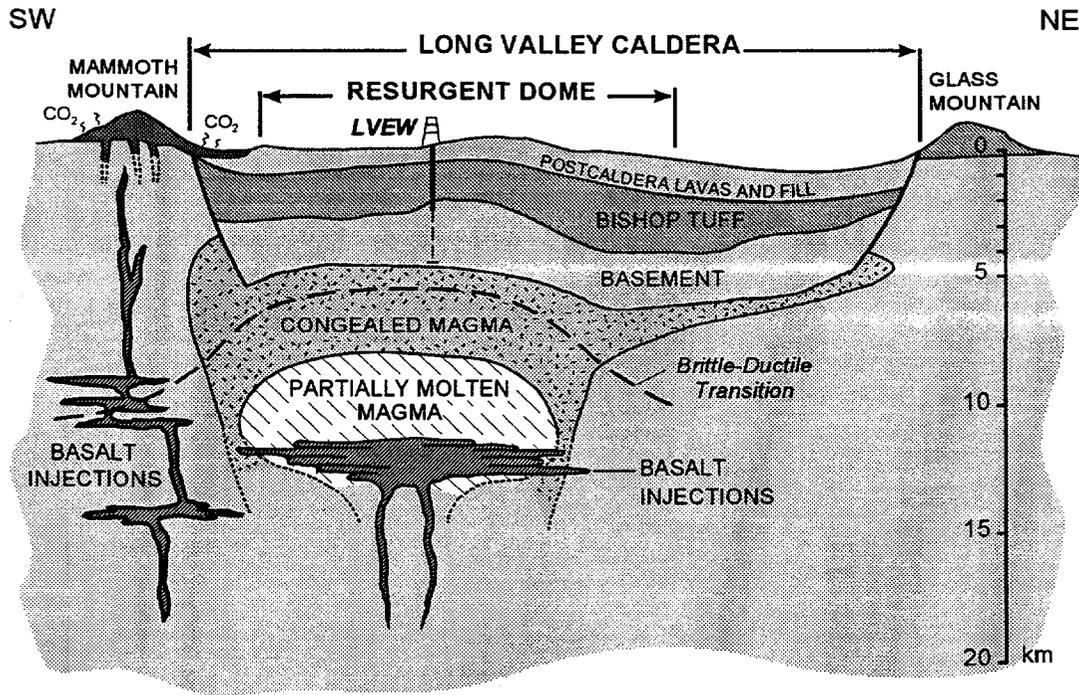


Figure 10 – Cross-section of Long Valley Caldera

of metapelite which sometimes grades into hornfels, and which is a product of metamorphism of sedimentary rock by a large granitic intrusion some 90 million years ago. The basement rock has periodic fine-grained intrusions of meta-volcanic and volcanic rock of undetermined age. The hornfels is a hard (~80% quartz), fine-grained, highly fractured (in the drilled interval) formation with high graphite content that gives a dark gray to black color. The combination of hardness, grain size, and fractures made the drilling difficult, with relatively short core runs and low bit life. This formation,

punctuated by extremely hard quartzite beds that were up to tens of feet thick, persisted until the end of drilling at 9832'.

VIII. GLOSSARY

The following terms are common in drilling practice; many of them are used in this report:

annular preventer - part of the BOP stack; an inflatable bladder which seals around drillpipe, casing, drill collars, or irregularly shaped components of the drillstring.

annulus - Drilling: the space between outside of drill string and inside of casing or wellbore. Casing: the space between outside of casing and the hole.

backside - annulus between drillpipe and surface casing

balling, bit balling - lumps or balls of clay which form around a bit's cutting structure when drilling soft formations. Balling prevents the bit cutting effectively.

block, or blocked run - a core run is blocked when fractured rock wedges into the core tube and prevents further drilling before the tube is full.

blow out - uncontrolled flow of fluids from a wellhead or wellbore.

Bowen spear - a fishing tool which expands inside a fish when the drillstring is pulled up

BOP - blow out preventer; one or more devices used to seal the well at the wellhead, preventing uncontrolled escape of gases, liquids, or steam. Also BOPE - blow-out prevention equipment. See *annular preventer, rams*.

boot, booting - forming a plug of drilled material or fill above the bit, usually caused by inadequate hole cleaning or swelling clays.

bottom hole assembly (BHA) - the assembly of heavy drilling tools at the bottom of the drill string; normally includes bit, reamers, stabilizers, drill collars, heavy-weight drill pipe, jars, and other miscellaneous tools.

bridge - a downhole obstruction, usually caused by part of the wellbore wall falling into the hole.

button bit - see tri-cone bit

cave - debris that falls off the wellbore walls and accumulates in the bottom of the hole.

CIP - cement in place

Dewar, Dewared - a Dewar is a double-walled container or heat shield, similar to a vacuum flask, which insulates a piece of equipment from high temperature.

drawworks - the large winch on the rig floor which takes up and pays out the drilling line, thus controlling the movement of the hoist or traveling block.

drilling break - an occasion during drilling when the rate of penetration suddenly increases.

fish - any part of the drillstring, or other tools, accidentally left in the hole

fishing - trying to retrieve a fish

float - essentially a check valve, used in the drillstring to keep liquid from flowing back up the drillpipe or casing

float collar - a coupling with built-in float; placed near the bottom of a casing string to prevent the heavy cement column in the annulus from flowing back into the casing. After displacing the cement in the casing with mud, the casing between the float collar and the shoe will be full of cement

float shoe - a casing shoe with built-in float; used like a float collar, except there won't be cement inside the casing

Geoset - a type of synthetic diamond cutter used in impregnated bits

H or HQ - designation of a coring tool size; rod outside diameter is 3.5", bit is approximately 3.9" OD and 2.5" ID

H₂S - hydrogen sulfide; a poisonous gas sometimes found in geothermal drilling

jars - tools which apply an impulse force to the bottom of the drillstring when the string is pulled up; usually used for fishing, but sometimes included in the string for normal drilling

lay down - to take a piece of equipment out of service; e.g., to lay down a worn core rod

LCM - lost circulation material; any material used for plugging formation fractures to avoid loss of drilling fluid

lubricator - sealing element attached to the wellhead which allows a wireline to pass up and down, or which allows a logging tool to be transferred into or out of the wellbore, while there is pressure in the wellbore

matrix - the hard metal portion of a bit which holds the diamond cutting elements in place

mill tooth bit - see tri-cone bit

mislatch - the condition when the core tube, or inner barrel, is not latched into the outer rotating barrel, sometimes caused by core dropped out of the core tube. If the core tube can't be worked down over the core in the barrel, then the drillstring must be tripped to clear it.

MRT - maximum reading thermometer; a mercury thermometer which retains the reading of the highest temperature it has seen (which may not be at the bottom of the hole)

N or NQ - coring tool size; rod OD is 2.75", bit is approximately 2.98" OD and 1.875" ID (N fits inside H)

nipple up (down) - to assemble (disassemble) something; usually the wellhead or BOP stack

OEDP - open ended drill pipe; drillpipe without a bit or other bottomhole assembly, generally used to place cement at a specific point in the wellbore.

overshot - in general, any tool that latches around the outside top of another tool; usually refers to the assembly which retrieves the core tube with the wireline, or to a fishing tool which extracts a fish by gripping it around the top

PTS - pressure-temperature-spinner tool; downhole instrumentation to measure these quantities (spinner output is an indication of velocity or flow rate)

pick up - to put any piece of equipment into use; e.g., to pick up a new bit

pitcher nipple - the vertical tube around the top of the blow-out preventer; it collects the drilling mud returns and empties them back into the mud tanks

POOH - pull out of hole; bringing the drill string and tools out of the hole

possum belly - manifold which connects the return line to the shale shaker

rams, pipe or blind - rams are part of the blow-out preventer; pipe rams seal around the drill pipe if it is in the hole, blind rams seal against each other if the pipe is not in the hole

rathole - either additional hole drilled below the target depth to give room for debris, fill, etc. or, on a rotary rig, where the kelly is stored while tripping pipe

RIH - run in hole; inserting the drillstring and tools into the hole

shoe - a heavy, tapered cap that attaches to the bottom of the casing string and protects it as the casing is lowered into the hole

spud - to begin drilling a well

squeeze - to deliberately apply pressure to the wellbore, usually by closing the BOP and pumping into the well. Often done to force cement into the formation at the casing shoe or into the annulus through perforations in the casing

stab(s) *n.* - stabilizer, or stabilizers; bottom-hole-assembly components which are almost hole diameter, used to keep the drill pipe relatively centered in the hole above the bit.

stab *v.* - to insert the pin-end of a drillstring component into the upward-looking box.

stand - more than one joint of drill pipe screwed together; when tripping, pipe is handled in stands to avoid making and breaking every connection - for a coring rig, a typical stand is four ten-foot joints (40 ft), but for a large rotary rig, a stand is three thirty-foot joints (90 ft).

strip - to wear away the matrix in an impregnated diamond bit; the bit must strip to expose the diamond cutting surfaces; also, to pull out of the hole under pressure, with the annular preventer closed around the drill pipe

swage, inside or outside - a fishing tool which grabs the inside or outside of a fish by forcing an interference fit

TOC - top of cement

top job - casing cement which is placed from the top, rather than being displaced through the casing shoe. It is either pumped directly into the top of the annulus, or pumped through a tremie line to get a deeper placement in the annulus.

tremie line - a small-diameter pipe or tube run down the annulus outside of casing

tri-cone bit - a bit having three toothed, conical rollers which rotate as the bit turns and crush the rock at the bottom of the hole. The teeth can be either steel, milled into the cones (mill tooth), or tungsten carbide buttons set into the steel cones (button bit, insert bit, TCI bit)

trip - any event of pulling the drillstring or core barrel out of the hole and returning it

wash - to run in the hole with circulation, usually required to get back to the bottom of a previously drilled hole when there is fill or cave in the hole

washout - a leak in the flow path through the drillstring, usually at a threaded connection in the drillpipe or drill collars. The hole is enlarged by high-pressure drilling fluid passing through it, and frequently causes the drillstring to fail and separate.

wet pull – pulling the drill string out of the hole with something plugging the bit or drill pipe that keeps it full of mud, rather than having it drain out as normally happens.

wiper trip - running the drill string, with a bit, to the bottom of the hole to make sure there are no obstructions in the hole

WOC - wait on cement, time spent waiting for cement to cure

WOO - wait on orders, time spent waiting for directions

xover or xo - crossover; a coupling used to adapt from one thread size to another

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APPENDIX A

The following day-by-day narrative represents notes made by Sandia field personnel during the drilling operations. Definitions of abbreviations and jargon are given in the Glossary, Section VIII. This narrative is complementary to the Daily Drilling Reports in Appendix B.

19 July

- 1800 – Spent most of the day completing rig-up, nipping up BOP, and rigging flow diverter (to dump mud/muck from hole clean-out into sump instead of mud tanks.)
- 2000 – Began RIH with ODP drill pipe that is standing in derrick.

20 July

- 0100 – All drill pipe from derrick (6721') is in hole, begin picking up additional ODP pipe from racks.
- 0200 – Begin circulation with bit at casing shoe (6825').
- 0345 – Reached 7050' (the point where logging tools have been stopping because of muck or other obstruction in hole.) Began washing in.
- 0400 – Rough drilling at 7078'. Rotating slowly and keeping very light weight (~4000 lb.) on bit because of lack of drill collars.
- 0530 – On bottom at 7176'. Pump viscous sweep; will continue circulating until returns show muck and cuttings/chips.
- 0900 – Casing crew completes rigging up lay-down machine. Begin POOH and laying down drill pipe.
- 1100 – Unloaded two trucks of Tonto equipment. Mud tanks, rods and tools.
- 1815 – Finish laying down drill pipe.
- 1945 – Start RIH with ODP drill pipe (lower part of bushing string). Total string is: joint of ODP (5") drill pipe with float welded to it; aluminum baffle plate in the box of the shoe joint with thread-lock on top and bottom of plate; 556' of ODP drill pipe; crossover/back-off sub with left-hand thread in middle; xo with 5-1/2" Hydril TAC-1 box and 8-rd pin; 6556' of 5-1/2", 20 lb./ft. Hydril TAC-1 tubing; xo with 5-1/2" Hydril TAC-1 pin and 8-rd pin; bit guide with 8-rd up and down; long joint of 5-1/2" casing with 8-rd both ends; 8-rd coupling. During running casing, the casing crew dropped a pin out of the tongs and could not find it.

21 July

- 0830 – On bottom with casing string, spacing is correct to place bit guide just above casinghead after pipe is pre-stretched. Bit guide is made up into last crossover and thread-locked into place. Long joint of casing is made up into top of bit guide and then backed off slightly.
- 1000 – Waiting on delivery of additional cement.
- 2000 – Cement arrives; rig up to pump cement.
- 2150 – Pump 64 bbl Class G cement with 40% silica flour and 0.5% fluid loss additive (HALAD-413). Drop plug and displace with 160 bbl water. Did not bump plug, but float held back flow. WOC.

22 July

- 0600 – Ran temperature log to locate top of cement. Got a temperature spike at 6685', which is a reasonable depth (calculated TOC was 6650', without allowance for hole being out of gauge), but then cable head leaked and log became faulty. Will try to diagnose failure mode and decide whether to log again. TOC at 6685' gives 140' lap above 13-3/8" casing shoe. Tag top of cement inside pipe at 7148'.
- 0830 – Crane arrives to begin unloading and spotting DHCS equipment.
- 1800 – Crane operator has to leave; most DHCS components are in place. Remaining picks are grasshopper and feed cylinder.
- 2100 – Complete pre-stretch on casing; 125 k-lb pull (over string weight) gives 4.5' stretch, which is enough to allow thermal expansion resulting from a temperature increase of 100°F. Top of casing is hung in slips in the casinghead. Top of bit guide is 12.5" above casinghead flange.

23 July

- 0700 – Resume rigging up DHCS.
- 1630 – Test BOP blind rams; test witnessed by Cheryl Seath, BLM. Continue rigging up DHCS and nipping-up BOP.

24 July

- 0700 – Continuing to work on DHCS and BOP.
- 1700 – Running pipe in hole; some difficulty with making up 4" Hydril tubing because the load cell failed, requiring use of the pressure gauge on the tongs. Correlation of pressure with torque is not linear, but it appears that we're getting about 2800-3000 ft-lb torque.

25 July

- 0700 – Held safety meeting to discuss well control with both crews. Begin BOP test,
- 1530 – Completed BOP test. Resume picking up drill pipe. Going about twice as fast as before, because Cavins are now working correctly.
- 2130 – Ran all 204 joints of 31' Hydril in hole. Picked up bent and tong-damaged joints on top. Total length of Hydril 6362'. With coring tools, bit is at 7138'.
- 2230 – Rigging up coring wireline. Fighting knot in drum.

26 July

- 0400 – Finish rigging up top-drive coring system and start washing in at 7134'.
- 0500 – Tag top of plug at 7160' and core. Top drive not oiling, repair.
- 0630 – Fine feed on top drive not working.
- 0900 – Coring through cement just above shoe. Trying to block. Will pull tube before drilling out float.

- 1000 – Tube stuck. Work stuck tube.
- 1030 – Drop wireline release and work stuck tube.
- 1130 – Wireline released. Pull wireline and drill on stuck tube.
- 1230 – RIH with overshot. Tube still stuck. Work tube free.
- 1330 – Out of hole with tube. Lifter case cracked and tube blocked by wiper plug. Driller depth 7178' is probably off. Wiper plug should have been at no deeper than 7163'.
- 1700 – Torque increasing due to vibrations. Dump cement-contaminated water and prepare to change over to mud
- 2000 – Rig up to use rig pill tank to mix mud. Having trouble keeping up with Tonto mud mixer.
- 2200 – Good mud coming back but still can only turn 120 RPM. ROP ~ 1 ft/hr. Try increasing viscosity to 60 seconds.

27 July

- 0030 – RPM up to 180 and torque lower. ROP still very low.
- 0130 – Tube blocked at 7190'. Pull tube.
- 0230 – Out of hole with core tube. No core. Either dropped core or drilled on mismatch.
- 0300 – Pump up to 200 psi surface pressure for shoe test.
- 0340 – Shoe test complete. Test witnessed by Dennis Simontacchi, BLM.
- 0400 – POOH to check tools and clear core.
- 1130 – Out of hole. Slow trip out having problems with Eckel tongs. Better inserts should be here today. One 20' joint of 4" Hydril has box crushed. Bit shot. Inside gage, outside gage and face hammered. Pipe strap agreed with original Hydril tally.
- 1215 – Recovered ~ 5' of the dropped core inside the core barrel. Also a large piece of aluminum junk was on top of the core. This probably caused the mismatch.
- 1300 – Check core barrel and inner tubes. Pick up # 12 Huddy bit and RIH.
- 1530 – Drill pipe in hole. RU core unit.
- 1830 – Blocked at 7199'. Pull tube.

28 July

- 0700 – Rock very blocky. Made 4 core runs for 18'. All core recovered.
- 0730 – Coring ahead at 7218' at report time.
- 1400 – Pull tube at 7245'. Looks like a possible mismatch.
- 1500 – Attach seismometer to top drive head for Duke University.
- 1700 – Cannot get inner tube to latch, no pressure or sound.
- 1730 – POOH to check for mismatch.
- 1930 – Pulling wet. Try to shake core out. Reverse circulate. Cannot clear bit.
- 2100 – POOH wet.

29 July

- 0030 – Out of hole. Last 6 stands of Hydril had tight connections.

- 0100 – Pick up new Huddy 12 bit. Bit #2 looks OK but drilling on mismatch started to wear out inside gage. Pick up 9 joints of HMQ and RIH. BHA will allow coring to 7460'. Function test BOP including annular.
- 0600 – Rig up coring unit and mix mud.
- 0700 – Coring ahead at 7245'.
- 1030 – Receive conditions of approval for hydrofrac sundry notice. After the frac, the hole must be tested to 200 psi at surface. If hole does not hold pressure, the open hole must be cemented and re-drilled. Since we are already losing returns, this won't work. Talked with Rich Estabrook about conditions. He will get back with us.
- 1200 – Pulling core at 7265'. Two runs for 20'.
- 1300 – Mark Keisler of the Great Basin Unified Air Pollution Control District on site to check our engines and permit compliance. He added the four SNL 65 kW generators to the equipment list.
- 1400 – Broke and dropped a piece of core while pulling inner tube out of string with tigger. Round trip inner tube to make sure core barrel is clear. Rig up so wireline can pull tube out of hole and set it in mouse hole. This will keep inner tube in better alignment.
- 1900 – Recover first 20' core run. Coring going much better.

30 July

- 0100 – Having problems with water swivel running very hot and leaking.
- 0600 – Scott packs on site. Train night tour on air packs before they go on days off. Will train two new crews tonight.
- 0700 - Work on swivel.
- 0900 - Back to coring.
- 0930 - Get approval from Rich Estabrook for hydrofrac without cementing up open hole. We will retest 13-3/8" to 5-1/2" annulus to 1000 psi to make sure 13-3/8" shoe is still good.
- 1700 - Retrieve CTDL from core run 7390' to 7409'. Temperature 209°F and inclination of 4.1 deg.
- 1800 – Train new crews on Scott packs.

31 July

- 0200 - Core to 7460'. Pull tube.
- 0300 – Circulate mud out and turn over to water for BHTV and mini-frac.
- 0530 – POOH
- 1030 – Out of hole. Bit gone. RIH with 70' of 4" Hydril. Halliburton rigging up.
- 1200 – Nipple up wireline packoff and logging truck. Run BHTV log.
- 1530 – Run PTS log and park at 7150' for mini-frac
- 1700 – Wireline packoff leaking at 1800 psi. Change rubbers but still too leaky at high pressures. Pull logging tool and tubing. Rig up to frac with blinds closed.
- 2000 – Finish mini frac experiment. Could not break down formation. Pumped up to 5 bbl/min at 2800 psi. Rig back up for TPS log.

- 2100 – Finish logging. Rig for 13-3/8" to 5-1/2" annulus pressure test.
- 2130 – Making up stabilized core barrel.
- 2230 – First test just over 10 % leak off. Pressure up again and shut in at well head.
- 2300 – Test OK. Lost about 45 psi in 30 min. RIH and pick up 270' of HQ rods.

1 August

- 0700 – Set down at ~ 7218'. Lay down 9 joints of 4" Hydril and rig up coring package to ream in.
- 0930 – Start washing and reaming in.
- 1430 – Back on bottom coring.
- 1900 – Having vibration problems. Mud is coming back water. Try to find mud man.
- 2100 – Mud man on site working on system.

2 August

- 0700 – Pumping tube down at 7515'. Still having mud problems.
- 0800 – Gel is dropping out. Dump mud and mix new mud.
- 1200 – Change mud formula. Less gel and more polymer. No one told derrick hand to add soda ash or polymer.
- 1400 – Ever since the attempted hydro frac we are having mud problems. When starting with fresh mud at the bit coring goes well, with high RPM and low torque. Then after pulling and pumping the tube we get vibrations and water back instead of mud. It may be that the swabbing caused by pulling the tube is pulling in the water from the frac job. The mud is also breaking down in the surface equipment.
- 1555 – Pump new mud down.
- 1635 – Pump tube down with the new 5' CTDL. Core start at 7445'.
- 1700 – Start coring with low torque and high RPM.
- 2000 – Core tube data logger indicates inclination of 4.8° at start, 4.5° when rod added and 5.1° after drilling. Used average of 4.8° for report. Temp was 202°F.
Downhole pressure while drilling at ~3850 psi, after 3275 psi. Pressure increased 35 psi while running overshot in to pull tube.

3 August

- 0600 – Coring ahead at 7603' at shift change.
- 0830 – Pump tube. No latch pressure. Pull tube.
- 0930 – Clear dropped core sitting on top of the CHD-101 pipe. Pump tube.
- 1000 – Tube latched. Core ahead.
- 1400 – Start planning for next bit trip. Power pack for top drive has developed a bad oil leak. Repair will be done on bit trip at or before 7930'.

4 August

- 0600 – Have cored steadily through the night. Coring ahead at 7693' at shift change.

- 1200 – Ran core tube data logger (CTDL) at 7716'. It showed an inclination of 5.8° at the beginning of the core run and 6.1° at the end. Max temperature was 215°F. Single-shot survey shows 6° inclination and 70° true azimuth.
- 1630 – Drilling on fractured rock has worn out bit; tripping out for new bit from 7728'. Will try new bit (Dimatec) which has been successful in similar formation in Indonesia.

5 August

- 0100 – Tripped out to the crossover between the 4" Hydril and CHD101, coupling slides down in the elevators and sticks. It's difficult to extract, takes about 2 hours to free it.
- 0500 – Pick up new bit and RIH.
- 1045 – On bottom and beginning to drill.
- 1130 – Lost packing out of swivel. Repairing swivel.
- 1230 – Swivel repaired, resume drilling.
- 1300 – Drill 1' and block. POOH with core barrel. Seal in wireline winch is leaking, flooding planetary gear. Will drain gear and watch to see how fast it fills up again.
- 1530 – Send wireline down to pick core barrel, comes back empty except for cedar fibers that are being used on rig floor for traction when it's slick and muddy. Try again, barrel is stuck, probably because of fibers. New rule: No cedar fibers on floor.
- 2400 – Continue coring; bit is cutting very well, but short runs because of fractured rock.

6 August

- 0600 – Coring ahead at 7787'. Short runs because of blocky rock, but no other problems. Dimatec bit cutting well. Have tried reducing mud viscosity, but this gives downhole vibrations; will keep minimum viscosity of 60 seconds.
- 1800 – Continue coring with little formation change (one large calcite vein). Short runs in broken formation but no major equipment problems. Coring ahead at 7834'.

7 August

- 0600 – Coring ahead at 7883'. One 21' run during the night, but other runs averaged less than 10'.
- 1200 – Ran core-tube data logger from 7883' to 7896'; inclination was 7.5°, at the beginning of the run, 7.7° at the end. Temperature = 215°F.
- 1500 – Bit appears worn out; trip inner tube then POOH.
- 2015 – Out of hole and core package engine oil leak fixed. Good trip out.
- 2030 – Pick up new # 9 Dimatec bit and core lifter springs and cases. (New design). Slightly harder matrix bit should cut a little slower but last longer.
- 2130 – Pick up 180' of HMQ and RIH.

8 August

- 0600 – Coring ahead at 7926'.
- 0755 – Core to 7937'; POOH with core and inner tube.
- 0948 – Resume coring.
- 1143 – POOH with core and tube from 7950'.
- 1250 – Resume drilling.
- 1630 – Maintenance on wireline winch (replace seal on planetary gear); install Duke University accelerometer on coring head.
- 2400 – Coring ahead at 7997'; 3 core trips in last 12 hours.

9 August

- 0600 – Coring ahead at 8018'; 1 core trip in last 6 hours.
- 0734 – Core trip from 8028'.
- 0900 – Resume drilling.
- 1005 – Core trip from 8039'.
- 1135 – Resume drilling with core-tube data logger in tube.
- 1351 – End of core run; rotate drill pipe 90° three times and wait a minute after each rotation – this is to give an average inclination for the CTDL. Trip tube and CTDL from 8058'.
- 1530 – Inclination is 8.8° but did not increase over the 20' run, temperature is 222°F.
- 2230 – Cored to 8098'. Last three runs in good rock have been two 19' and one 21'. Have been drilling in a felsic intrusion, occasionally inter-fingered with the metapelite, since 8043'. This rock cuts slower than the metapelite, but lack of fractures gives long cores.

10 August

- 0700 – Coring ahead at 8135'; still getting long core runs.
- 1230 – Ran single-shot survey at 8158'; inclination was 8.4° (slightly less than CTDL measurement at 8058') and azimuth was 93° true.
- 1500 – Had 21' and 18' core runs earlier in the day, but this one is only 4'.
- 2230 – Had a 10' core run and then a 2.5' run; bit is gone, POOH for bit change.

11 August

- 0400 – Pick up new bit (another Dimatec #9) and RIH.
- 0700 – Rig up for log; run RTD real-time tool and pressure/temperature/inclination memory tool. Stopped every 100' on the way out from TD to the shoe, to let the inclination tool have some time for a better reading.
- 1200 – RTD tool developed leak and did not take any useful data, but memory tool indicated that temperature was 217°F and inclination had held steady at about 8.5°, although comparison of the readings between the CTDL and the single-shot don't quite agree. The temperature reading from the long memory tool (which has an RTD) is also different from the CTDL (which has a thermistor). Need to resolve this discrepancy.

- 1400 – Washing in from 8147'.
- 2100 – Cored to 8209' with long runs.

12 August

- 0500 – Cored to 8244' with 14' and 21' runs.
- 1200 – Cored ahead to 8272'.
- 1330 – Pumped tube down and Sandia instrumentation indicated a mismatch (neither acoustic nor pressure signals showed latching). Retrieved core tube, worked pipe, and pumped tube down again. Both instruments and touch signaled a solid latch.
- 1530 – Resume drilling at 8272'.
- 2130 – Core from 8284' to 8290', pull tube, pump back down, try to cut again, but bit is gone. POOH.

13 August

- 0800 – Wash in from 8268' to 8290'.
- 1100 – Pull core tube from 8309'. Run back in hole with long memory tool and CTDL in core tube, to get comparison of temperature readings between thermistor and RTD.
- 1500 – Compare two memory tools and get excellent repeatability; temperatures are 106.1°C and 106.2°C, inclinations are 10.0° and 10.5°. Will only run CTDL now unless there is another reason for the long tool.
- 2330 – Retrieve inner barrel from 8348'; last three runs have been fairly short (average 8').

14 August

- 0600 – Pulling core tube from 8364'; last two runs still 8' average.
- 2100 – Continue coring with two 20' foot runs, one 15' and one 7'.

15 August

- 0600 – Coring ahead at 8446'.
- 0700 - Having problems with mud rings. Dump mud and start mixing new mud. Bit cutting slow. Drop nut to try to strip.
- 0830 - Inner tube does not latch. Chase tube.
- 0900 - Tube must have caught nut at 5600'. Pump tube to bottom.
- 1030 – Tried to drill but bit gone. POOH for new bit.
- 1600 – Out of hole. Pick up new Hobic #14 bit, and put CTDL in inner core tube. Prepare to RIH. This is usually a soft-formation bit (different numbers have different meanings among manufacturers), but we will try it in the present formation.
- 2130 - On bottom coring ahead. Little or no fill.
- 2300 – Retrieve core tube with 1.5' core.

16 August

- 0600 – Coring ahead at 8484'.
- 1430 – Cored ahead to 8498'; last two runs have been 6' and 5'.
- 2230 – Cored to 8508'. Tried twice to make bit cut, but it is gone. POOH.

17 August

- 0600 – Still coming out of the hole.
- 1930 – Started losing returns at 8524'
- 2100 – Total lost circulation. Fluid level at ~ 500' when lowering inner tube.
- 2130 – Try to drill but no luck. Pull tube and try to nut bit.
- 2330 – Drill up nut. Bit will not drill. Core looks like bit is gone. POOH

18 August

- 0500 – Lay down CHD101 rods. Have enough HMQ in hole that we don't need the 101 for stability. Will just use HMQ and Hydril. Huddy H-14 bit only went 18'.
- 0600 – Pick up Dimatec 12-T bit. Change center stabilizer in core barrel. Also pick up 270' of HQ to replace the CHD101.
- 1200 – Back in hole trying to rotate at 8525', still no fluid returns. Rigging up hydraulic Beam pump to pump down annulus.
- 1400 – Fluid level ~ 1080' while lowering inner tube
- 1800 – Lower inner tube. Fluid level still ~ 1080'. Turn off pump and listen for latch. Can not use sonic latch detector while pumping with total LC because there is no pressure restriction to give a signal.

19 August

- 0600 – Coring at 8540'; only made 6' last night. Formation is extremely hard.
- 1000 – Threw piece of matrix down hole to try and strip bit.
- 1400 – Still trying to drill with slow advance.
- 1700 – Retrieved CTDL. Temperature = 203^oF (because of lost circulation, we are constantly pumping fresh, cool mud down the hole), inclination = 11.6^o, and bottomhole pressure = 3200 psi when not pumping. This pressure is an anomaly, because it indicates that fluid level is ~ 1300', although the core tube hits water at about 1080'. May be connected with the fact that tool still read 185 psi when back at the surface.
- 2330 – Tried to core ahead, but bit will not cut. Last four runs have averaged 2.5'.
- 2400 – POOH for new bit.

20 August

- 0330 – Lay down core barrel, pick up new bit (Hobic #14.)

- 0800 – Back to drilling. Rock appears to have changed again, because we are making good progress without excessive weight on bit or rotary speed.
- 1100 – Retrieved 11' of core; appear to be back into the metapelite.
- 1700 – Retrieved 15' of core from 8575'. Longer runs in metapelite, although some new minerals appearing now.
- 2200 – Cored ahead to 8592' in an 8' run. We are now using a flow-restrictive latch head on the inner tube that gives some pump pressure, even with total lost returns, and gives a more distinct latch signal.

21 August

- 0600 – Retrieving core from 8601'. Latch heads are working well, but it requires almost 20 minutes to drain the differential fluid pressure from above the head in order to pull the tube. Will adjust spacing on the sealing ball to try and solve this problem.
- 1030 – Coring ahead at 8620'.
- 1630 – Ran single-shot survey at 8626'; inclination = 12.2°, direction = 91° true.
- 2100 – Retrieving 6' run from 8640'. Short runs since 1030 hours.

22 August

- 0530 – Retrieving 4' core from 8652'.
- 1300 – Cored to 8656' in three runs; rock extremely broken.
- 2400 – Cored to 8700' in three runs, 9', 14' and 21' and relatively high ROP ~ 7-8 ft/hr.

23 August

- 0600 – Just finishing another 21' run. Can drill to 8781' before tripping to pick up more HMQ rod.
- 1000 – Nabors crew making up 30' lengths of HMQ. Will pick up 450' at trip.
- 1200 – Inner tube is stuck. Try circulating and pulling hard with wireline. Tube finally comes free, although it's not clear why. (At a pump rate of 100 gpm, we were getting approximately 15 gpm returns. Could be that walnut-shell LCM is beginning to work.)
- 1330 – With inner tube back on surface, the only apparent reason for hanging up is a belled connection between the two core tubes. Replaced connection and RIH with inner tube. Core recovered in the last two trips has been very folded; the regular black-and-white bands, intersected by multi-generation fractures, seen earlier have been replaced by curved and folded, highly mixed strata. Minerals found in these cores (principally pyroxene) do not form at temperatures below 1000°C, so it would appear that this rock must lie near the granitic contact.
- 1700 – Retrieving core from 8759'. Tube pulled free with little effort, and with little time to equalize static head above latch. Rock is same tortured metapelite as previous core.
- 2100 – Core to 8780' in a 21' run. POOH to pick up 450' HMQ rods.

24 August

- 0600 – Running in hole, about 40 stands of 4" in the derrick. Additional HMQ will allow coring to 9230' if bit lasts that long.
- 1200 – Retrieving core from 8798'. Cutting this core has been very good drilling; low WOB (1500-2000 lb) and feed rates over 10 ft/hr.
- 1400 – Coring again at 8802'; core-tube data logger on board.
- 1630 – Retrieved CTDL from 8812'; inclination = 13.2°, temperature = 191°F.
- 2100 – Core to 8833'.

25 August

- 0600 – Retrieving 5' core from 8860'.
- 1600 – Start using sump water as partial makeup water. Will try to mix ½ tank of fresh water with gel, then top off with sump water. Add polymer for viscosity. The sump water has a viscosity of about 41 seconds and is clean.
- 1800 – Cored through the day with relatively short runs (34' in 4 runs.)

26 August

- 0600 – Continued coring to 8921' with moderate runs (27' in three runs.)
- 1430 – Did not get tube latch indication on drilling display. Chase tube.
- 1600 – Core ahead from 8943'
- 1830 – Pulling core at 8953' at shift change.
- 2000 – No latch indication. Chase tube.
- 2200 – Rebuild both latch heads. Water retention bushing seat washed out. Replaced spring, threaded ball, and bushing seat.

27 August

- 0300 – Having problems with mud rings. Stop using sump water.
- 0600 – Pulling core at 8977' at shift change.
- 1600 – Cored from 8990' to 9006' with short CTDL in place. Retrieved CTDL; inclination = 13.0°, temperature = 187°F.
- 1830 – Adding a twenty-foot Hydril at shift change at 9019'. Have 13' in inner tube.
- 2100 – Retrieve full 21' core run at 9027'.

28 August

- 0200 – Pump tube but no latch indication. Chase tube and rotate.
- 0330 – Latch tube and core ahead.
- 0600 – Coring ahead at 9055'.
- 0630 – Go after 21' core run at 9059'.
- 1000 – Will stop using Dris-pac in mud.
- 1830 – Adding a 20' and coring ahead at 9100' at shift change.

29 August

- 0600 – Pulling short run to 9134' at shift change.
- 1530 – Ran single-shot survey at 9163'; inclination = 13.2° , direction = 92° true.
- 1700 – Will not drill at 9164'. Water pressure high. Pull tube.
- 1830 – Core is in-gage and highly fractured. Will try to drill with conventional latch head.
- 1930 – Will not drill. POOH for bit change.

30 August

- 0130 – Out of hole. Bit is gone. Laid down 18 ea 20' Hydril tubing. Pick up 360' HMQ.
- 0600 – Ran in to 6512'. Pull inner tube for temperature log.
- 0630 – Rig up logging truck.
- 0930 – Rig down logger. Lower and pump inner tube.
- 1100 – Rig up coring package.
- 1230 – Try to core. Will not go. Pull tube.
- 1330 – Tube stuck. Work free.
- 1400 – Pump rebuilt restricted tube.
- 1500 – Mud very thick. It took 50 minutes to land tube.
- 1600 – Still won't drill and water pressure high. Pull tube. May have drilled one foot.
- 2300 – Bit will not cut. Back in quartzite. Throw matrix in hole to try and strip bit.

31 August

- 0600 – Very slow in solid quartzite. ROP less than 1 ft per hour. Will try to strip bit with Cut-Right.
- 1030 – Pull inner tube after cutting ~ 0.5'. No core in tube. Bit will not drill off at 6000 lb weight.
- 1100 – Drop nut and pump tube.
- 1330 – Core to 9180'. Nut worked. Pull tube.
- 1500 – Nut again and pump tube.
- 1800 – Pulling core from 9191'. A 12' run.

1 September

- 0600 – Pumping tube down to core ahead at 9209'. Short runs in hard, broken rock.
- 1100 – Calibrate H₂S system.
- 1730 – Pulling a full tube at 9245'.

2 September

- 0600 – Pulling core tube at report time.

1300 – Ran CTDL at 9292'. Incline = 13.3°, temperature = 205°F. This is a significant increase in temperature measured by the CTDL, compared to the last run at 9006'.

1700 – Trying to drill after returning last core tube. Can't make any progress. Will POOH for bit change and pick up one stand of HMQ rod.

3 September

0200 – Back to 9262' after a quick trip. Hang top-drive and wash to bottom.

0430 – On bottom and drilling slowly; have made 2' in an hour.

0600 – Pulled core tube from 9294'; no core.

0800 – Drilling with over 5500 lb WOB and almost no advance. May be some crown in hole; last bit came out completely stripped.

0930 – Retrieved core tube with ~ 1' of core and several fragments of the previous bit crown, which had been burned and left in the hole. Reviewed pressure records from yesterday and found one spot just before the bit quit drilling where pressure and flow rate dropped significantly while bit still rotating at normal RPM. This could have been caused by the flow-restrictive latch head, but this is uncertain.

1830 – Have cored to 9322' with moderate length (~12-13') runs, but rate of penetration is relatively low (< 5'/hr).

4 September

0330 – Continued coring to 9343' in 10' runs at about the same ROP.

1300 – Pulled a 21' run from 9371'. This interval drilled at a good ROP but there is no apparent change in the rock.

1530 – Pulled 6' run from 9377'.

2300 – Core to 9397'.

5 September

0800 – Core to 9423' in a 6' and a 20' run.

1215 – Going after tube with 17' at 9340'.

1500 – Ran CTDL, but could not drill. Pulled tube after about one hour, CTDL showed 14.4° inclination and 199°F but these numbers may not be reliable.

2130 – Start core run at 9456.5'.

6 September

0530 – Give up on core run. 13.5' in eight hours. Very hard, but drilling off.

0600 – Inner tube stuck, no core break.

0700 – Still working on stuck tube.

0730 – Got tube loose; coupling was belled. Only 7' of rock in tube (out of 13' drilled); core lifter was not a tight fit on core, probably left 6' or so in hole. Core lifter spring not bad. Core lifter case had signs of possible matrix on face.

- 0830 – Pumped tube down. Got soft latch and pressure.
- 0900 – Will not drill. Mud pressure up and will not drill off. Pull restricted head and drop old unrestricted head for bit trip. Nothing in core tube.
- 1000 – Stand back coring package and begin POOH for bit trip.
- 1200 – Start to pull wet at 16 stands off bottom. Surge pipe to clear. Continue trip out dry.
- 1300 – Found a connection in HMQ rods where both pin and box were split; laid down 2 singles.
- 1500 – Bit is back to floor. It's fairly green, with probably 50% life left, but wasn't drilling very fast. About 2-3' of missing 6' of core is in tube. Inner tube is stuck in core barrel, lifter case is belled. Replaced lifter case and pulled free. Pick up Huddy H14 bit and RIH.
- 1600 – Start in hole. Pick up two stands and two singles.
- 1900 – Set down on dropped core at 8083'. Push to 8351'. Try to drill with rotary table and power tongs. Will not go.
- 2000 – Pick up top drive and drill dropped core. Re-drill three times. Slide to 8371'.
- 2100 – Hang back top drive and RIH.
- 2200 – Chased core to 9442'. Pick up top drive to wash and ream to bottom.
- 2300 – Wash over core from 9468' to 9470'. Start coring new hole.

7 September

- 0100 – Cut core to 9473'. Pull tube and recover 3' of new hole and 2' of dropped core.
- 0600 – Pumping tube at shift change at 9482'. Having some pressure problems with latch heads.
- 1400 – Pulled 20' run from 9504'. Core is undersized (2.450" instead of 2.500"); have modified core-catcher case to grab smaller core. Not clear why core is small, but it may be that a piece of matrix was somehow pushed into the ID on trip in.
- 1630 – Retrieved 8' core and CTDL from 9512'. Incline = 15.0°, temperature = 199°F. Temperature decreased while waiting in hole for wireline.
- 2230 – Cored to 9538'.

8 September

- 0600 – Cored to 9560' in two runs.
- 0700 – Checked diameter on core at 2.475" from 9560'.
- 1430 – Pulled 18' run from 9590'. Part of this rock drilled very fast; over 2"/min with under 1000# WOB. Core diameter is coming back (2.483") to normal.
- 1800 – Pulling tube from 9606'.
- 1900 – Tube did not latch. Pump and rotate and get pressure latch indication.

9 September

- 0200 – Pipe stuck after tube latch at 9633'. It took 12,000 pounds over string weight to free.

- 0500 – Tube hung at 2200' on pump down. Pull tube and circulate dropped core out.
- 0630 – Drop tube and try again.
- 0830 – Core 3' to 9641' and pull tube.
- 2230 – Core to 9660' in five runs. Rock is very broken, with fault gouge and highly altered, clay-like material loosely cementing rock together.

10 September

- 0300 – Core to 9665' and pull core that shows bit's inner gauge completely gone.
- 0330 – Hang back top-drive and begin POOH for new bit.
- 1330 – Run in hole and begin drilling at 9665'.
- 1845 – Drilling ahead at 9682'.

11 September

- 0400 – Core to 9707', pump down tube and pipe is stuck. Had pulled tube three feet off bottom.
- 0830 – Have pulled 25k-lb over string weight, and tried to rotate. Pipe won't move, appears to be stuck at bottom. Pumping down a polymer sweep.
- 1200 – Working pipe and pumping, no movement. Have spotting fluid on the way, wireline and fishing companies alerted for action.
- 1300 – Pipe comes free at top, can rotate without drag and can build up pump pressure when on bottom. This looks like pipe has come free but when driller runs tube down on wireline, cannot get past ~8200'. Assume that pipe is parted at this depth.
- 1430 – Begin POOH to verify depth and separation.
- 1730 – HMQ pipe is parted at 8132'; pin is broken on bottom joint, with about half a thread left on pipe. Order out wireline unit with jet cutters and fishing tools (bumper sub, jars and spear).
- 1800 – Lay down two 20' of 4" and two damaged singles of HMQ, pick up spear on HMQ, and RIH.
- 2230 – Stab into top of fish, work pipe, and pull with 40,000 lb over string weight. Fish comes free and string weight indicates that all of it is on spear. POOH. Turn off fishing tools and wireline truck.

12 September

- 0200 – Top of fish to surface.
- 0330 – Lay down core barrel and bit, both appear to be in good condition. Last few stands of drill pipe have balled mud on them, possibly indicating that there was too much gel in the fluid. Will go to mud mixture of: 3 sacks gel, 1 bucket EZ Mud DP, and soda ash per mixing pit (volume ~ 50-55 bbl).
- 0400 – Pick up core barrel, two singles of HMQ, and bit, RIH.

- 0900 – Circulating mud into hole (had turned hole over to water to try un-sticking pipe, based on the idea that the water would wash away the heavy gel that was sealing the differential sticking.)
- 1030 – Start coring ahead at 9707'.
- 1200 – Tripping core tube at 9716'. New procedure includes turning drillstring with rotary table (~ every 3 minutes) while running wireline and getting at least 10' off bottom before pulling tube.
- 1700 – Planned on running single shot survey but torque is fairly high when turning the rods with rotary table while retrieving core. Will wait until hole is in better shape.

13 September

- 0600 – Pumping tube down at 9768'. Coring long runs but ROP is low. The last 18' run took 6 hours.
- 0700 – Check mud viscosity at 40. Cannot get over 200 rpm. Start mixing better mud. It will take two hours to get it around.
- 1600 – Have been drilling with 300 rpm and low torque since getting mud up to minimum 60 sec viscosity.
- 1930 – Ran single shot survey at hole depth 9803' (camera at 9790'). Azimuth = 91° true, inclination = 15.6°.

14 September

- 0700 – Drilling at 9830'. ROP has been slow (9' in one three hour interval) with moderately long runs (21', 13', 14').
- 1100 – Drilling very slow, put down nut, no improvement.
- 1330 – Inner tube stuck at 9832'; pulled on it hard enough to pull wireline out of rope socket. Getting ready to come out of hole with wet pull.
- 2230 – Out of hole, remove inner tube which was jammed in place with last piece of core.
- 2300 – Replace core barrel and RIH.

15 September

- 0300 – Pick up top drive and ream from 9800' to 9812'.
- 0500 – Have circulated for an hour. POOH. Mistake made last night was in the pipe tally; crew thought we were on bottom but were really 20' up, consequently the bottom 20' of hole were not circulated clean.
- 0800 – Pipe is pulling wet, cannot circulate. Repair wireline and pick inner tube.
- 0900 – Re-run half an inner tube, continue pulling out of hole.
- 1430 – Have come out of hole and are about to run 10 stands of 4" back in (string weight to balance pump pressure). Preparing for injection test. Will run PTS tool, rigged for surface readout, to bottom; then pull back into shoe; pump at a flow rate which gives relatively stable pressure at shoe, log to bottom and back to shoe, do one or two steps, and repeat shoe-bottom-shoe log after stabilizing at highest flow rate.

- 1600 – RIH with PTS tool. Spinner quits working at about 4000'. Do static log to TD and pull back to casing (7100').
- 1700 – Start pumping 50 gpm into kill line with rams closed around 4" pipe. Initial downhole pressure at 7100' is 2656 psia.
- 1806 – Downhole pressure stabilizes at 2903 psia. Increase pump rate to 80 gpm.
- 1846 – Downhole pressure stabilizes at 3033 psia. Increase pump rate to 110 gpm. Pump plugs off because of debris in water. Stop pumping and clean filters.
- 1918 – Resume injecting 110 gpm.
- 1954 – Pressure is still increasing 1.5-2 psi/minute, but total data recording time for the tool is running out, so we log to bottom while still injecting 110 gpm.
Temperature shows that most fluid is leaving the wellbore at about 8560', which is where the lost circulation began.
- 2100 – Going in hole with televiewer.

16 September

- 0700 – Complete BHTV log and come out of hole with it. Begin POOH with ten stands of Hydril.
- 1200 – Have mostly nipped down BOP. Possible that a flange bolt fell down the hole. Will run the wireline down and see if it goes to bottom.
- 1500 – Wireline goes to bottom of hole with no obstruction. Prepare to stretch casing.
- 1700 – Rigged up to pull casing. Purpose of this is to release the pre-load stretched into the pipe at beginning of the job. We have a 40' joint of 5.5" L-80 in the elevators, screwed into a 5' casing pup, made up into the bit guide that is just above the slips. We plan to pull enough to stretch the 5.5" casing above the 13-3/8" casinghead and then remove the slips to lower the casing down to its normal length. That is, only string weight will be supported in the slips. We have removed the top plate and taken the elastomer seals out of the slips, and removed the radial bolts that go through the wellhead flange.
- 1740 – Pulling at 330,000 lb, the slip assembly starts to come up out of the casinghead, and then relaxes about 0.25", which wedges the slips into the top of the casinghead. Derrick hand starts hammering the slips to try releasing them. At that point the string parts when the casing threads pull out of the bottom of the bit guide. Slip assembly is jammed more tightly into the top of casinghead. Later conversation with drilling engineer indicates that the bottom bit guide threads may have galled, and thus not made up properly. Slip assembly is sitting with the two hinged sections of the bowl tilted inward, because the bottom end of it is above the smaller diameter of the wellbore and can flare out. In other words, only the top edges of the slips are holding the casing, which is precarious. Call out Weatherford fisherman with casing spear.

17 September

- 0130 – Fisherman arrives with spear, crossovers, and extensions. When he looks down the casing with a flashlight, it is clear that the casing is crimped inward by the top

of the slips. Dimension across the crimp is less than the minimum diameter of the grapple, so we can only get in about 12". That means that the grapple will be holding inside the casing pin, where we plan to screw and weld on another collar to make up the 5' casing pup. Decide to weld on the collar first. Drill 4 holes in the collar, make it up to the pup, and make up to the fish. Weld through the holes and three passes around the bottom edge of the collar.

- 0400 – Run into the fish with the grapple; assembly is: spear, 8' extension, 3 crossovers, and 1 joint 5-1/2" drill pipe in the elevators. Pull up 260,000 lb and pipe moves up enough to get slips out of casinghead. It isn't clear why we got more movement with less force than yesterday. Get all parts away from wellhead and slack off to string weight.
- 0500 – Repair slips (grind out gouges, etc. Note the slip assembly hinges are no longer connected because the hinge closing bolt sheared and went down the hole) and land top casing collar in the slips in the casinghead. Back off spear with pipe wrenches. Pull out of fish and lay down fishing tools.
- 1220 – Complete picking up and running 69 joints of 2-3/8 4.7# EUE tubing with 4' float collar on bottom. Cross over from EUE to NQ to HMQ.
- 1830 – Running in hole with Hydril to 8560', hit obstruction. Put weight on, work pipe up and down and rotate with tongs and table, but can't move.
- 1900 – Rig up top drive and wash down. Set down with 6000 lb and bridge gave way. Pipe moves, although slowly. Continue washing in 80'.
- 1930 – Hang back top drive and run in one stand of pipe, goes without problem.
- 2200 – Tag bottom; bottom of tubing at 9822'. Lay down one 20' joint and pick up a 5' to make landed length correct. Make up kelly to top of liner string and land 4" IF (4" IF = 4-1/2" XH) saver sub on top of liner in a nubbin which rests in the top collar of the 5-5" bushing string.
- 2300 – Start circulating out polymer mud that was used when stuck. Will pump 800 gallons gel next.

18 September

- 0055 – Finished pumping 3400 gallons of water; this should leave water inside liner and mud outside. Back off kelly and crossovers at top of saver sub and leave liner string hanging in wellhead.
- 0800 – Crane on site to rig down top-drive, Tonto mud tanks, and Rig 202 components.

19 September

- 1500 – Doing temperature log with line running over logging truck's on-board boom; forward edge of base plate is lifting and buckling with ~ 7000' of line in the hole. Re-rig to sheave hung through rotary table. Complete log to indicated 9825'. End of drilling and testing operations.

APPENDIX B

This appendix contains daily reports filed by on-site Sandia personnel during the drilling operations. These incorporate information from drilling contractor's daily reports, from mud engineering reports, and from geological core logs prepared by USGS and university personnel. These reports are complementary to the field notes in Appendix A.

DAILY DRILLING REPORT - July 19, 1998
LONG VALLEY EXPLORATORY WELL
 Time of report - 0700

Well number - LVF 51-20 | Location - Section 20, T3S, R28E, Mono County, CA

All depth measurements refer to KB; KB = 29' above ground level

Days since spud - 0 | Depth @ 0600 hrs - 7178' | Hole advance last 24 hr - 0' | Core recovered - na'
 Last casing - 13-3/8", 72# casing to 6825'

Bits -- Now coring x" hole | Rotary speed - xx rpm; WOB - xx K lb; Rate of Penetration - avg. x ft/hr

Bit number	Type	In, KB	Out, KB	Footage	Hours
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Drilling Assembly: na

Surveys:	Depth	Inclination	Direction	Bottom-hole Temperature
	x'	x°	x° true	x° F

Drilling fluid - na

Flow rate - ~x gal/min | Pressure - ~ x psi | Returns temp - x°F max | Wt - x lb/gal | Vis - x sec
 | Filtrate x cm³/30 min | PV - x cP | YP - x lb/100ft² | pH - x | Lost circulation - none

Lithology: x x

Summary of events last 24 hours:

Rig-up is almost complete at report time; will begin nipping-up BOP and rig will go on day-rate today.

Report by: John Finger/Ron Jacobson

DAILY DRILLING REPORT - July 20, 1998
LONG VALLEY EXPLORATORY WELL
 Time of report - 0700

Well number - LVF 51-20 | Location - Section 20, T3S, R28E, Mono County, CA

All depth measurements refer to KB; KB = 29' above ground level

Days since spud - 1 | Depth @ 0600 hrs - 7178' | Hole advance last 24 hr - 0' | Core recovered - na'
 Last casing - 13-3/8", 72# casing to 6825'

Bits -- Now coring x" hole | Rotary speed - xx rpm; WOB - xx K lb; Rate of Penetration - avg. x ft/hr

Bit number	Type	In, KB	Out, KB	Footage	Hours
1	12-1/4" mill tooth	7178'	7178'	0	3

Drilling Assembly: bit, bit sub, 7174' ODP drill pipe

Surveys:	Depth	Inclination	Direction	Bottom-hole Temperature
	x'	x ^o	x ^o true	x ^o F

Drilling fluid - Water

Flow rate - ~400 gal/min | Pressure - ~ x psi | Returns temp - x^oF max | Wt - x lb/gal | Vis - x sec
 | Filtrate x cm³/30 min | PV - x cP | YP - x lb/100ft² | pH - x | Lost circulation - none

Lithology: x x

Summary of events last 24 hours:

Nippled-up BOPE (without connecting choke and kill lines). RIH with 12-1/4" bit to clean out bottom of hole. Tripped in to shoe at 6825' and began circulation with water. Began washing in from 7050' (the point where the muck has been stopping logging tools). Began hitting rough spots at 7078', rotated slowly with very little weight on bit (no drill collars) and reached TD (7178') at 0530. Pumped viscous sweep around, circulating and rotating (while waiting for casing crew to rig up lay-down machine) at report time.

Report by: John Finger/Ron Jacobson

DAILY DRILLING REPORT - July 21, 1998
LONG VALLEY EXPLORATORY WELL
 Time of report - 0700

Well number - LVF 51-20 | Location - Section 20, T3S, R28E, Mono County, CA

All depth measurements refer to KB; KB = 29' above ground level

Days since spud - 2 | Depth @ 0600 hrs - 7178' | Hole advance last 24 hr - 0' | Core recovered - na'

Last casing - 13-3/8", 72# casing to 6825'

Bits -- Now coring x" hole | Rotary speed -- xx rpm; WOB - xx K lb; Rate of Penetration - avg. x ft/hr

Bit number	Type	In, KB	Out, KB	Footage	Hours
1	12-1/4" mill tooth	7178'	7178'	0	3

Drilling Assembly: na

Surveys:	Depth	Inclination	Direction	Bottom-hole Temperature
	x'	x ⁰	x ⁰ true	x ⁰ F

Drilling fluid -

Flow rate - ~x gal/min | Pressure - ~ x psi | Returns temp - x⁰F max | Wt - x lb/gal | Vis - x sec

| Filtrate x cm³/30 min | PV - x cP | YP - x lb/100ft² | pH - x | Lost circulation - none

Lithology: x x

Summary of events last 24 hours:

Laid down all but 6 stands of the ODP drill pipe that has been in the derrick since the last drilling here in 1993. RIH with the following casing/bushing string:

1. Joint of ODP (5") drill pipe with float welded to it.
2. Aluminum baffle plate in the box of the shoe joint with thread-lock on top and bottom of plate.
3. 556' of ODP pipe.
4. Crossover/back-off sub (connection in sub is LEFT HAND)
5. Crossover with 5-1/2" Hydril TAC-1 box and 8-rd pin.
6. 6556' 5-1/2", 20 lb./ft. Hydril TAC-1 tubing.
7. Crossover with 5-1/2" Hydril TAC-1 pin and 8-rd pin
8. Bit guide with 8-rd up and down
9. Long pc of 5-1/2" casing with 8-rd both ends
10. 8-rd coupling

Just getting to bottom with casing string at report time.

Report by: John Finger/Ron Jacobson

DAILY DRILLING REPORT - July 22, 1998
LONG VALLEY EXPLORATORY WELL
 Time of report - 0700

Well number – LVF 51-20 | **Location** - Section 20, T3S, R28E, Mono County, CA

All depth measurements refer to KB; KB = 29' above ground level

Days since spud - 3 | Depth @ 0600 hrs - 7178' | Hole advance last 24 hr - 0' | Core recovered - na'
 Last casing – Bushing string: 5", 19.5 lb/ft drill pipe from 7177' to 6600'; 5-1/2", 20 lb/ft Hydril tubing to surface; cemented to 6685'

Bits -- Now coring x" hole | Rotary speed – xx rpm; WOB - xx K lb; Rate of Penetration - avg. x ft/hr

Bit number	Type	In, KB	Out, KB	Footage	Hours
1	12-1/4" mill tooth	7178'	7178'	0	3

Drilling Assembly: na

Surveys:	Depth	Inclination	Direction	Bottom-hole Temperature
	x'	x ^o	x ^o true	x ^o F

Drilling fluid -

Flow rate - ~x gal/min | Pressure - ~ x psi | Returns temp - x^oF max | Wt - x lb/gal | Vis - x sec
 | Filtrate x cm³/30 min | PV - x cP | YP - x lb/100ft² | pH - x | Lost circulation - none

Lithology: x x

Summary of events last 24 hours:

Cemented bushing string: pumped 64 bbl premium cement w/40% silica flour, 0.5% HALAD-413 (fluid loss additive), and displaced with 160 bbl water. WOC. Ran temperature log to locate top of cement in annulus, it appears to be at 6685', which is consistent with calculated value and gives 140' lap over the 13-3/8" casing shoe. Tagged cement inside pipe at 7148'. Ready to begin unloading DHCS (DOSECC Hybrid Coring System) at report time.

Report by: John Finger/Ron Jacobson

DAILY DRILLING REPORT - July 23, 1998
LONG VALLEY EXPLORATORY WELL
 Time of report - 0700

Well number - LVF 51-20 | Location - Section 20, T3S, R28E, Mono County, CA

All depth measurements refer to KB; KB = 29' above ground level

Days since spud - 4 | Depth @ 0600 hrs - 7178' | Hole advance last 24 hr - 0' | Core recovered - na'
 Last casing - Bushing string: 5", 19.5 lb/ft drill pipe from 7177' to 6600'; 5-1/2", 20 lb/ft Hydril tubing to surface; cemented to 6685'

Bits -- Now coring x" hole | Rotary speed - xx rpm; WOB - xx K lb; Rate of Penetration - avg. x ft/hr

Bit number	Type	In, KB	Out, KB	Footage	Hours
1	12-1/4" mill tooth	7178'	7178'	0	3

Drilling Assembly: na

Surveys:	Depth	Inclination	Direction	Bottom-hole Temperature
	x'	x ⁰	x ⁰ true	x ⁰ F

Drilling fluid -

Flow rate - ~x gal/min | Pressure - ~ x psi | Returns temp - x⁰F max | Wt - x lb/gal | Vis - x sec
 | Filtrate x cm³/30 min | PV - x cP | YP - x lb/100ft² | pH - x | Lost circulation - none

Lithology: x x

Summary of events last 24 hours:

Unloaded DHCS (DOSECC Hybrid Coring System) and spent daylight hours rigging up that unit. Also completed nipping up and function-testing BOPE. Pre-loaded the casing string by pulling 300 k-lb (125k-lb over string weight), which stretched the pipe approximately 4.5 feet, and then set it in slips in the casinghead. That pre-load will allow for thermal expansion caused by a temperature increase of 100⁰F as the drilling fluid warms up.

Report by: John Finger/Ron Jacobson

DAILY DRILLING REPORT - July 24, 1998
LONG VALLEY EXPLORATORY WELL
 Time of report - 0700

Well number – LVF 51-20 | **Location** - Section 20, T3S, R28E, Mono County, CA

All depth measurements refer to KB; KB = 29' above ground level

Days since spud - 5 | Depth @ 0600 hrs - 7178' | Hole advance last 24 hr - 0' | Core recovered - na'

Last casing – Bushing string: 5", 19.5 lb/ft drill pipe from 7177' to 6600'; 5-1/2", 20 lb/ft Hydril tubing to surface; cemented to 6685'

Bits -- Now coring x" hole | Rotary speed – xx rpm; WOB - xx K lb; Rate of Penetration - avg. x ft/hr

Bit number	Type	In, KB	Out, KB	Footage	Hours
1	12-1/4" mill tooth	7178'	7178'	0	3

Drilling Assembly: na

Surveys:	Depth	Inclination	Direction	Bottom-hole Temperature
	x'	x ^o	x ^o true	x ^o F

Drilling fluid -

Flow rate - ~x gal/min | Pressure - ~ x psi | Returns temp - x^oF max | Wt - x lb/gal | Vis - x sec
 | Filtrate x cm³/30 min | PV - x cP | YP - x lb/100ft² | pH - x | Lost circulation - none

Lithology: x x

Summary of events last 24 hours:

Continued rigging up DHCS. Tested BOP blind rams; test witnessed by Cheryl Seath, BLM. It is necessary to get about 3500' of drill pipe in the hole to test the pipe rams, so that the string weight will balance the hydraulic up-load on the pipe. Almost ready to start picking up drill pipe at report time.

Report by: John Finger/Ron Jacobson

DAILY DRILLING REPORT - July 25, 1998
LONG VALLEY EXPLORATORY WELL
 Time of report - 0700

Well number - LVF 51-20 | Location - Section 20, T3S, R28E, Mono County, CA

All depth measurements refer to KB; KB = 29' above ground level

Days since spud - 6 | Depth @ 0600 hrs - 7178' | Hole advance last 24 hr - 0' | Core recovered - na'
 Last casing - Bushing string: 5", 19.5 lb/ft drill pipe from 7177' to 6600'; 5-1/2", 20 lb/ft Hydril tubing to surface; cemented to 6685'

Bits -- Now coring x" hole | Rotary speed - xx rpm; WOB - xx K lb; Rate of Penetration - avg. x ft/hr

Bit number	Type	In, KB	Out, KB	Footage	Hours
1	12-1/4" mill tooth	7178'	7178'	0	3

Drilling Assembly: na

Surveys:	Depth	Inclination	Direction	Bottom-hole Temperature
	x'	x ^o	x ^o true	x ^o F

Drilling fluid -

Flow rate - ~x gal/min | Pressure - ~ x psi | Returns temp - x^oF max | Wt - x lb/gal | Vis - x sec
 | Filtrate x cm³/30 min | PV - x cP | YP - x lb/100ft² | pH - x | Lost circulation - none

Lithology: x x

Summary of events last 24 hours:

Picked up coring tools, HMQ and CHD101 rods, and 4" Hydril tubing and RIH to approximately 3875'. Held safety meeting with both crews to discuss well control. Beginning BOP test at report time.

Report by: John Finger/Ron Jacobson

DAILY DRILLING REPORT - July 26, 1998
LONG VALLEY EXPLORATORY WELL
 Time of report - 0700

Well number – LVF 51-20 | **Location** - Section 20, T3S, R28E, Mono County, CA

All depth measurements refer to KB; KB = 29' above ground level

Days since spud - 7 | Depth @ 0600 hrs - 7178' | Hole advance last 24 hr - 0' | Core recovered - na'
 Last casing – Bushing string: 5", 19.5 lb/ft drill pipe from 7177' to 6600'; 5-1/2", 20 lb/ft Hydril tubing to surface; cemented to 6685'

Bits -- Now coring x" hole | Rotary speed – xx rpm; WOB - xx K lb; Rate of Penetration - avg. x ft/hr

Bit number	Type	In, KB	Out, KB	Footage	Hours
1	12-1/4" mill tooth	7178'	7178'	0	3
2	Huddy 10 impreg	7178'			

Drilling Assembly: 21' HQ core barrel, 450' HMQ rods, xo, 295' CHD101 rods, xo, 4" Hydril 563 tubing

Surveys:	Depth	Inclination	Direction	Bottom-hole Temperature
	x'	x°	x° true	x° F

Drilling fluid -

Flow rate - ~x gal/min | Pressure - ~ x psi | Returns temp - x°F max | Wt - x lb/gal | Vis - x sec
 | Filtrate x cm³/30 min | PV - x cP | YP - x lb/100ft² | pH - x | Lost circulation - none

Lithology: x x

Summary of events last 24 hours:

Completed BOP test, witnessed by Dennis Simontacchi, BLM. Resumed picking tubing and RIH. Tagged something solid (probably cement wiper plug) at 7160'. Started to drill on it, but feed system failed. Repairing DHCS at report time.

Report by: John Finger/Ron Jacobson

DAILY DRILLING REPORT - July 27, 1998
LONG VALLEY EXPLORATORY WELL
 Time of report - 0700

Well number - LVF 51-20 | Location - Section 20, T3S, R28E, Mono County, CA

All depth measurements refer to KB; KB = 29' above ground level

Days since spud - 8 | Depth @ 0600 hrs - 7190' | Hole advance last 24 hr - 12' | Core recovered - 0'
 Last casing - Bushing string: 5", 19.5 lb/ft drill pipe from 7177' to 6600'; 5-1/2", 20 lb/ft Hydril tubing to surface; cemented to 6685'

Bits -- Now coring 3.850" hole | Rotary speed - xx rpm; WOB - xx K lb; Rate of Penetration - avg. x ft/hr

Bit number	Type	In, KB	Out, KB	Footage	Hours
1	12-1/4" mill tooth	7178'	7178'	0	3
2	Huddy 10 impreg	7178'			

Drilling Assembly: 21' HQ core barrel, 450' HMQ rods, xo, 295' CHD101 rods, xo, 4" Hydril 563 tubing

Surveys:	Depth	Inclination	Direction	Bottom-hole Temperature
	x'	x ^o	x ^o true	x ^o F

Drilling fluid -

Flow rate - ~25 gal/min | Pressure - ~ 300 psi | Returns temp - 65°F max | Wt - 8.5 lb/gal | Vis - 55 sec
 | Filtrate x cm³/30 min | PV - x cP | YP - x lb/100ft² | pH - 9 | Lost circulation - none

Lithology: x x

Summary of events last 24 hours:

Cored out cement and float equipment. Cored ahead to 7190' for shoe test. Completed shoe test with 200 psi surface pressure. Test witnessed by Dennis Simontacchi, BLM. Pulling out of hole to clear dropped core and check tools at report time.

Report by: John Finger/Ron Jacobson

DAILY DRILLING REPORT - July 28, 1998

LONG VALLEY EXPLORATORY WELL

Time of report - 0700

Well number - LVF 51-20 | Location - Section 20, T3S, R28E, Mono County, CA

All depth measurements refer to KB; KB = 29' above ground level

Days since spud - 9 | Depth @ 0600 hrs - 7218' | Hole advance last 24 hr - 19' | Core recovered - 24'

Last casing - Bushing string: 5", 19.5 lb/ft drill pipe from 7177' to 6600'; 5-1/2", 20 lb/ft Hydril tubing to surface; cemented to 6685'

Bits -- Now coring 3.850" hole | Rotary speed - 300 rpm; WOB - 2000 K lb; Rate of Penetration - avg. 5 ft/hr

Bit number	Type	In, KB	Out, KB	Footage	Hours
1	12-1/4" mill tooth	7178'	7178'	0	3
2	Huddy 10 impreg	7178'	7190'	12	9
3	Huddy 12 impreg	7190'			

Drilling Assembly: 21' HQ core barrel, 450' HMQ rods, xo, 295' CHD101 rods, xo, 4" Hydril 563 tubing

Surveys:	Depth	Inclination	Direction	Bottom-hole Temperature
	x'	x°	x° true	x° F

Drilling fluid -

Flow rate - ~25 gal/min | Pressure - ~550 psi | Returns temp - 65°F max | Wt - 8.5 lb/gal | Vis - 55 sec

| Filtrate x cm³/30 min | PV - x cP | YP - x lb/100ft² | pH - 9 | Lost circulation - none

Lithology: x x

Summary of events last 24 hours:

Recovered 5' of core and junk from dart and baffle inside core barrel on trip out. Ran in hole with new bit. Core ahead. Rock highly fractured causing short runs. Coring ahead at report time

Report by: John Finger/Ron Jacobson

DAILY DRILLING REPORT - July 29, 1998
LONG VALLEY EXPLORATORY WELL
 Time of report - 0700

Well number - LVF 51-20 | **Location** - Section 20, T3S, R28E, Mono County, CA

All depth measurements refer to KB; KB = 29' above ground level

Days since spud - 10 | Depth @ 0600 hrs - 7245' | Hole advance last 24 hr - 27' | Core recovered - 25'

Last casing - Bushing string: 5", 19.5 lb/ft drill pipe from 7177' to 6600'; 5-1/2", 20 lb/ft Hydril tubing to surface; cemented to 6685'

Bits -- Now coring 3.850" hole | Rotary speed - 250 rpm; WOB - 2500 K lb; Rate of Penetration - avg. 5 ft/hr

Bit number	Type	In, KB	Out, KB	Footage	Hours
1	12-1/4" mill tooth	7178'	7178'	0	3
2	Huddy 10 impreg	7178'	7190'	12	9
3	Huddy 12 impreg	7190'	7245'	55	
4	Huddy 12 impreg	7245'			

Drilling Assembly: 21' HQ core barrel, 540' HMQ rods, xo, 295' CHD101rods, xo, 4" Hydril 563 tubing

Surveys:	Depth x'	Inclination x°	Direction x° true	Bottom-hole Temperature x° F

Drilling fluid -

Flow rate - ~25 gal/min | Pressure - ~520 psi | Returns temp - 65°F max | Wt - 8.5 lb/gal | Vis - 50 sec
 | Filtrate 12 cm³/30 min | PV - 15 cP | YP -5 lb/100ft² | pH - 9 | Lost circulation - none

Lithology: 7178 to 7245 metapelite with quartzite layers

Summary of events last 24 hours:

Core to 7240'. Core on possible mismatch to 7245'. Pull out of hole wet to clear mismatch. Pick up a new bit and reamer shell. Clear debris from core barrel and run in hole. Coring ahead at report time

Report by: John Finger/Ron Jacobson

DAILY DRILLING REPORT - July 30, 1998
LONG VALLEY EXPLORATORY WELL
 Time of report - 0700

Well number - LVF 51-20 | Location - Section 20, T3S, R28E, Mono County, CA

All depth measurements refer to KB; KB = 29' above ground level

Days since spud - 11 | Depth @ 0600 hrs - 7358' | Hole advance last 24 hr - 113' | Core recovered - 113'
 Last casing - Bushing string: 5", 19.5 lb/ft drill pipe from 7177' to 6600'; 5-1/2", 20 lb/ft Hydril tubing to surface; cemented to 6685'

Bits -- Now coring 3.850" hole | Rotary speed - 250 rpm; WOB - 2500 K lb; Rate of Penetration - avg. 8 ft/hr

Bit number	Type	In, KB	Out, KB	Footage	Hours
1	12-1/4" mill tooth	7178'	7178'	0	3
2	Huddy 10 impreg	7178'	7190'	12	9
3	Huddy 12 impreg	7190'	7245'	55	
4	Huddy 12 impreg	7245'			

Drilling Assembly: 21' HQ core barrel, 540' HMQ rods, xo, 295' CHD101rods, xo, 4" Hydril 563 tubing

Surveys:	Depth	Inclination	Direction	Bottom-hole Temperature
	x'	x ^o	x ^o true	x ^o F

Drilling fluid -

Flow rate - ~20 gal/min | Pressure - ~650 psi | Returns temp - 65°F max | Wt - 8.5 lb/gal | Vis - 50 sec
 | Filtrate 12 cm³/30 min | PV - 15 cP | YP -5 lb/100ft² | pH - 9 | Lost circulation - slight

Lithology: 7178 to 7245 metapelite with quartzite layers

Summary of events last 24 hours:

Core ahead with 100 % recovery. Repairing/adjusting water swivel at report time.

Report by: John Finger/Ron Jacobson

DAILY DRILLING REPORT - July 31, 1998
LONG VALLEY EXPLORATORY WELL
 Time of report - 0700

Well number - LVF 51-20 | **Location** - Section 20, T3S, R28E, Mono County, CA

All depth measurements refer to KB; KB = 29' above ground level

Days since spud - 12 | Depth @ 0600 hrs - 7460' | Hole advance last 24 hr - 102' | Core recovered - 102'
 Last casing - Bushing string: 5", 19.5 lb/ft drill pipe from 7177' to 6600'; 5-1/2", 20 lb/ft Hydril tubing to surface; cemented to 6685'

Bits -- Now coring 3.850" hole | Rotary speed - 250 rpm; WOB - 2500 K lb; Rate of Penetration - avg. 8 ft/hr

Bit number	Type	In, KB	Out, KB	Footage	Hours
1	12-1/4" mill tooth	7178'	7178'	0	3
2	Huddy 10 impreg	7178'	7190'	12	9
3	Huddy 12 impreg	7190'	7245'	55	
4	Huddy 12 impreg	7245'	7460'	215'	

Drilling Assembly: 21' HQ core barrel, 540' HMQ rods, xo, 295' CHD101 rods, xo, 4" Hydril 563 tubing

Surveys:	Depth	Inclination	Direction	Bottom-hole Temperature
	7409'	4.1°	na° true	209° F

Drilling fluid -

Flow rate - ~15 gal/min | Pressure - ~850 psi | Returns temp - 65°F max | Wt - 8.5 lb/gal | Vis - 50 sec
 | Filtrate 12 cm³/30 min | PV - 15 cP | YP -5 lb/100ft² | pH - 9 | Lost circulation - slight

Lithology: 7178 to 7245 metapelite with quartzite layers

Summary of events last 24 hours:

Core ahead to 7460' with 100 % recovery. Turn hole over to water for BHTV log and mini-frac. Pulling out of hole at report time.

Report by: John Finger/Ron Jacobson

DAILY DRILLING REPORT – August 1, 1998
LONG VALLEY EXPLORATORY WELL
 Time of report - 0700

Well number – LVF 51-20 | Location - Section 20, T3S, R28E, Mono County, CA

All depth measurements refer to KB; KB = 29' above ground level
 Days since spud - 13 | Depth @ 0600 hrs - 7460' | Hole advance last 24 hr - 0' | Core recovered - 0'
 Last casing – Bushing string: 5", 19.5 lb/ft drill pipe from 7177' to 6600'; 5-1/2", 20 lb/ft Hydril tubing to surface; cemented to 6685'

Bits -- Now coring 3.850" hole | Rotary speed – 250 rpm; WOB - 2500 K lb; Rate of Penetration - avg. 8 ft/hr

Bit number	Type	In, KB	Out, KB	Footage	Hours
1	12-1/4" mill tooth	7178'	7178'	0	3
2	Huddy 10 impreg	7178'	7190'	12	9
3	Huddy 12 impreg	7190'	7245'	55	
4	Huddy 12 impreg	7245'	7460'	215'	
5	Huddy 10 impreg	7460'			

Drilling Assembly: 21' HQ core barrel, 900' HMQ rods, xo, 295' CHD101rods, xo, 4" Hydril 563 tubing

Surveys:	Depth	Inclination	Direction	Bottom-hole Temperature
	7409'	4.1°	na° true	209° F

Drilling fluid -

Flow rate - ~15 gal/min | Pressure - ~850 psi | Returns temp - 65°F max | Wt - 8.5 lb/gal | Vis - 50 sec
 | Filtrate 12 cm³/30 min | PV - 15 cP | YP -5 lb/100ft² | pH - 9 | Lost circulation - slight

Lithology: 7178 to 7255 metapelite with quartzite layers 7255-7260 felsic intrusion

Summary of events last 24 hours:

Bit #4 was almost worn out. Order stabilized core barrel to try to stop building angle. Rig up and run borehole televiewer (BHTV) log, which showed lots of fractures and some probable breakouts. Run temperature-pressure-spinner (TPS) log and try to hydrofrac. Could not break down formation with surface pressure of 1600 psi. Wireline packoff leaking. POOH with logging tool and drill pipe and try fracturing with blind rams closed. Stepped injections to 5 bbl/min at 2600 psi. Could not break down formation. Run static PTS survey. Rig down logging and frac equipment. Pressure test 13-3/8" by 5-1/2" annulus to 1500 psi for 30 minutes. Pick up new bit, 270' of HMQ drill rods and RIH.

Report by: John Finger/Ron Jacobson

DAILY DRILLING REPORT – August 2, 1998
LONG VALLEY EXPLORATORY WELL
 Time of report - 0700

Well number – LVF 51-20 | Location - Section 20, T3S, R28E, Mono County, CA

All depth measurements refer to KB; KB = 29' above ground level

Days since spud - 14 | Depth @ 0600 hrs - 7515' | Hole advance last 24 hr - 55' | Core recovered - 55'
 Last casing – Bushing string: 5", 19.5 lb/ft drill pipe from 7177' to 6600'; 5-1/2", 20 lb/ft Hydril tubing to surface; cemented to 6685'

Bits -- Now coring 3.850" hole | Rotary speed – 250 rpm; WOB - 2500 K lb; Rate of Penetration - avg. 8 ft/hr

Bit number	Type	In, KB	Out, KB	Footage	Hours
1	12-1/4" mill tooth	7178'	7178'	0	3
2	Huddy 10 impreg	7178'	7190'	12	9
3	Huddy 12 impreg	7190'	7245'	55	
4	Huddy 12 impreg	7245'	7460'	215'	
5	Huddy 10 impreg	7460'			

Drilling Assembly: 21' HQ core barrel, 900' HMQ rods, xo, 295' CHD101 rods, xo, 4" Hydril 563 tubing

Surveys:	Depth	Inclination	Direction	Bottom-hole Temperature
	7409'	4.1°	na° true	209° F

Drilling fluid -

Flow rate - ~20 gal/min | Pressure - ~750 psi | Returns temp - 67°F max | Wt – 8.5 lb/gal | Vis - 50 sec
 | Filtrate 12 cm³/30 min | PV - 15 cP | YP – 5 lb/100ft² | pH - 9 | Lost circulation - none

Lithology: 7178 to 7255 metapelite with quartzite layers 7255-7260 felsic intrusion

Summary of events last 24 hours:

Run in hole to 7128' and ream tight hole to 7460' while circulating water out. Core ahead to 7515' at report time. Having downhole vibration problems. Still getting back water that appears to have been left in the formation after the attempted mini-frac.

Report by: John Finger/Ron Jacobson

DAILY DRILLING REPORT – August 3, 1998
LONG VALLEY EXPLORATORY WELL
 Time of report - 0700

Well number – LVF 51-20 | Location - Section 20, T3S, R28E, Mono County, CA

All depth measurements refer to KB; KB = 29' above ground level

Days since spud - 15 | Depth @ 0600 hrs - 7599' | Hole advance last 24 hr - 84' | Core recovered - 84'
 Last casing – Bushing string: 5", 19.5 lb/ft drill pipe from 7177' to 6600'; 5-1/2", 20 lb/ft Hydril tubing to surface; cemented to 6685'

Bits -- Now coring 3.850" hole | Rotary speed – 290 rpm; WOB - 3200 K lb; Rate of Penetration - avg. 8 ft/hr

Bit number	Type	In, KB	Out, KB	Footage	Hours
1	12-1/4" mill tooth	7178'	7178'	0	3
2	Huddy 10 impreg	7178'	7190'	12	9
3	Huddy 12 impreg	7190'	7245'	55	
4	Huddy 12 impreg	7245'	7460'	215'	
5	Huddy 10 impreg	7460'			

Drilling Assembly: 21' HQ core barrel, 900' HMQ rods, xo, 295' CHD101 rods, xo, 4" Hydril 563 tubing

Surveys:	Depth	Inclination	Direction	Bottom-hole Temperature
	7409'	4.1°	na° true	209° F
	7556'	4.8°	na° true	202° F

Drilling fluid -

Flow rate - ~17 gal/min | Pressure - ~700 psi | Returns temp - 67°F max | Wt - 8.5 lb/gal | Vis - 50 sec
 | Filtrate 14 cm³/30 min | PV - 14 cP | YP - 10 lb/100ft² | pH - 9 | Lost circulation - none

Lithology: 7178 to 7255 metapelite 7255-7260 felsic intrusion 7260-7460 metapelite to hornfels

Summary of events last 24 hours:

Condition mud and core ahead. Ran new Dewared core tube data logger on core run from 7544' to 7556'. This tool measures inclination, pressure and temperature inside the core barrel. Coring ahead at 7603' at report time.

Report by: John Finger/Ron Jacobson

DAILY DRILLING REPORT – August 4, 1998
LONG VALLEY EXPLORATORY WELL
 Time of report - 0700

Well number – LVF 51-20 | Location - Section 20, T3S, R28E, Mono County, CA

All depth measurements refer to KB; KB = 29' above ground level

Days since spud - 16 | Depth @ 0600 hrs - 7693' | Hole advance last 24 hr - 94' | Core recovered - 94'

Last casing – Bushing string: 5", 19.5 lb/ft drill pipe from 7177' to 6600'; 5-1/2", 20 lb/ft Hydril tubing to surface; cemented to 6685'

Bits -- Now coring 3.850" hole | Rotary speed – 290 rpm; WOB - 3200 K lb; Rate of Penetration - avg. 8 ft/hr

Bit number	Type	In, KB	Out, KB	Footage	Hours
1	12-1/4" mill tooth	7178'	7178'	0	3
2	Huddy 10 impreg	7178'	7190'	12	9
3	Huddy 12 impreg	7190'	7245'	55	
4	Huddy 12 impreg	7245'	7460'	215'	
5	Huddy 10 impreg	7460			

Drilling Assembly: 21' HQ core barrel, 900' HMQ rods, xo, 295' CHD101rods, xo, 4" Hydril 563 tubing

Surveys:	Depth	Inclination	Direction	Bottom-hole Temperature
	7409'	4.1°	na° true	209° F
	7556'	4.8°	na° true	202° F

Drilling fluid -

Flow rate - ~18 gal/min | Pressure - ~750 psi | Returns temp - 67°F max | Wt - 8.5 lb/gal | Vis - 55 sec
 | Filtrate 11 cm³/30 min | PV - 14 cP | YP - 11 lb/100ft² | pH - 9 | Lost circulation - none

Lithology: 7178 to 7255 metapelite 7255-7260 intrusion 7260-7660 metapelite with two small intrusions

Summary of events last 24 hours:

Condition mud and core ahead. Rock is fairly broken, resulting in short runs. Seven tube trips were required for 94' of core. Dropped core once, but cleared pipe with wireline.

Report by: John Finger/Ron Jacobson

DAILY DRILLING REPORT – August 5, 1998
LONG VALLEY EXPLORATORY WELL
 Time of report - 0700

Well number – LVF 51-20 | Location - Section 20, T3S, R28E, Mono County, CA

All depth measurements refer to KB; KB = 29' above ground level

Days since spud - 17 | Depth @ 0600 hrs - 7728' | Hole advance last 24 hr - 35' | Core recovered - 35'
 Last casing – Bushing string: 5", 19.5 lb/ft drill pipe from 7177' to 6600'; 5-1/2", 20 lb/ft Hydril tubing to surface; cemented to 6685'

Bits -- Now coring 3.850" hole | Rotary speed – 290 rpm; WOB - 3200 K lb; Rate of Penetration - avg. 8 ft/hr

Bit number	Type	In, KB	Out, KB	Footage
1	12-1/4" mill tooth	7178'	7178'	0
2	Huddy 10 impreg	7178'	7190'	12
3	Huddy 12 impreg	7190'	7245'	55
4	Huddy 12 impreg	7245'	7460'	215'
5	Huddy 10 impreg	7460'	7728'	268'
6	Dimatec 12 impreg	7728'		

Drilling Assembly: 21' HQ core barrel, 1170' HMQ rods, xo, 295' CHD101rods, xo, 4" Hydril 563 tubing

Surveys:	Depth	Inclination	Direction	Bottom-hole Temperature
	7409'	4.1°	na° true	209° F
	7556'	4.8°	na° true	202° F
	7716'	5.8°	70° true	215° F

Drilling fluid -

Flow rate - ~18 gal/min | Pressure - ~750 psi | Returns temp - 67°F max | Wt - 8.5 lb/gal | Vis - 55 sec
 | Filtrate 11 cm³/30 min | PV - 14 cP | YP - 11 lb/100ft² | pH - 9 | Lost circulation - none

Lithology:	7178-7255	metapelite
	7255-7260	felsic intrusion
	7260-7660	metapelite – there are with two small intrusions
	7660-7700	metapelite with more open, hydrothermal-type veins; there is evidence of ductile folding and stretching in the primary banding

Summary of events last 24 hours:

Cored through highly fractured rock. Pulled out of hole for bit change. Worn coupling on crossover jammed in elevator and was difficult to get out. Picked up new bit and running back in hole at report time.

Report by: John Finger/Ron Jacobson

DAILY DRILLING REPORT – August 6, 1998
LONG VALLEY EXPLORATORY WELL
 Time of report - 0700

Well number – LVF 51-20 | Location - Section 20, T3S, R28E, Mono County, CA

All depth measurements refer to KB; KB = 29' above ground level

Days since spud - 18 | Depth @ 0600 hrs - 7787' | Hole advance last 24 hr - 59' | Core recovered - 59'
 Last casing – Bushing string: 5", 19.5 lb/ft drill pipe from 7177' to 6600'; 5-1/2", 20 lb/ft Hydril tubing to surface; cemented to 6685'

Bits -- Now coring 3.850" hole | Rotary speed – 290 rpm; WOB - 3200 K lb; Rate of Penetration - avg. 10 ft/hr

Bit number	Type	In, KB	Out, KB	Footage
1	12-1/4" mill tooth	7178'	7178'	0
2	Huddy 10 impreg	7178'	7190'	12
3	Huddy 12 impreg	7190'	7245'	55
4	Huddy 12 impreg	7245'	7460'	215'
5	Huddy 10 impreg	7460'	7728'	268'
6	Dimatec 12 impreg	7728'		

Drilling Assembly: 21' HQ core barrel, 1170' HMQ rods, xo, 295' CHD101rods, xo, 4" Hydril 563 tubing

Surveys:	Depth	Inclination	Direction	Bottom-hole Temperature
	7409'	4.1°	na° true	209° F
	7556'	4.8°	na° true	202° F
	7716'	5.8°	70° true	215° F

Drilling fluid -

Flow rate - ~18 gal/min | Pressure - ~750 psi | Returns temp - 67°F max | Wt - 8.5 lb/gal | Vis - 55 sec
 | Filtrate 11 cm³/30 min | PV - 14 cP | YP - 11 lb/100ft² | pH - 9 | Lost circulation - none

Lithology:	Interval	Description
	7178-7255	metapelite
	7255-7260	felsic intrusion
	7260-7660	metapelite – there are two small intrusions
	7660-7780	metapelite with more open, hydrothermal-type veins; there is evidence of ductile folding and stretching in the primary banding

Summary of events last 24 hours:

Still coring through the same fractured formation (8 runs to get 59' of core). Minor problems with DHCS (swivel packing, leaking oil pan on power package, leak into planetary gear on wireline winch) but good drilling with new bit.

Report by: John Finger/Ron Jacobson

DAILY DRILLING REPORT – August 7, 1998
LONG VALLEY EXPLORATORY WELL
 Time of report - 0700

Well number – LVF 51-20 | Location - Section 20, T3S, R28E, Mono County, CA

All depth measurements refer to KB; KB = 29' above ground level

Days since spud - 19 | Depth @ 0600 hrs – 7883' | Hole advance last 24 hr - 96' | Core recovered - 96'
 Last casing – Bushing string: 5", 19.5 lb/ft drill pipe from 7177' to 6600'; 5-1/2", 20 lb/ft Hydril tubing to surface; cemented to 6685'

Bits -- Now coring 3.850" hole | Rotary speed – 290 rpm; WOB - 3200 lb; Rate of Penetration - avg. 10 ft/hr

Bit number	Type	In, KB	Out, KB	Footage
1	12-1/4" mill tooth	7178'	7178'	0
2	Huddy 10 impreg	7178'	7190'	12
3	Huddy 12 impreg	7190'	7245'	55
4	Huddy 12 impreg	7245'	7460'	215'
5	Huddy 10 impreg	7460'	7728'	268'
6	Dimatec 12 impreg	7728'		

Drilling Assembly: 21' HQ core barrel, 1170' HMQ rods, xo, 295' CHD101 rods, xo, 4" Hydril 563 tubing

Surveys:	Depth	Inclination	Direction	Bottom-hole Temperature
	7409'	4.1°	na° true	209° F
	7556'	4.8°	na° true	202° F
	7716'	5.8°	70° true	215° F

Drilling fluid -

Flow rate - ~18 gal/min | Pressure - ~750 psi | Returns temp - 67°F max | Wt - 8.4 lb/gal | Vis - 65 sec
 | Filtrate 10 cm³/30 min | PV - 20 cP | YP - 15 lb/100ft² | pH - 10 | Lost circulation - none

Lithology:	Interval	Description
	7660-7780	metapelite with more open, hydrothermal-type veins; there is evidence of ductile folding and stretching in the primary banding
	7838-7847	quartzite
	7847-7864	metapelite
	7864-7869	quartzite
	7869-7880	metapelite

Summary of events last 24 hours:

Still coring through the same fractured formation with short core runs (one 21' run, others average less than 10'). Two quartzite intervals cut very freely. Running the core-tube data logger (downhole temperature and inclination) at report time.

Report by: John Finger/Ron Jacobson

DAILY DRILLING REPORT – August 8, 1998
LONG VALLEY EXPLORATORY WELL
 Time of report - 0700

Well number – LVF 51-20 | Location - Section 20, T3S, R28E, Mono County, CA

All depth measurements refer to KB; KB = 29' above ground level

Days since spud - 20 | Depth @ 0600 hrs – 7926' | Hole advance last 24 hr - 43' | Core recovered - 43'

Last casing – Bushing string: 5", 19.5 lb/ft drill pipe from 7177' to 6600'; 5-1/2", 20 lb/ft Hydril tubing to surface; cemented to 6685'

Bits -- Now coring 3.850" hole | Rotary speed – 295 rpm; WOB - 3000 lb; Rate of Penetration - avg. 8 ft/hr

Bit number	Type	In, KB	Out, KB	Footage
2	Huddy 10 impreg	7178'	7190'	12
3	Huddy 12 impreg	7190'	7245'	55
4	Huddy 12 impreg	7245'	7460'	215'
5	Huddy 10 impreg	7460'	7728'	268'
6	Dimatec 12 impreg	7728'	7915'	187'
7	Dimatec 9 impreg	7915'		

Drilling Assembly: 21' HQ core barrel, 1350' HMQ rods, xo, 295' CHD101rods, xo, 4" Hydril 563 tubing

Surveys:	Depth	Inclination	Direction	Bottom-hole Temperature
	7409'	4.1°	na° true	209° F
	7556'	4.8°	na° true	202° F
	7716'	5.8°	70° true	215° F
	7896'	7.6°	na° true	215° F

Drilling fluid -

Flow rate - ~18 gal/min | Pressure - ~750 psi | Returns temp - 67°F max | Wt – 8.4 lb/gal | Vis - 65 sec
 | Filtrate 10 cm³/30 min | PV - 20 cP | YP – 15 lb/100ft² | pH - 10 | Lost circulation - none

Lithology:	Depth	Description
	7660-7780	metapelite with more open, hydrothermal-type veins; there is evidence of ductile folding and stretching in the primary banding
	7838-7847	quartzite
	7847-7864	metapelite
	7864-7869	quartzite
	7869-7905	metapelite
	7905-7926	fine-grained felsic intrusion

Summary of events last 24 hours:

Core ahead at 7915' when bit went. Pull out of hole and pick up a slightly harder matrix bit in an attempt to increase bit life. Run in hole and wash in last 40'. No fill or cave. Coring ahead at report time.

Report by: John Finger/Ron Jacobson

DAILY DRILLING REPORT – August 9, 1998
LONG VALLEY EXPLORATORY WELL
 Time of report - 0700

Well number – LVF 51-20 | Location - Section 20, T3S, R28E, Mono County, CA

All depth measurements refer to KB; KB = 29' above ground level

Days since spud - 21 | Depth @ 0600 hrs – 8011' | Hole advance last 24 hr - 85' | Core recovered - 85'
 Last casing – Bushing string: 5", 19.5 lb/ft drill pipe from 7177' to 6600'; 5-1/2", 20 lb/ft Hydril tubing to surface; cemented to 6685'

Bits -- Now coring 3.850" hole | Rotary speed – 295 rpm; WOB - 3000 lb; Rate of Penetration - avg. 8 ft/hr

Bit number	Type	In, KB	Out, KB	Footage
2	Huddy 10 impreg	7178'	7190'	12
3	Huddy 12 impreg	7190'	7245'	55
4	Huddy 12 impreg	7245'	7460'	215'
5	Huddy 10 impreg	7460'	7728'	268'
6	Dimatec 12 impreg	7728'	7915'	187'
7	Dimatec 9 impreg	7915'		

Drilling Assembly: 21' HQ core barrel, 1350' HMQ rods, xo, 295' CHD101 rods, xo, 4" Hydril 563 tubing

Surveys:	Depth	Inclination	Direction	Bottom-hole Temperature
	7409'	4.1°	na° true	209° F
	7556'	4.8°	na° true	202° F
	7716'	5.8°	70° true	215° F
	7896'	7.6°	na° true	215° F

Drilling fluid -

Flow rate - ~18 gal/min | Pressure - ~750 psi | Returns temp - 67°F max | Wt – 8.5 lb/gal | Vis - 55 sec
 | Filtrate 8 cm³/30 min | PV - 23 cP | YP – 16 lb/100ft² | pH - 10 | Lost circulation - none

Lithology:	7869-7905	metapelite
	7905-7926	fine-grained felsic intrusion
	7926-8011	metapelite with actinolite in veins, which indicates intrusion proximity

Summary of events last 24 hours:

Cored steadily ahead from 7926'. Repaired wireline winch and attached Duke University accelerometer (for seismic experiments) during drilling yesterday. Coring ahead at 8018' report time. According to Tonto drillers, this is the deepest core they know taken with H-size tools (previous record was 8003').

Report by: John Finger/Ron Jacobson

DAILY DRILLING REPORT – August 10, 1998
LONG VALLEY EXPLORATORY WELL
 Time of report - 0700

Well number – LVF 51-20 | Location - Section 20, T3S, R28E, Mono County, CA

All depth measurements refer to KB; KB = 29' above ground level

Days since spud - 22 | Depth @ 0600 hrs – 8119' | Hole advance last 24 hr - 108' | Core recovered - 108'
 Last casing – Bushing string: 5", 19.5 lb/ft drill pipe from 7177' to 6600'; 5-1/2", 20 lb/ft Hydril tubing to surface; cemented to 6685'

Bits -- Now coring 3.850" hole | Rotary speed – 295 rpm; WOB - 3000 lb; Rate of Penetration - avg. 8 ft/hr

Bit number	Type	In, KB	Out, KB	Footage
2	Huddy 10 impreg	7178'	7190'	12
3	Huddy 12 impreg	7190'	7245'	55
4	Huddy 12 impreg	7245'	7460'	215'
5	Huddy 10 impreg	7460'	7728'	268'
6	Dimatec 12 impreg	7728'	7915'	187'
7	Dimatec 9 impreg	7915'		

Drilling Assembly: 21' HQ core barrel, 1350' HMQ rods, xo, 295' CHD101rods, xo, 4" Hydril 563 tubing

Surveys:	Depth	Inclination	Direction	Bottom-hole Temperature
	7409'	4.1°	na° true	209° F
	7556'	4.8°	na° true	202° F
	7716'	5.8°	70° true	215° F
	7896'	7.6°	na° true	215° F
	8058'	8.7°	na° true	222° F

Drilling fluid -

Flow rate - ~18 gal/min | Pressure - ~750 psi | Returns temp - 77°F max | Wt – 8.5 lb/gal | Vis - 55 sec
 | Filtrate 8 cm³/30 min | PV - 23 cP | YP – 16 lb/100ft² | pH - 10 | Lost circulation - none

Lithology:	Depth	Description
	7869-7905	metapelite
	7905-7926	fine-grained felsic intrusion
	7926-8043	metapelite with actinolite in veins, which indicates intrusion proximity
	8043-8119	altered felsic intrusion, inter-fingered in places with the metapelite

Summary of events last 24 hours:

Cored steadily ahead from 8011'. Ran core-tube data logger from 8039' to 8058' and got temperature/inclination data reported above. Rotated the pipe and took inclination readings after each quarter-turn at the end of the core run. Longer core runs gave good progress. Coring ahead at 8135' at report time.

Report by: John Finger/Ron Jacobson

DAILY DRILLING REPORT – August 11, 1998
LONG VALLEY EXPLORATORY WELL
 Time of report - 0700

Well number – LVF 51-20 | Location - Section 20, T3S, R28E, Mono County, CA

All depth measurements refer to KB; KB = 29' above ground level
 Days since spud - 23 | Depth @ 0600 hrs – 8174' | Hole advance last 24 hr - 55' | Core recovered - 55'
 Last casing – Bushing string: 5", 19.5 lb/ft drill pipe from 7177' to 6600'; 5-1/2", 20 lb/ft Hydril tubing to surface; cemented to 6685'

Bits -- Now coring 3.850" hole | Rotary speed – 295 rpm; WOB - 3000 lb; Rate of Penetration - avg. 8 ft/hr

Bit number	Type	In, KB	Out, KB	Footage
2	Huddy 10 impreg	7178'	7190'	12
3	Huddy 12 impreg	7190'	7245'	55
4	Huddy 12 impreg	7245'	7460'	215'
5	Huddy 10 impreg	7460'	7728'	268'
6	Dimatec 12 impreg	7728'	7915'	187'
7	Dimatec 9 impreg	7915'	8174'	259'
8	Dimatec 9 impreg	8174'		

Drilling Assembly: 21' HQ core barrel, 1620' HMQ rods, xo, 295' CHD101rods, xo, 4" Hydril 563 tubing

Surveys:	Depth	Inclination	Direction	Bottom-hole Temperature
	7409'	4.1 ^o	na ^o true	209 ^o F
	7556'	4.8 ^o	na ^o true	202 ^o F
	7716'	5.8 ^o	70 ^o true	215 ^o F
	7896'	7.6 ^o	na ^o true	215 ^o F
	8058'	8.7 ^o	na ^o true	222 ^o F
	8158'	8.4 ^o	93 ^o true	not available

Drilling fluid -

Flow rate - ~18 gal/min | Pressure - ~750 psi | Returns temp - 77^oF max | Wt - 8.5 lb/gal | Vis - 63 sec
 | Filtrate 8 cm³/30 min | PV - 23 cP | YP - 16 lb/100ft² | pH - 10 | Lost circulation - none

Lithology:	7869-7905	metapelite
	7905-7926	fine-grained felsic intrusion
	7926-8043	metapelite with actinolite in veins, which indicates intrusion proximity
	8043-8174	altered felsic intrusion, inter-fingered in places with the metapelite

Summary of events last 24 hours:

Cored steadily ahead from 8119'. Ran single-shot camera for inclination and orientation with results reported above. Began pulling out of hole for new bit at 2300 hours. Tripping in at report time; will stop trip at the shoe and do a temperature/inclination log.

Report by: John Finger/Ron Jacobson

DAILY DRILLING REPORT – August 12, 1998
LONG VALLEY EXPLORATORY WELL
 Time of report - 0700

Well number – LVF 51-20 | Location - Section 20, T3S, R28E, Mono County, CA

All depth measurements refer to KB; KB = 29' above ground level

Days since spud - 24 | Depth @ 0600 hrs – 8244' | Hole advance last 24 hr - 70' | Core recovered - 70'
 Last casing – Bushing string: 5", 19.5 lb/ft drill pipe from 7177' to 6600'; 5-1/2", 20 lb/ft Hydril tubing to surface; cemented to 6685'

Bits -- Now coring 3.850" hole | Rotary speed – 295 rpm; WOB - 3000 lb; Rate of Penetration - avg. 8 ft/hr

Bit number	Type	In, KB	Out, KB	Footage
5	Huddy 10 impreg	7460'	7728'	268'
6	Dimatec 12 impreg	7728'	7915'	187'
7	Dimatec 9 impreg	7915'	8174'	259'
8	Dimatec 9 impreg	8174'		

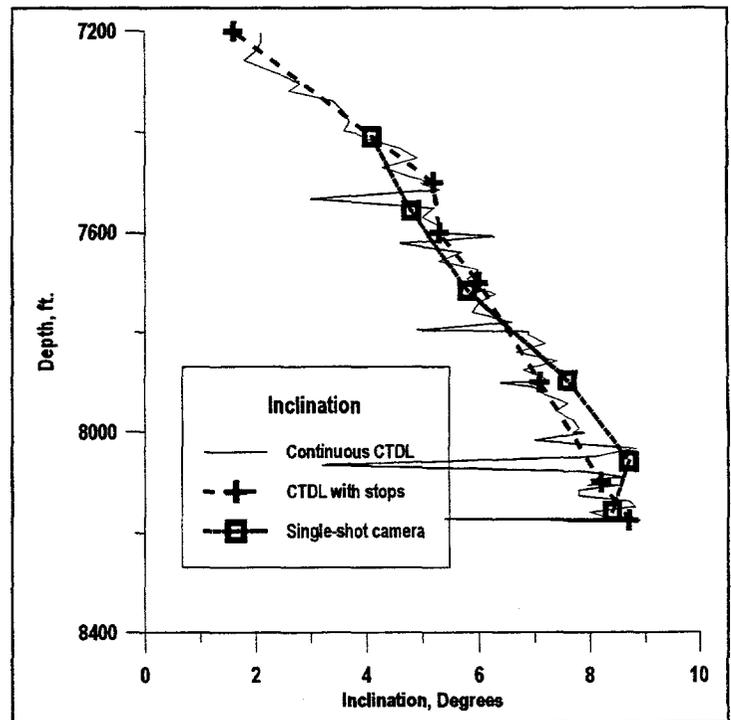
Drilling Assembly: 21' HQ core barrel, 1350' HMQ rods, xo, 295' CHD101rods, xo, 4" Hydril 563 tubing

Surveys:	Depth	Inclination	Direction	Bottom-hole Temperature
	7409'	4.1 ⁰	na	209 ⁰ F
	7556'	4.8 ⁰	na	202 ⁰ F
	7716'	5.8 ⁰	70 ⁰ true	215 ⁰ F
	7896'	7.6 ⁰	na	215 ⁰ F
	8058'	8.7 ⁰	na	222 ⁰ F
	8158'	8.4 ⁰	93 ⁰ true	not available
	8174'	8.8 ⁰	na	217 ⁰ F

Summary of events last 24 hours:

Completed bit trip from 8174'. Ran back in hole to shoe and did temperature/pressure/inclination survey with Sandia memory tool. It successfully took data to TD, stopping every 100' on the way out to give the inclination measurement more steady-state time. Inclination data are somewhat ambiguous but it is clear that the stabilized core-barrel reduced the rate of deviation increase. Temperature log is very similar to logs from previous years (plot in tomorrow's report). Cored from 8174' with long runs. Coring ahead at 8249' at report time.

Report by: John Finger/Ron Jacobson



DAILY DRILLING REPORT – August 13, 1998
LONG VALLEY EXPLORATORY WELL
 Time of report - 0700

Well number – LVF 51-20 | Location - Section 20, T3S, R28E, Mono County, CA

All depth measurements refer to KB; KB = 29' above ground level
 Days since spud - 25 | Depth @ 0600 hrs – 8290' | Hole advance last 24 hr -46' | Core recovered - 46'
 Last casing – Bushing string: 5", 19.5 lb/ft drill pipe from 7177' to 6600'; 5-1/2", 20 lb/ft Hydril tubing to surface; cemented to 6685'

Bits -- Now coring 3.850" hole | Rotary speed – 295 rpm; WOB - 3000 lb; Rate of Penetration - avg. 8 ft/hr

Bit number	Type	In, KB	Out, KB	Footage
2	Huddy 10 impreg	7178'	7190'	12
3	Huddy 12 impreg	7190'	7245'	55
4	Huddy 12 impreg	7245'	7460'	215'
5	Huddy 10 impreg	7460'	7728'	268'
6	Dimatec 12 impreg	7728'	7915'	187'
7	Dimatec 9 impreg	7915'	8174'	259'
8	Dimatec 9 impreg	8174'	8290'	116'
9	Huddy 10 impreg	8290'		

Drilling Assembly: 21' HQ core barrel, 1710' HMQ rods, xo, 295' CHD101rods, xo, 4" Hydril 563 tubing

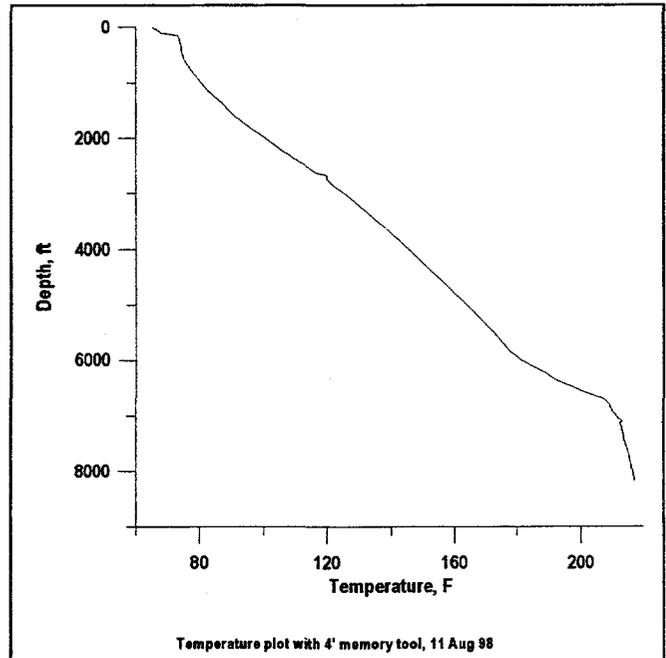
Lithology:

8174-8201	metapelite
8201-8204	sandy marble
8204-8273	metapelite
8273-8284	faulted and silicified metapelite and quartzite

Summary of events last 24 hours:

Cored from 8244'. Reasonably good ROP and long runs, but bit worn out in 116'. Round trip for bit, almost back to drilling at report time.

Report by: John Finger/Ron Jacobson



DAILY DRILLING REPORT – August 14, 1998
LONG VALLEY EXPLORATORY WELL
 Time of report - 0700

Well number – LVF 51-20 | Location - Section 20, T3S, R28E, Mono County, CA

All depth measurements refer to KB; KB = 29' above ground level
 Days since spud - 26 | Depth @ 0600 hrs – 8364' | Hole advance last 24 hr - 74' | Core recovered - 74'
 Last casing – Bushing string: 5", 19.5 lb/ft drill pipe from 7177' to 6600'; 5-1/2", 20 lb/ft Hydril tubing to surface; cemented to 6685'

Bits -- Now coring 3.850" hole | Rotary speed – 295 rpm; WOB - 3000 lb; Rate of Penetration - avg. 8 ft/hr

Bit number	Type	In, KB	Out, KB	Footage
2	Huddy 10 impreg	7178'	7190'	12
3	Huddy 12 impreg	7190'	7245'	55
4	Huddy 12 impreg	7245'	7460'	215'
5	Huddy 10 impreg	7460'	7728'	268'
6	Dimatec 12 impreg	7728'	7915'	187'
7	Dimatec 9 impreg	7915'	8174'	259'
8	Dimatec 9 impreg	8174'	8290'	116'
9	Huddy 10 impreg	8290'		

Drilling Assembly: 21' HQ core barrel, 1710' HMQ rods, xo, 295' CHD101rods, xo, 4" Hydril 563 tubing

Surveys:	Depth	Inclination	Direction	Bottom-hole Temperature
	7409'	4.1 ^o	na	209 ^o F
	7556'	4.8 ^o	na	202 ^o F
	7716'	5.8 ^o	70 ^o true	215 ^o F
	7896'	7.6 ^o	na	215 ^o F
	8058'	8.7 ^o	na	222 ^o F
	8158'	8.4 ^o	93 ^o true	na
	8322'	10.2 ^o	na	223 ^o F

Drilling fluid -

Flow rate - ~18 gal/min | Pressure - ~800 psi | Returns temp - 77^oF max | Wt - 8.6 lb/gal | Vis - 60 sec
 | Filtrate 6.8 cm³/30 min | PV - 30 cP | YP - 16 lb/100ft² | pH - 10 | Lost circulation - none

Lithology:	Depth	Description
	8174-8201	metapelite
	8201-8204	sandy marble
	8204-8273	metapelite
	8273-8284	faulted and silicified metapelite and quartzite
	8284-8364	metapelite inter-fingered with intrusion

Summary of events last 24 hours:

Completed bit trip at 8290'; washed in from 8268' with no fill. Ran CTDL and long memory tool together; tools gave good agreement on temperature and inclination, reported above. Cored steadily through the night, with mostly short (< 8') core runs.

Report by: John Finger/Ron Jacobson

DAILY DRILLING REPORT – August 15, 1998
LONG VALLEY EXPLORATORY WELL

Time of report - 0700

Well number – LVF 51-20 | Location - Section 20, T3S, R28E, Mono County, CA

All depth measurements refer to KB; KB = 29' above ground level

Days since spud - 27 | Depth @ 0600 hrs – 8446' | Hole advance last 24 hr - 82' | Core recovered - 82'

Last casing – Bushing string: 5", 19.5 lb/ft drill pipe from 7177' to 6600'; 5-1/2", 20 lb/ft Hydril tubing to surface; cemented to 6685'

Bits -- Now coring 3.850" hole | Rotary speed – 295 rpm; WOB - 3000 lb; Rate of Penetration - avg. 8 ft/hr

Bit number	Type	In, KB	Out, KB	Footage
2	Huddy 10 impreg	7178'	7190'	12
3	Huddy 12 impreg	7190'	7245'	55
4	Huddy 12 impreg	7245'	7460'	215'
5	Huddy 10 impreg	7460'	7728'	268'
6	Dimatec 12 impreg	7728'	7915'	187'
7	Dimatec 9 impreg	7915'	8174'	259'
8	Dimatec 9 impreg	8174'	8290'	116'
9	Huddy 10 impreg	8290'		

Drilling Assembly: 21' HQ core barrel, 1710' HMQ rods, xo, 295' CHD101rods, xo, 4" Hydril 563 tubing

Surveys:	Depth	Inclination	Direction	Bottom-hole Temperature
	7409'	4.1°	na	209° F
	7556'	4.8°	na	202° F
	7716'	5.8°	70° true	215° F
	7896'	7.6°	na	215° F
	8058'	8.7°	na	222° F
	8158'	8.4°	93° true	na
	8322'	10.2°	na	223° F

Drilling fluid -

Flow rate - ~18 gal/min | Pressure - ~800 psi | Returns temp - 77°F max | Wt – 8.5 lb/gal | Vis - 55 sec
 | Filtrate 6.8 cm³/30 min | PV - 30 cP | YP – 16 lb/100ft² | pH - 10 | Lost circulation - none

Lithology:	Interval	Description
	8174-8201	metapelite
	8201-8204	sandy marble
	8204-8273	metapelite
	8273-8284	faulted and silicified metapelite and quartzite
	8284-8364	metapelite inter-fingered with intrusion
	8364-8446	metapelite with mineralogy indicating metamorphosis at higher temperature and pressure than previous formations

Summary of events last 24 hours:

Cored ahead from 8364' to 8406' with mostly short (< 9') runs, then got two 20' average runs.

Report by: John Finger/Ron Jacobson

DAILY DRILLING REPORT – August 16, 1998

LONG VALLEY EXPLORATORY WELL

Time of report - 0700

Well number – LVF 51-20 | Location - Section 20, T3S, R28E, Mono County, CA

All depth measurements refer to KB; KB = 29' above ground level

Days since spud - 28 | Depth @ 0600 hrs – 8473' | Hole advance last 24 hr -27' | Core recovered - 27'

Last casing – Bushing string: 5", 19.5 lb/ft drill pipe from 7177' to 6600'; 5-1/2", 20 lb/ft Hydril tubing to surface; cemented to 6685'

Bits -- Now coring 3.850" hole | Rotary speed – 295 rpm; WOB - 3000 lb; Rate of Penetration - avg. 8 ft/hr

Bit number	Type	In, KB	Out, KB	Footage
2	Huddy 10 impreg	7178'	7190'	12'
3	Huddy 12 impreg	7190'	7245'	55'
4	Huddy 12 impreg	7245'	7460'	215'
5	Huddy 10 impreg	7460'	7728'	268'
6	Dimatec 12 impreg	7728'	7915'	187'
7	Dimatec 9 impreg	7915'	8174'	259'
8	Dimatec 9 impreg	8174'	8290'	116'
9	Huddy 10 impreg	8290'	8461'	171'
10	Hobic 14 impreg	8461'		

Drilling Assembly: 21' HQ core barrel, 1890' HMQ rods, xo, 295' CHD101rods, xo, 4" Hydril 563 tubing

Surveys:	Depth	Inclination	Direction	Bottom-hole Temperature
	7409'	4.1 ⁰	na	209 ⁰ F
	7556'	4.8 ⁰	na	202 ⁰ F
	7716'	5.8 ⁰	70 ⁰ true	215 ⁰ F
	7896'	7.6 ⁰	na	215 ⁰ F
	8058'	8.7 ⁰	na	222 ⁰ F
	8158'	8.4 ⁰	93 ⁰ true	na
	8322'	10.2 ⁰	na	223 ⁰ F
	8461'	10.2 ⁰	na	223 ⁰ F

Drilling fluid -

Flow rate - ~18 gal/min | Pressure - ~800 psi | Returns temp - 77°F max | Wt - 8.5 lb/gal | Vis - 55 sec
| Filtrate 6.8 cm³/30 min | PV - 30 cP | YP - 16 lb/100ft² | pH - 10 | Lost circulation - none

Lithology: 8284-8364 metapelite inter-fingered with intrusion
8364-8473 metapelite with mineralogy indicating metamorphosis at higher temperature and pressure than previous formations

Summary of events last 24 hours:

Cored ahead from 8446' to 8461'. Mud rings causing problems retrieving inner tube. Change out mud. Bit gone, POOH for new bit. RIH with new bit. Coring ahead at report time.

Report by: John Finger/Ron Jacobson

DAILY DRILLING REPORT – August 17, 1998
LONG VALLEY EXPLORATORY WELL
 Time of report - 0700

Well number – LVF 51-20 | Location - Section 20, T3S, R28E, Mono County, CA

All depth measurements refer to KB; KB = 29' above ground level

Days since spud - 29 | Depth @ 0600 hrs – 8508' | Hole advance last 24 hr -35' | Core recovered - 35'
 Last casing – Bushing string: 5", 19.5 lb/ft drill pipe from 7177' to 6600'; 5-1/2", 20 lb/ft Hydril tubing to surface; cemented to 6685'

Bits -- Now coring 3.850" hole | Rotary speed – 295 rpm; WOB - 3000 lb; Rate of Penetration - avg. 8 ft/hr

Bit number	Type	In, KB	Out, KB	Footage
2	Huddy 10 impreg	7178'	7190'	12'
3	Huddy 12 impreg	7190'	7245'	55'
4	Huddy 12 impreg	7245'	7460'	215'
5	Huddy 10 impreg	7460'	7728'	268'
6	Dimatec 12 impreg	7728'	7915'	187'
7	Dimatec 9 impreg	7915'	8174'	259'
8	Dimatec 9 impreg	8174'	8290'	116'
9	Huddy 10 impreg	8290'	8461'	171'
10	Hobic 14 impreg	8461'	8508'	47'
11	Huddy 14 impreg	8508'		

Drilling Assembly: 21' HQ core barrel, 1890' HMQ rods, xo, 295' CHD101rods, xo, 4" Hydril 563 tubing

Surveys:	Depth	Inclination	Direction	Bottom-hole Temperature
	7409'	4.1 ^o	na	209 ^o F
	7556'	4.8 ^o	na	202 ^o F
	7716'	5.8 ^o	70 ^o true	215 ^o F
	7896'	7.6 ^o	na	215 ^o F
	8058'	8.7 ^o	na	222 ^o F
	8158'	8.4 ^o	93 ^o true	na
	8322'	10.2 ^o	na	223 ^o F

Drilling fluid -

Flow rate - ~18 gal/min | Pressure - ~800 psi | Returns temp - 77^oF max | Wt - 8.5 lb/gal | Vis - 55 sec
 | Filtrate 6.8 cm³/30 min | PV - 30 cP | YP - 16 lb/100ft² | pH - 10 | Lost circulation - none

Lithology: 8284-8364 metapelite inter-fingered with intrusion
 8364-8473 metapelite with mineralogy indicating metamorphosis at higher temperature and pressure than previous formations

Summary of events last 24 hours:

Cored ahead to 8508', mostly with short runs. Bit is gone, POOH for new bit. Running in hole with new bit at report time.

Report by: John Finger/Ron Jacobson

DAILY DRILLING REPORT – August 18, 1998
LONG VALLEY EXPLORATORY WELL

Time of report - 0700

Well number – LVF 51-20 | Location - Section 20, T3S, R28E, Mono County, CA

All depth measurements refer to KB; KB = 29' above ground level

Days since spud - 30 | Depth @ 0600 hrs – 8525' | Hole advance last 24 hr -17' | Core recovered - 17'

Last casing – Bushing string: 5", 19.5 lb/ft drill pipe from 7177' to 6600'; 5-1/2", 20 lb/ft Hydril tubing to surface; cemented to 6685'

Bits -- Now coring 3.850" hole | Rotary speed – 295 rpm; WOB - 3000 lb; Rate of Penetration - avg. 8 ft/hr

Bit number	Type	In, KB	Out, KB	Footage
	See pre-August 18 reports for prior bits			
9	Huddy 10 impreg	8290'	8461'	171'
10	Hobic 14 impreg	8461'	8508'	47'
11	Huddy 14 impreg	8508'	8525'	17'
12	Dimatec 12 impreg	8525'		

Drilling Assembly: 21' HQ core barrel, 2160' HMQ rods, xo, 4" Hydril 563 tubing

Surveys:	Depth	Inclination	Direction	Bottom-hole Temperature
	See pre-August 18 reports for prior surveys			
	8158'	8.4 ⁰	93 ⁰ true	na
	8322'	10.2 ⁰	na	223 ⁰ F

Drilling fluid -

Flow rate - ~18 gal/min | Pressure - ~30 psi | Returns temp - 77°F max | Wt - 8.5 lb/gal | Vis - 55 sec
 | Filtrate 6.8 cm³/30 min | PV - 30 cP | YP - 16 lb/100ft² | pH - 10 | Lost circulation - total

Lithology:	Depth	Description
	8284-8364	metapelite inter-fingered with intrusion
	8364-8473	metapelite with mineralogy indicating metamorphosis at higher temperature and pressure than previous formations
	8473-8525	very hard, fine-grained quartzite; some open fractures with quartz crystals

Summary of events last 24 hours:

Finished RIH with new bit. Cored ahead to 8525 in two runs; bit is gone. Lost circulation when pumping tube down. POOH. Out of hole at report time.

Report by: John Finger/Ron Jacobson

DAILY DRILLING REPORT – August 19, 1998
LONG VALLEY EXPLORATORY WELL

Time of report - 0700

Well number – LVF 51-20 | Location - Section 20, T3S, R28E, Mono County, CA

All depth measurements refer to KB; KB = 29' above ground level

Days since spud - 31 | Depth @ 0600 hrs – 8541' | Hole advance last 24 hr -16' | Core recovered - 11'

Last casing – Bushing string: 5", 19.5 lb/ft drill pipe from 7177' to 6600'; 5-1/2", 20 lb/ft Hydril tubing to surface; cemented to 6685'

Bits -- Now coring 3.850" hole | Rotary speed – 295 rpm; WOB - 3000 lb; Rate of Penetration - avg. 2-3 ft/hr

Bit number	Type	In, KB	Out, KB	Footage
	See pre-August 18 reports for prior bits			
9	Huddy 10 impreg	8290'	8461'	171'
10	Hobic 14 impreg	8461'	8508'	47'
11	Huddy 14 impreg	8508'	8525'	17'
12	Dimatec 12 impreg	8525'		

Drilling Assembly: 21' HQ core barrel, 2160' HMQ rods, xo, 4" Hydril 563 tubing

Surveys:	Depth	Inclination	Direction	Bottom-hole Temperature
	See pre-August 18 reports for prior surveys			
	8158'	8.4 ^o	93 ^o true	na
	8322'	10.2 ^o	na	223 ^o F

Drilling fluid -

Flow rate - ~18 gal/min | Pressure - ~35 psi | Returns temp - na^oF max | Wt - 8.5 lb/gal | Vis - 60 sec
 | Filtrate 6.8 cm³/30 min | PV - 30 cP | YP - 16 lb/100ft² | pH - 10 | Lost circulation - total

Lithology:	8284-8364	metapelite inter-fingered with intrusion
	8364-8473	metapelite with mineralogy indicating metamorphosis at higher temperature and pressure than previous formations
	8473-8525	very hard, fine-grained quartzite; some open fractures with quartz crystals
	8525-8541	quartzite becoming more fractured, full of open veins filled with drusy quartz, pyrite, calcite, epidote, and chlorite.

Summary of events last 24 hours:

Finished RIH with new bit. Cored ahead to 8541 in six runs. Some voids and lots of cave. Fluid level at ~ 1080 when lowering inner tube. Pumping down the backside to lubricate rods while coring. Very hard rock. Expect bit to go soon.

Report by: John Finger/Ron Jacobson

DAILY DRILLING REPORT – August 20, 1998
LONG VALLEY EXPLORATORY WELL
 Time of report - 0700

Well number – LVF 51-20 | Location - Section 20, T3S, R28E, Mono County, CA

All depth measurements refer to KB; KB = 29' above ground level

Days since spud - 32 | Depth @ 0600 hrs – 8550' | Hole advance last 24 hr -9' | Core recovered - 9'
 Last casing – Bushing string: 5", 19.5 lb/ft drill pipe from 7177' to 6600'; 5-1/2", 20 lb/ft Hydril tubing to surface; cemented to 6685'

Bits – Now coring 3.850" hole | Rotary speed – 295 rpm; WOB – 3-4000 lb; Rate of Penetration - avg. 2-3 ft/hr

Bit number	Type	In, KB	Out, KB	Footage
	See pre-August 18 reports for prior bits			
9	Huddy 10 impreg	8290'	8461'	171'
10	Hobic 14 impreg	8461'	8508'	47'
11	Huddy 14 impreg	8508'	8525'	17'
12	Dimatec 12 impreg	8525'	8550'	25'
13	Hobic 14 impreg	8550'		

Drilling Assembly: 21' HQ core barrel, 2160' HMQ rods, xo, 4" Hydril 563 tubing

Surveys:	Depth	Inclination	Direction	Bottom-hole Temperature
	See pre-August 18 reports for prior surveys			
	8158'	8.4 ⁰	93 ⁰ true	na
	8322'	10.2 ⁰	na	223 ⁰ F
	8547'	11.6 ⁰	na	203 ⁰ F

Drilling fluid -

Flow rate - ~18 gal/min | Pressure - ~35 psi | Returns temp - na⁰F max | Wt - 8.5 lb/gal | Vis - 60 sec
 | Filtrate 6.8 cm³/30 min | PV - 30 cP | YP - 16 lb/100ft² | pH - 10 | Lost circulation - total

Lithology:	Depth	Description
	8284-8364	metapelite inter-fingered with intrusion
	8364-8473	metapelite with mineralogy indicating metamorphosis at higher temperature and pressure than previous formations
	8473-8525	very hard, fine-grained quartzite; some open fractures with quartz crystals
	8525-8540	quartzite becoming more fractured, full of open veins filled with drusy quartz, pyrite, calcite, epidote, and chlorite.
	8540-8550	quartzite becoming less fractured, but still extremely hard

Summary of events last 24 hours:

Cored ahead with new bit. Ran core-tube data logger and got temperature/pressure/inclination. Temperature was lower than previous readings because, with total lost circulation, we are constantly pumping fresh mud down the hole. Tried coring ahead but bit was gone. POOH for new bit; going in hole at report time.

Report by: John Finger/Ron Jacobson

DAILY DRILLING REPORT – August 21, 1998
LONG VALLEY EXPLORATORY WELL

Time of report - 0700

Well number – LVF 51-20 | Location - Section 20, T3S, R28E, Mono County, CA

All depth measurements refer to KB; KB = 29' above ground level

Days since spud - 33 | Depth @ 0600 hrs – 8601' | Hole advance last 24 hr - 51' | Core recovered - 51'

Last casing – Bushing string: 5", 19.5 lb/ft drill pipe from 7177' to 6600'; 5-1/2", 20 lb/ft Hydril tubing to surface; cemented to 6685'

Bits -- Now coring 3.850" hole | Rotary speed – 295 rpm; WOB – 3-4000 lb; Rate of Penetration - avg. 8 ft/hr

Bit number	Type	In, KB	Out, KB	Footage
	See pre-August 18 reports for prior bits			
9	Huddy 10 impreg	8290'	8461'	171'
10	Hobic 14 impreg	8461'	8508'	47'
11	Huddy 14 impreg	8508'	8525'	17'
12	Dimatec 12 impreg	8525'	8550'	25'
13	Hobic 14 impreg	8550'		

Drilling Assembly: 21' HQ core barrel, 2160' HMQ rods, xo, 4" Hydril 563 tubing

Surveys:	Depth	Inclination	Direction	Bottom-hole Temperature
	See pre-August 18 reports for prior surveys			
	8158'	8.4 ⁰	93 ⁰ true	na
	8322'	10.2 ⁰	na	223 ⁰ F
	8547'	11.6 ⁰	na	203 ⁰ F

Drilling fluid -

Flow rate - ~18 gal/min | Pressure - ~120 psi | Returns temp - na⁰F max | Wt - 8.5 lb/gal | Vis - 60 sec
 | Filtrate 6.8 cm³/30 min | PV - 30 cP | YP - 16 lb/100ft² | pH - 10 | Lost circulation - total

Lithology: 8487-8555 Quartzite, massively to severely hydrothermally altered
 8555-8601 Graphitic metapelite, some signs of hydrothermal alteration and mineralization that would have required fluid temperatures ~ 300⁰C

Summary of events last 24 hours:

Cored ahead from 8550' with new bit. Drilling rate picked up significantly as we re-entered a formation very similar to the metapelite drilled earlier, but core runs still tend to be short (< 8'). Standing fluid level remaining at ~ 1080' with complete lost circulation. Drilling with new flow-restrictive latch heads that give a positive latch signal and circulating pressure even with lost returns. Coring ahead at 8610' at report time.

Report by: John Finger/Ron Jacobson

DAILY DRILLING REPORT – August 22, 1998
LONG VALLEY EXPLORATORY WELL
 Time of report - 0700

Well number – LVF 51-20 | Location - Section 20, T3S, R28E, Mono County, CA

All depth measurements refer to KB; KB = 29' above ground level

Days since spud - 34 | Depth @ 0600 hrs – 8652' | Hole advance last 24 hr - 51' | Core recovered - 51'
 Last casing – Bushing string: 5", 19.5 lb/ft drill pipe from 7177' to 6600'; 5-1/2", 20 lb/ft Hydril tubing to surface; cemented to 6685'

Bits -- Now coring 3.850" hole | Rotary speed – 295 rpm; WOB – 3-4000 lb; Rate of Penetration - avg. 8 ft/hr

Bit number	Type	In, KB	Out, KB	Footage
	See pre-August 18 reports for prior bits			
9	Huddy 10 impreg	8290'	8461'	171'
10	Hobic 14 impreg	8461'	8508'	47'
11	Huddy 14 impreg	8508'	8525'	17'
12	Dimatec 12 impreg	8525'	8550'	25'
13	Hobic 14 impreg	8550'		

Drilling Assembly: 21' HQ core barrel, 2160' HMQ rods, xo, 4" Hydril 563 tubing

Surveys:	Depth	Inclination	Direction	Bottom-hole Temperature
	See pre-August 18 reports for prior surveys			
	8158'	8.4 ⁰	93 ⁰ true	na
	8322'	10.2 ⁰	na	223 ⁰ F
	8547'	11.6 ⁰	na	203 ⁰ F
	8628'	12.2 ⁰	91 ⁰ true	na

Drilling fluid -

Flow rate - ~18 gal/min | Pressure - ~120 psi | Returns temp - na⁰F max | Wt - 8.4 lb/gal | Vis - 60 sec
 | Filtrate 6.8 cm³/30 min | PV - 30 cP | YP - 16 lb/100ft² | pH - 10 | Lost circulation - total

Lithology:	Depth	Description
	8487-8555	Quartzite, massively to severely hydrothermally altered
	8555-8601	Graphitic metapelite, some signs of hydrothermal alteration and mineralization that would have required fluid temperatures ~ 300 ⁰ C
	8601-8652	Same metapelite as above, very broken.

Summary of events last 24 hours:

Cored ahead from 8601', mostly with short runs. Single-shot survey at 8628' with results reported above. Cored ahead with no runs more than 6'. RIH with core tube at report time.

Report by: John Finger/Ron Jacobson

DAILY DRILLING REPORT – August 23, 1998
LONG VALLEY EXPLORATORY WELL

Time of report - 0700

Well number – LVF 51-20 | Location - Section 20, T3S, R28E, Mono County, CA

All depth measurements refer to KB; KB = 29' above ground level

Days since spud - 35 | Depth @ 0600 hrs – 8721' | Hole advance last 24 hr - 69' | Core recovered - 69'

Last casing – Bushing string: 5", 19.5 lb/ft drill pipe from 7177' to 6600'; 5-1/2", 20 lb/ft Hydril tubing to surface; cemented to 6685'

Bits -- Now coring 3.850" hole | Rotary speed – 295 rpm; WOB – 3-4000 lb; Rate of Penetration - avg. 8 ft/hr

Bit number	Type	In, KB	Out, KB	Footage
	See pre-August 18 reports for prior bits			
9	Huddy 10 impreg	8290'	8461'	171'
10	Hobic 14 impreg	8461'	8508'	47'
11	Huddy 14 impreg	8508'	8525'	17'
12	Dimatec 12 impreg	8525'	8550'	25'
13	Hobic 14 impreg	8550'		

Drilling Assembly: 21' HQ core barrel, 2160' HMQ rods, xo, 4" Hydril 563 tubing

Surveys:	Depth	Inclination	Direction	Bottom-hole Temperature
	See pre-August 18 reports for prior surveys			
	8158'	8.4 ^o	93 ^o true	na
	8322'	10.2 ^o	na	223 ^o F
	8547'	11.6 ^o	na	203 ^o F
	8628'	12.2 ^o	91 ^o true	na

Drilling fluid -

Flow rate - ~18 gal/min | Pressure - ~120 psi | Returns temp - na^oF max | Wt - 8.4 lb/gal | Vis - 60 sec
 | Filtrate 6.8 cm³/30 min | PV - 30 cP | YP - 16 lb/100ft² | pH - 10 | Lost circulation - total

Lithology:	Depth	Description
	8487-8555	Quartzite, massively to severely hydrothermally altered
	8555-8601	Graphitic metapelite, some signs of hydrothermal alteration and mineralization that would have required fluid temperatures ~ 300 ^o C
	8601-8656	Same metapelite as above, very broken.
	8656-8721	Metapelite, more competent, considerable evidence of ductile folding

Summary of events last 24 hours:

Cored from 8652' to 8656' in three runs, but then rock became more competent. Next four runs were 9', 14' and two 21'. Pumping tube down at report time.

Report by: John Finger/Ron Jacobson

DAILY DRILLING REPORT – August 24, 1998
LONG VALLEY EXPLORATORY WELL
 Time of report - 0700

Well number – LVF 51-20 | Location - Section 20, T3S, R28E, Mono County, CA

All depth measurements refer to KB; KB = 29' above ground level

Days since spud - 36 | Depth @ 0600 hrs – 8780' | Hole advance last 24 hr -59' | Core recovered - 59'
 Last casing – Bushing string: 5", 19.5 lb/ft drill pipe from 7177' to 6600'; 5-1/2", 20 lb/ft Hydril tubing to surface; cemented to 6685'

Bits -- Now coring 3.850" hole | Rotary speed – 295 rpm; WOB – 3-4000 lb; Rate of Penetration - avg. 8 ft/hr

Bit number	Type	In, KB/date	Out, KB/date	Footage
		See pre-August 18 reports for prior bits		
9	Huddy 10 impreg	8290'/13 Aug	8461'/15 Aug	171'
10	Hobic 14 impreg	8461'/15 Aug	8508'/17 Aug	47'
11	Huddy 14 impreg	8508'/17 Aug	8525'/18 Aug	17'
12	Dimatec 12 impreg	8525'/18 Aug	8550'/20 Aug	25'
13	Hobic 14 impreg	8550'/20 Aug	8780'/24 Aug	230'
14	Christensen 10GD impreg	8780'/24 Aug		

Drilling Assembly: 21' HQ core barrel, 2610' HMQ rods, xo, 4" Hydril 563 tubing

Surveys:	Depth	Inclination	Direction	Bottom-hole Temperature
		See pre-August 18 reports for prior surveys		
	8158'	8.4 ⁰	93 ⁰ true	na
	8322'	10.2 ⁰	na	223 ⁰ F
	8547'	11.6 ⁰	na	203 ⁰ F
	8628'	12.2 ⁰	91 ⁰ true	na

Drilling fluid -

Flow rate - ~18 gal/min | Pressure - ~120 psi | Returns temp - na⁰F max | Wt – 8.4 lb/gal | Vis - 60 sec
 | Filtrate 6.8 cm³/30 min | PV - 30 cP | YP – 16 lb/100ft² | pH - 10 | Lost circulation - total

Lithology:	Depth	Description
	8487-8555	Quartzite, massively to severely hydrothermally altered
	8555-8601	Graphitic metapelite, some signs of hydrothermal alteration and mineralization that would have required fluid temperatures ~ 300 ⁰ C
	8601-8656	Same metapelite as above, very broken.
	8656-8721	Metapelite, more competent, considerable evidence of ductile folding
	8721-8780	Metapelite, much ductile folding, shows minerals (especially pyroxene) which are formed at temperatures above 1000 ⁰ C

Summary of events last 24 hours:

Cored from 8721' to 8780' in three runs. Tripped to add more HMQ rod to the drill string. Picked up 450' of rod, which will allow coring to 9230' if bit lasts that long. Running in hole at report time.

Report by: John Finger/Ron Jacobson

DAILY DRILLING REPORT – August 25, 1998
LONG VALLEY EXPLORATORY WELL

Time of report - 0700

Well number – LVF 51-20 | Location - Section 20, T3S, R28E, Mono County, CA

All depth measurements refer to KB; KB = 29' above ground level

Days since spud - 37 | Depth @ 0600 hrs – 8860' | Hole advance last 24 hr -80' | Core recovered - 80'
 Last casing – Bushing string: 5", 19.5 lb/ft drill pipe from 7177' to 6600'; 5-1/2", 20 lb/ft Hydril tubing to surface; cemented to 6685'

Bits -- Now coring 3.850" hole | Rotary speed – 295 rpm; WOB – 3-4000 lb; Rate of Penetration - avg. 8 ft/hr

Bit number	Type	In, KB/date	Out, KB/date	Footage
See pre-August 18 reports for prior bits				
9	Huddy 10 impreg	8290'/13 Aug	8461'/15 Aug	171'
10	Hobic 14 impreg	8461'/15 Aug	8508'/17 Aug	47'
11	Huddy 14 impreg	8508'/17 Aug	8525'/18 Aug	17'
12	Dimatec 12 impreg	8525'/18 Aug	8550'/20 Aug	25'
13	Hobic 14 impreg	8550'/20 Aug	8780'/24 Aug	230'
14	Christensen 10GD impreg	8780'/24 Aug		

Drilling Assembly: 21' HQ core barrel, 2610' HMQ rods, xo, 4" Hydril 563 tubing

Surveys:	Depth	Inclination	Direction	Bottom-hole Temperature
See pre-August 18 reports for prior surveys				
	8158'	8.4 ^o	93 ^o true	na
	8322'	10.2 ^o	na	223 ^o F
	8547'	11.6 ^o	na	203 ^o F
	8628'	12.2 ^o	91 ^o true	na
	8813'	13.2 ^o	na	191 ^o F

Drilling fluid – Bentonite, dry polymer, fine walnut shells, soda ash

Flow rate - ~18 gal/min | Pressure - ~120 psi | Returns temp - na^oF max | Wt – 8.4 lb/gal | Vis - 60 sec
 | Filtrate 6.8 cm³/30 min | PV - 30 cP | YP – 16 lb/100ft² | pH - 10 | Lost circulation - total

Lithology:	Depth	Description
	8656-8721	Metapelite, more competent, considerable evidence of ductile folding
	8721-8780	Metapelite, much ductile folding, shows minerals (especially pyroxene) which are formed at temperatures above 1000 ^o C
	8780-8860	Metapelite, showing a higher metamorphic grade than before

Summary of events last 24 hours:

Completed running in hole with drill string. Cored from 8780' to 8860' in six runs. Ran core-tube data logger at 8813' with results reported above (bottomhole temperature continues to decline because of cooling from lost circulation/fresh mud.) Coring at 8863' at report time.

Report by: John Finger/Ron Jacobson

DAILY DRILLING REPORT – August 26, 1998
LONG VALLEY EXPLORATORY WELL
 Time of report - 0700

Well number – LVF 51-20 | Location - Section 20, T3S, R28E, Mono County, CA

All depth measurements refer to KB; KB = 29' above ground level

Days since spud - 38 | Depth @ 0600 hrs – 8921' | Hole advance last 24 hr - 61' | Core recovered - 61'
 Last casing – Bushing string: 5", 19.5 lb/ft drill pipe from 7177' to 6600'; 5-1/2", 20 lb/ft Hydril tubing to surface; cemented to 6685'

Bits -- Now coring 3.850" hole | Rotary speed – 295 rpm; WOB – 3-4000 lb; Rate of Penetration - avg. 8 ft/hr

Bit number	Type	In, KB/date	Out, KB/date	Footage
		See pre-August 18 reports for prior bits		
9	Huddy 10 impreg	8290'/13 Aug	8461'/15 Aug	171'
10	Hobic 14 impreg	8461'/15 Aug	8508'/17 Aug	47'
11	Huddy 14 impreg	8508'/17 Aug	8525'/18 Aug	17'
12	Dimatec 12 impreg	8525'/18 Aug	8550'/20 Aug	25'
13	Hobic 14 impreg	8550'/20 Aug	8780'/24 Aug	230'
14	Christensen 10GD impreg	8780'/24 Aug		

Drilling Assembly: 21' HQ core barrel, 2610' HMQ rods, xo, 4" Hydril 563 tubing

Surveys:	Depth	Inclination	Direction	Bottom-hole Temperature
	See pre-August 18 reports for prior surveys			
	8158'	8.4 ⁰	93 ⁰ true	na
	8322'	10.2 ⁰	na	223 ⁰ F
	8547'	11.6 ⁰	na	203 ⁰ F
	8628'	12.2 ⁰	91 ⁰ true	na
	8813'	13.2 ⁰	na	191 ⁰ F

Drilling fluid – Bentonite, dry polymer, fine walnut shells, soda ash

Flow rate - ~18 gal/min | Pressure - ~120 psi | Returns temp - na⁰F max | Wt – 8.4 lb/gal | Vis - 60 sec
 | Filtrate 6.8 cm³/30 min | PV - 30 cP | YP – 16 lb/100ft² | pH - 10 | Lost circulation - total

Lithology:	Depth	Description
	8656-8721	Metapelite, more competent, considerable evidence of ductile folding
	8721-8780	Metapelite, much ductile folding, shows minerals (especially pyroxene) that are formed at temperatures above 1000 ⁰ C
	8780-8860	Metapelite, showing a higher metamorphic grade than before
	8860-8921	Same metapelite, fractured, high-angle dipping bands

Summary of events last 24 hours:

Cored from 8860' to 8921' in seven runs. Formation is still metapelite, although fractures and open veins cause blocks and relatively short runs. Since losing circulation, water level has fluctuated between the original depth of 1080' up to 650'. A possible explanation of this is that we're partially curing the losses with walnut shell but, as we drill into new fractures, the water level falls back to its original depth. Coring ahead at 8927' at report time.

Report by: John Finger/Ron Jacobson

DAILY DRILLING REPORT – August 27, 1998
LONG VALLEY EXPLORATORY WELL

Time of report - 0700

Well number – LVF 51-20 | Location - Section 20, T3S, R28E, Mono County, CA

All depth measurements refer to KB; KB = 29' above ground level

Days since spud - 39 | Depth @ 0600 hrs – 8977' | Hole advance last 24 hr - 56' | Core recovered - 56'
 Last casing – Bushing string: 5", 19.5 lb/ft drill pipe from 7177' to 6600'; 5-1/2", 20 lb/ft Hydril tubing to surface; cemented to 6685'

Bits -- Now coring 3.850" hole | Rotary speed – 295 rpm; WOB – 3-4000 lb; Rate of Penetration - avg. 6 ft/hr

Bit number	Type	In, KB/date	Out, KB/date	Footage
See pre-August 18 reports for prior bits				
9	Huddy 10 impreg	8290'/13 Aug	8461'/15 Aug	171'
10	Hobic 14 impreg	8461'/15 Aug	8508'/17 Aug	47'
11	Huddy 14 impreg	8508'/17 Aug	8525'/18 Aug	17'
12	Dimatec 12 impreg	8525'/18 Aug	8550'/20 Aug	25'
13	Hobic 14 impreg	8550'/20 Aug	8780'/24 Aug	230'
14	Christensen 10GD impreg	8780'/24 Aug		

Drilling Assembly: 21' HQ core barrel, 2610' HMQ rods, xo, 4" Hydril 563 tubing

Surveys:	Depth	Inclination	Direction	Bottom-hole Temperature
See pre-August 18 reports for prior surveys				
	8158'	8.4 ^o	93 ^o true	na
	8322'	10.2 ^o	na	223 ^o F
	8547'	11.6 ^o	na	203 ^o F
	8628'	12.2 ^o	91 ^o true	na
	8813'	13.2 ^o	na	191 ^o F

Drilling fluid – Bentonite, dry polymer, fine walnut shells, soda ash

Flow rate - ~18 gal/min | Pressure - ~120 psi | Returns temp - na^oF max | Wt – 8.4 lb/gal | Vis - 60 sec
 | Filtrate 6.8 cm³/30 min | PV - 30 cP | YP – 16 lb/100ft² | pH - 10 | Lost circulation - total

Lithology:	8656-8721	Metapelite, more competent, considerable evidence of ductile folding
	8721-8780	Metapelite, much ductile folding, shows minerals (especially pyroxene) that are formed at temperatures above 1000 ^o C
	8780-8860	Metapelite, showing a higher metamorphic grade than before
	8860-8950	Same metapelite, fractured, high-angle dipping bands

Summary of events last 24 hours:

Cored from 8921' to 8977' in 5 runs. Had to chase tube twice due to possible mismatch indication. Rebuild latch heads. Penetration rate slowing as rock becomes more silicic again. Pumping tube at report time.

Report by: John Finger/Ron Jacobson

DAILY DRILLING REPORT – August 28, 1998
LONG VALLEY EXPLORATORY WELL
 Time of report - 0700

Well number – LVF 51-20 | Location - Section 20, T3S, R28E, Mono County, CA

All depth measurements refer to KB; KB = 29' above ground level
 Days since spud - 40 | Depth @ 0600 hrs – 9039' | Hole advance last 24 hr - 62' | Core recovered - 62'
 Last casing – Bushing string: 5", 19.5 lb/ft drill pipe from 7177' to 6600'; 5-1/2", 20 lb/ft Hydril tubing to surface; cemented to 6685'

Bits -- Now coring 3.850" hole | Rotary speed – 295 rpm; WOB – 3-4000 lb; Rate of Penetration - avg. 8 ft/hr

Bit number	Type	In, KB/date	Out, KB/date	Footage
		See pre-August 18 reports for prior bits		
9	Huddy 10 impreg	8290'/13 Aug	8461'/15 Aug	171'
10	Hobic 14 impreg	8461'/15 Aug	8508'/17 Aug	47'
11	Huddy 14 impreg	8508'/17 Aug	8525'/18 Aug	17'
12	Dimatec 12 impreg	8525'/18 Aug	8550'/20 Aug	25'
13	Hobic 14 impreg	8550'/20 Aug	8780'/24 Aug	230'
14	Christensen 10GD impreg	8780'/24 Aug		

Drilling Assembly: 21' HQ core barrel, 2610' HMQ rods, xo, 4" Hydril 563 tubing

Surveys:	Depth	Inclination	Direction	Bottom-hole Temperature
		See pre-August 18 reports for prior surveys		
	8158'	8.4 ^o	93 ^o true	na
	8322'	10.2 ^o	na	223 ^o F
	8547'	11.6 ^o	na	203 ^o F
	8628'	12.2 ^o	91 ^o true	na
	8813'	13.2 ^o	na	191 ^o F
	9006'	13.0 ^o	na	187 ^o F

Drilling fluid – Bentonite, dry polymer, fine walnut shells, soda ash

Flow rate - ~18 gal/min | Pressure - ~120 psi | Returns temp - na^oF max | Wt – 8.4 lb/gal | Vis - 60 sec
 | Filtrate 6.8 cm³/30 min | PV - 30 cP | YP – 16 lb/100ft² | pH - 10 | Lost circulation - total

Lithology:	Depth	Description
	8656-8721	Metapelite, more competent, considerable evidence of ductile folding
	8721-8780	Metapelite, much ductile folding, shows minerals (especially pyroxene) that are formed at temperatures above 1000 ^o C
	8780-8860	Metapelite, showing a higher metamorphic grade than before
	8860-8950	Same metapelite, fractured, high-angle dipping bands
	8950-8970	Pelitic hornfels

Summary of events last 24 hours:

Core runs getting longer. Had to chase tube once due to mismatch indication. Going after inner tube with 21' of core at 9059' at report time. Fluid level rising to about 750'.

Report by: John Finger/Ron Jacobson

DAILY DRILLING REPORT – August 29, 1998
LONG VALLEY EXPLORATORY WELL

Time of report - 0700

Well number – LVF 51-20 | Location - Section 20, T3S, R28E, Mono County, CA

All depth measurements refer to KB; KB = 29' above ground level

Days since spud - 41 | Depth @ 0600 hrs – 9134' | Hole advance last 24 hr - 95' | Core recovered - 95'
 Last casing – Bushing string: 5", 19.5 lb/ft drill pipe from 7177' to 6600'; 5-1/2", 20 lb/ft Hydril tubing to surface; cemented to 6685'

Bits -- Now coring 3.850" hole | Rotary speed – 295 rpm; WOB – 3-4000 lb; Rate of Penetration - avg. 7 ft/hr

Bit number	Type	In, KB/date	Out, KB/date	Footage
See pre-August 18 reports for prior bits				
9	Huddy 10 impreg	8290'/13 Aug	8461'/15 Aug	171'
10	Hobic 14 impreg	8461'/15 Aug	8508'/17 Aug	47'
11	Huddy 14 impreg	8508'/17 Aug	8525'/18 Aug	17'
12	Dimatec 12 impreg	8525'/18 Aug	8550'/20 Aug	25'
13	Hobic 14 impreg	8550'/20 Aug	8780'/24 Aug	230'
14	Christensen 10GD impreg	8780'/24 Aug		

Drilling Assembly: 21' HQ core barrel, 2610' HMQ rods, xo, 4" Hydril 563 tubing

Surveys:	Depth	Inclination	Direction	Bottom-hole Temperature
See pre-August 18 reports for prior surveys				
	8158'	8.4 ^o	93 ^o true	na
	8322'	10.2 ^o	na	223 ^o F
	8547'	11.6 ^o	na	203 ^o F
	8628'	12.2 ^o	91 ^o true	na
	8813'	13.2 ^o	na	191 ^o F
	9006'	13.0 ^o	na	187 ^o F

Drilling fluid – Bentonite, dry polymer, fine walnut shells, soda ash

Flow rate - ~18 gal/min | Pressure - ~120 psi | Returns temp - na^oF max | Wt – 8.4 lb/gal | Vis - 60 sec
 | Filtrate 6.8 cm³/30 min | PV - 30 cP | YP – 16 lb/100ft² | pH - 10 | Lost circulation - total

Lithology:

8970-9045 Limey beds increase in volume and metamorphic grade to marbles
 9045-9090 Hornfels full of open hydrothermal veining, particularly in marble beds
 9090- Hornfels becoming more silicic and graphitic

Summary of events last 24 hours:

Core runs getting shorter again at report time. Made 8 runs for 95'. Fluid level dropping to about 980'. Core recovery remains at 100%.

Report by: John Finger/Ron Jacobson

DAILY DRILLING REPORT – August 30, 1998
LONG VALLEY EXPLORATORY WELL
 Time of report - 0700

Well number – LVF 51-20 | Location - Section 20, T3S, R28E, Mono County, CA

All depth measurements refer to KB; KB = 29' above ground level
 Days since spud - 42 | Depth @ 0600 hrs – 9164' | Hole advance last 24 hr - 34' | Core recovered - 34'
 Last casing – Bushing string: 5", 19.5 lb/ft drill pipe from 7177' to 6600'; 5-1/2", 20 lb/ft Hydril tubing to surface; cemented to 6685'

Bits – Now coring 3.850" hole | Rotary speed – 295 rpm; WOB – 3-4000 lb; Rate of Penetration - avg. 7 ft/hr

Bit number	Type	In, KB/date	Out, KB/date	Footage
		See pre-August 18 reports for prior bits		
9	Huddy 10 impreg	8290'/13 Aug	8461'/15 Aug	171'
10	Hobic 14 impreg	8461'/15 Aug	8508'/17 Aug	47'
11	Huddy 14 impreg	8508'/17 Aug	8525'/18 Aug	17'
12	Dimatec 12 impreg	8525'/18 Aug	8550'/20 Aug	25'
13	Hobic 14 impreg	8550'/20 Aug	8780'/24 Aug	230'
14	Christensen 10GD impreg	8780'/24 Aug	9164'/29 Aug	384'
15	Christensen 12PR impreg	9164'/30 Aug		

Drilling Assembly: 21' HQ core barrel, 2970' HMQ rods, xo, 4" Hydril 563 tubing

Surveys:	Depth	Inclination	Direction	Bottom-hole Temperature
	See pre-August 18 reports for prior surveys			
	8158'	8.4 ⁰	93 ⁰ true	na
	8322'	10.2 ⁰	na	223 ⁰ F
	8547'	11.6 ⁰	na	203 ⁰ F
	8628'	12.2 ⁰	91 ⁰ true	na
	8813'	13.2 ⁰	na	191 ⁰ F
	9006'	13.0 ⁰	na	187 ⁰ F
	9163'	13.2 ⁰	92 ⁰ true	na

Drilling fluid – Bentonite, dry polymer, fine walnut shells, soda ash

Flow rate - ~18 gal/min | Pressure - ~120 psi | Returns temp - na⁰F max | Wt - 8.4 lb/gal | Vis - 60 sec
 | Filtrate 6.8 cm³/30 min | PV - 30 cP | YP - 16 lb/100ft² | pH - 10 | Lost circulation - total

Lithology:

8970-9045 Limey beds increase in volume and metamorphic grade to marbles
 9045-9090 Hornfels full of open hydrothermal veining, particularly in marble beds
 9090- Hornfels becoming more silicic and graphitic

Summary of events last 24 hours:

Bit went after survey. Trip out and pick up new bit and four stands of HMQ. Rigging up to Temperature log through bit at 6600' at report time.

Report by: John Finger/Ron Jacobson

DAILY DRILLING REPORT – August 31, 1998
LONG VALLEY EXPLORATORY WELL

Time of report - 0700

Well number – LVF 51-20 | Location - Section 20, T3S, R28E, Mono County, CA

All depth measurements refer to KB; KB = 29' above ground level

Days since spud - 43 | Depth @ 0600 hrs – 9175' | Hole advance last 24 hr - 11' | Core recovered - 11'
 Last casing – Bushing string: 5", 19.5 lb/ft drill pipe from 7177' to 6600'; 5-1/2", 20 lb/ft Hydril tubing to surface; cemented to 6685'

Bits -- Now coring 3.850" hole | Rotary speed – 310 rpm; WOB – 3-5000 lb; Rate of Penetration - avg. 1 ft/hr

Bit number	Type	In, KB/date	Out, KB/date	Footage
See pre-August 18 reports for prior bits				
9	Huddy 10 impreg	8290'/13 Aug	8461'/15 Aug	171'
10	Hobic 14 impreg	8461'/15 Aug	8508'/17 Aug	47'
11	Huddy 14 impreg	8508'/17 Aug	8525'/18 Aug	17'
12	Dimatec 12 impreg	8525'/18 Aug	8550'/20 Aug	25'
13	Hobic 14 impreg	8550'/20 Aug	8780'/24 Aug	230'
14	Christensen 10GD impreg	8780'/24 Aug	9164'/29 Aug	384'
15	Christensen 12PR impreg	9164'/30 Aug		

Drilling Assembly: 21' HQ core barrel, 2970' HMQ rods, xo, 4" Hydril 563 tubing

Surveys:	Depth	Inclination	Direction	Bottom-hole Temperature
See pre-August 18 reports for prior surveys				
	8158'	8.4 ⁰	93 ⁰ true	na
	8322'	10.2 ⁰	na	223 ⁰ F
	8547'	11.6 ⁰	na	203 ⁰ F
	8628'	12.2 ⁰	91 ⁰ true	na
	8813'	13.2 ⁰	na	191 ⁰ F
	9006'	13.0 ⁰	na	187 ⁰ F
	9163'	13.2 ⁰	92 ⁰ true	na

Drilling fluid – Bentonite, dry polymer, fine walnut shells, soda ash

Flow rate - ~18 gal/min | Pressure - ~120 psi | Returns temp - na⁰F max | Wt – 8.4 lb/gal | Vis - 60 sec
 | Filtrate 6.8 cm³/30 min | PV - 30 cP | YP – 16 lb/100ft² | pH - 10 | Lost circulation - total

Lithology:

8970-9045	Limey beds increase in volume and metamorphic grade to marbles
9045-9090	Hornfels full of open hydrothermal veining, particularly in marble beds
9090-9165	Hornfels becoming more silicic and graphitic
9165	Quartzite

Summary of events last 24 hours:

Ran Temperature log through bit at 6512' to 9164' Hole open and clean to bottom. Maximum temperature 223⁰ F. Pump tube down and trip to bottom. Drill ahead in solid quartzite. Rate of penetration dropped to less than one foot per hour. Bit will not strip. Had to pull core after one foot to drop old bit matrix in an attempt to make bit strip.

Report by: John Finger/Ron Jacobson

DAILY DRILLING REPORT – September 1, 1998
LONG VALLEY EXPLORATORY WELL

Time of report - 0700

Well number – LVF 51-20 | Location - Section 20, T3S, R28E, Mono County, CA

All depth measurements refer to KB; KB = 29' above ground level

Days since spud - 44 | Depth @ 0600 hrs – 9209' | Hole advance last 24 hr - 34' | Core recovered - 34'

Last casing – Bushing string: 5", 19.5 lb/ft drill pipe from 7177' to 6600'; 5-1/2", 20 lb/ft Hydril tubing to surface; cemented to 6685'

Bits -- Now coring 3.850" hole | Rotary speed – 310 rpm; WOB – 3-5000 lb; Rate of Penetration - avg. 4 ft/hr

Bit number	Type	In, KB/date	Out, KB/date	Footage
		See pre-August 18 reports for prior bits		
9	Huddy 10 impreg	8290'/13 Aug	8461'/15 Aug	171'
10	Hobic 14 impreg	8461'/15 Aug	8508'/17 Aug	47'
11	Huddy 14 impreg	8508'/17 Aug	8525'/18 Aug	17'
12	Dimatec 12 impreg	8525'/18 Aug	8550'/20 Aug	25'
13	Hobic 14 impreg	8550'/20 Aug	8780'/24 Aug	230'
14	Christensen 10GD impreg	8780'/24 Aug	9164'/29 Aug	384'
15	Christensen 12PR impreg	9164'/30 Aug		

Drilling Assembly: 21' HQ core barrel, 2970' HMQ rods, xo, 4" Hydril 563 tubing

Surveys:	Depth	Inclination	Direction	Bottom-hole Temperature
		See pre-August 18 reports for prior surveys		
	8158'	8.4°	93° true	na
	8322'	10.2°	na	223° F
	8547'	11.6°	na	203° F
	8628'	12.2°	91° true	na
	8813'	13.2°	na	191° F
	9006'	13.0°	na	187° F
	9163'	13.2°	92° true	na

Drilling fluid – Bentonite, dry polymer, soda ash

Flow rate - ~18 gal/min | Pressure - ~100 psi | Returns temp - na°F max | Wt – 8.4 lb/gal | Vis - 60 sec

| Filtrate 6.8 cm³/30 min | PV - 30 cP | YP – 16 lb/100ft² | pH - 10 | Lost circulation - total

Lithology:

8970-9045	Limey beds increase in volume and metamorphic grade to marbles
9045-9090	Hornfels full of open hydrothermal veining, particularly in marble beds
9090-9165	Hornfels becoming more silicic and graphitic
9165-9183	Quartzite
9183-9207	Metapelite

Summary of events last 24 hours:

Rock is still hard but becoming more broken and is helping strip the bit. Coring ahead at report time.

Report by: John Finger/Ron Jacobson

DAILY DRILLING REPORT – September 2, 1998

LONG VALLEY EXPLORATORY WELL

Time of report - 0700

Well number – LVF 51-20 | Location - Section 20, T3S, R28E, Mono County, CA

All depth measurements refer to KB; KB = 29' above ground level

Days since spud - 45 | Depth @ 0600 hrs – 9281' | Hole advance last 24 hr - 72' | Core recovered - 72'

Last casing – Bushing string: 5", 19.5 lb/ft drill pipe from 7177' to 6600'; 5-1/2", 20 lb/ft Hydril tubing to surface; cemented to 6685'

Bits -- Now coring 3.850" hole | Rotary speed – 310 rpm; WOB – 3-5000 lb; Rate of Penetration - avg. 4 ft/hr

Bit number	Type	In, KB/date	Out, KB/date	Footage
		See pre-August 18 reports for prior bits		
9	Huddy 10 impreg	8290'/13 Aug	8461'/15 Aug	171'
10	Hobic 14 impreg	8461'/15 Aug	8508'/17 Aug	47'
11	Huddy 14 impreg	8508'/17 Aug	8525'/18 Aug	17'
12	Dimatec 12 impreg	8525'/18 Aug	8550'/20 Aug	25'
13	Hobic 14 impreg	8550'/20 Aug	8780'/24 Aug	230'
14	Christensen 10GD impreg	8780'/24 Aug	9164'/29 Aug	384'
15	Christensen 12PR impreg	9164'/30 Aug		

Drilling Assembly: 21' HQ core barrel, 2970' HMQ rods, xo, 4" Hydril 563 tubing

Surveys:	Depth	Inclination	Direction	Bottom-hole Temperature
	See pre-August 18 reports for prior surveys			
	8158'	8.4 ^o	93 ^o true	na
	8322'	10.2 ^o	na	223 ^o F
	8547'	11.6 ^o	na	203 ^o F
	8628'	12.2 ^o	91 ^o true	na
	8813'	13.2 ^o	na	191 ^o F
	9006'	13.0 ^o	na	187 ^o F
	9163'	13.2 ^o	92 ^o true	na

Drilling fluid – Bentonite, dry polymer, soda ash

Flow rate - ~18 gal/min | Pressure - ~100 psi | Returns temp - na^oF max | Wt – 8.4 lb/gal | Vis - 60 sec
| Filtrate 6.8 cm³/30 min | PV - 30 cP | YP – 16 lb/100ft² | pH - 10 | Lost circulation - total

Lithology:

8970-9045	Limey beds increase in volume and metamorphic grade to marbles
9045-9090	Hornfels full of open hydrothermal veining, particularly in marble beds
9090-9165	Hornfels becoming more silicic and graphitic
9165-9183	Quartzite
9183-9207	Cherty metapelitic hornfels
9207-9281	Altered hornfels and meta-volcanic intrusion

Summary of events last 24 hours:

Rock still broken with change in formation. Pulling core tube at report time.

Report by: John Finger/Ron Jacobson

DAILY DRILLING REPORT – September 3, 1998
LONG VALLEY EXPLORATORY WELL
 Time of report - 0700

Well number – LVF 51-20 | Location - Section 20, T3S, R28E, Mono County, CA

All depth measurements refer to KB; KB = 29' above ground level

Days since spud - 46 | Depth @ 0600 hrs – 9294' | Hole advance last 24 hr - 13' | Core recovered - 13'
 Last casing – Bushing string: 5", 19.5 lb/ft drill pipe from 7177' to 6600'; 5-1/2", 20 lb/ft Hydril tubing to surface; cemented to 6685'

Bits -- Now coring 3.850" hole | Rotary speed – 310 rpm; WOB – 3-5000 lb; Rate of Penetration - avg. 4 ft/hr

Bit number	Type	In, KB/date	Out, KB/date	Footage
		See pre-September 2 reports for prior bits		
13	Hobic 14 impreg	8550'/20 Aug	8780'/24 Aug	230'
14	Christensen 10GD impreg	8780'/24 Aug	9164'/29 Aug	384'
15	Christensen 12PR impreg	9164'/30 Aug	9292'/2 Sep	128'
16	Christensen 12PR impreg	9292'/2 Sep		

Drilling Assembly: 21' HQ core barrel, 3060' HMQ rods, xo, 4" Hydril 563 tubing

Surveys:	Depth	Inclination	Direction	Bottom-hole Temperature
		See pre-September 2 reports for prior surveys		
	8813'	13.2°	na	191° F
	9006'	13.0°	na	187° F
	9163'	13.2°	92° true	na
	9292'	13.3°	na	205° F

Drilling fluid – Bentonite, dry polymer, soda ash

Flow rate - ~18 gal/min | Pressure - ~100 psi | Returns temp - na° F max | Wt – 8.4 lb/gal | Vis - 60 sec
 | Filtrate 6.8 cm³/30 min | PV - 30 cP | YP – 16 lb/100ft² | pH - 10 | Lost circulation - total

Lithology:	Depth	Description
	9165-9183	Quartzite
	9183-9207	Cherty metapelitic hornfels
	9207-9292	Altered hornfels and meta-volcanic intrusion

Summary of events last 24 hours:

Cored through same formation to 9292'. Core-tube data logger gave results above; temperature is a significant increase over previous CTDL measurement. After retrieving that tube, could not drill. POOH for bit change. Tried coring, made 2' and were having difficulty drilling, pulled core tube and didn't retrieve core. Trying to drill ahead at 9294' at report time.

Report by: John Finger/Ron Jacobson

DAILY DRILLING REPORT – September 4, 1998
LONG VALLEY EXPLORATORY WELL

Time of report - 0700

Well number – LVF 51-20 | Location - Section 20, T3S, R28E, Mono County, CA

All depth measurements refer to KB; KB = 29' above ground level

Days since spud - 47 | Depth @ 0600 hrs – 9343' | Hole advance last 24 hr - 49' | Core recovered - 49'

Last casing – Bushing string: 5", 19.5 lb/ft drill pipe from 7177' to 6600'; 5-1/2", 20 lb/ft Hydril tubing to surface; cemented to 6685'

Bits – Now coring 3.850" hole | Rotary speed – 310 rpm; WOB – 3-5000 lb; Rate of Penetration - avg. 4 ft/hr

Bit number	Type	In, KB/date	Out, KB/date	Footage
	See pre-September 2 reports for prior bits			
13	Hobic 14 impreg	8550'/20 Aug	8780'/24 Aug	230'
14	Christensen 10GD impreg	8780'/24 Aug	9164'/29 Aug	384'
15	Christensen 12PR impreg	9164'/30 Aug	9292'/2 Sep	128'
16	Christensen 12PR impreg	9292'/2 Sep		

Drilling Assembly: 21' HQ core barrel, 3060' HMQ rods, xo, 4" Hydril 563 tubing

Surveys:	Depth	Inclination	Direction	Bottom-hole Temperature
	See pre-September 2 reports for prior surveys			
	8813'	13.2 ⁰	na	191 ⁰ F
	9006'	13.0 ⁰	na	187 ⁰ F
	9163'	13.2 ⁰	92 ⁰ true	na
	9292'	13.3 ⁰	na	205 ⁰ F

Drilling fluid – Bentonite, dry polymer, soda ash

Flow rate - ~18 gal/min | Pressure - ~200 psi | Returns temp - na⁰F max | Wt – 8.4 lb/gal | Vis - 60 sec
 | Filtrate 6.8 cm³/30 min | PV - 30 cP | YP – 16 lb/100ft² | pH - 10 | Lost circulation - total

Lithology:	Depth	Description
	9165-9183	Quartzite
	9183-9207	Cherty metapelitic hornfels
	9207-9292	Altered hornfels and meta-volcanic intrusion
	9292-9343	Banded metapelite/hornfels with occasional intrusions

Summary of events last 24 hours:

After considerable difficulty, were able to core ahead for about 1' and pull core tube. Got a short piece of core with four large fragments of the previous bit's crown on top of it. This had been the cause of extremely slow progress for a couple of hours but, once the junk was retrieved, drilling proceeded at a reasonably good rate. Cored ahead with runs mostly around 10'. Coring ahead at 9350' at report time.

Report by: John Finger/Ron Jacobson

DAILY DRILLING REPORT – September 5, 1998
LONG VALLEY EXPLORATORY WELL

Time of report - 0700

Well number – LVF 51-20 | Location - Section 20, T3S, R28E, Mono County, CA

All depth measurements refer to KB; KB = 29' above ground level

Days since spud - 48 | Depth @ 0600 hrs – 9403' | Hole advance last 24 hr - 60' | Core recovered - 60'

Last casing – Bushing string: 5", 19.5 lb/ft drill pipe from 7177' to 6600'; 5-1/2", 20 lb/ft Hydril tubing to surface; cemented to 6685'

Bits -- Now coring 3.850" hole | Rotary speed – 310 rpm; WOB – 3-5000 lb; Rate of Penetration - avg. 4 ft/hr

Bit number	Type	In, KB/date	Out, KB/date	Footage
	See pre-September 2 reports for prior bits			
13	Hobic 14 impreg	8550'/20 Aug	8780'/24 Aug	230'
14	Christensen 10GD impreg	8780'/24 Aug	9164'/29 Aug	384'
15	Christensen 12PR impreg	9164'/30 Aug	9292'/2 Sep	128'
16	Christensen 12PR impreg	9292'/2 Sep		

Drilling Assembly: 21' HQ core barrel, 3060' HMQ rods, xo, 4" Hydril 563 tubing

Surveys:	Depth	Inclination	Direction	Bottom-hole Temperature
	See pre-September 2 reports for prior surveys			
	8813'	13.2 ^o	na	191 ^o F
	9006'	13.0 ^o	na	187 ^o F
	9163'	13.2 ^o	92 ^o true	na
	9292'	13.3 ^o	na	205 ^o F

Drilling fluid – Bentonite, dry polymer, soda ash

Flow rate - ~18 gal/min | Pressure - ~200 psi | Returns temp - na^oF max | Wt – 8.4 lb/gal | Vis - 60 sec
 | Filtrate 6.8 cm³/30 min | PV - 30 cP | YP – 16 lb/100ft² | pH - 10 | Lost circulation - total

Lithology:	Depth	Description
	9165-9183	Quartzite
	9183-9207	Cherty metapelitic hornfels
	9207-9292	Altered hornfels and meta-volcanic intrusion
	9292-9382	Banded metapelite/hornfels with occasional intrusions
	9382-9388	Altered intrusion
	9388-9403	Metapelite hornfels

Summary of events last 24 hours:

Continued coring at a better ROP (~ 8 ft/hr) to 9371' and pulled a full 21' tube. Cored ahead to 9403' in four more runs. Pulling core tube from 9423' at report time.

Report by: John Finger/Ron Jacobson

DAILY DRILLING REPORT – September 6, 1998
LONG VALLEY EXPLORATORY WELL

Time of report - 0700

Well number – LVF 51-20 | Location - Section 20, T3S, R28E, Mono County, CA

All depth measurements refer to KB; KB = 29' above ground level

Days since spud - 49 | Depth @ 0600 hrs – 9457' | Hole advance last 24 hr - 54' | Core recovered - 54'
 Last casing – Bushing string: 5", 19.5 lb/ft drill pipe from 7177' to 6600'; 5-1/2", 20 lb/ft Hydril tubing to surface; cemented to 6685'

Bits -- Now coring 3.850" hole | Rotary speed – 310 rpm; WOB – 3-5000 lb; Rate of Penetration - avg. 4 ft/hr

Bit number	Type	In, KB/date	Out, KB/date	Footage
		See pre-September 2 reports for prior bits		
13	Hobic 14 impreg	8550'/20 Aug	8780'/24 Aug	230'
14	Christensen 10GD impreg	8780'/24 Aug	9164'/29 Aug	384'
15	Christensen 12PR impreg	9164'/30 Aug	9292'/2 Sep	128'
16	Christensen 12PR impreg	9292'/2 Sep		

Drilling Assembly: 21' HQ core barrel, 3060' HMQ rods, xo, 4" Hydril 563 tubing

Surveys:	Depth	Inclination	Direction	Bottom-hole Temperature
		See pre-September 2 reports for prior surveys		
	8813'	13.2°	na	191° F
	9006'	13.0°	na	187° F
	9163'	13.2°	92° true	na
	9292'	13.3°	na	205° F

Drilling fluid – Bentonite, dry polymer, soda ash

Flow rate - ~18 gal/min | Pressure - ~200 psi | Returns temp - na°F max | Wt – 8.4 lb/gal | Vis - 60 sec
 | Filtrate 6.8 cm³/30 min | PV - 30 cP | YP – 16 lb/100ft² | pH - 10 | Lost circulation - total

Lithology:	9292-9382	Banded metapelite/hornfels with occasional intrusions
	9382-9388	Altered intrusion
	9388-9457	Metapelite hornfels

Summary of events last 24 hours:

Cored to 9441' in two runs, then could not drill because of apparent block. Pulled tube with less than 1' of core and tried again; continued drilling. Cored one run from 9457' to 9470' in seven hours. Working on stuck tube at 9470' at report time.

Report by: John Finger/Ron Jacobson

DAILY DRILLING REPORT – September 7, 1998
LONG VALLEY EXPLORATORY WELL
 Time of report - 0700

Well number – LVF 51-20 | Location - Section 20, T3S, R28E, Mono County, CA

All depth measurements refer to KB; KB = 29' above ground level
 Days since spud - 50 | Depth @ 0600 hrs – 9473' | Hole advance last 24 hr - 16' | Core recovered - 16'
 Last casing – Bushing string: 5", 19.5 lb/ft drill pipe from 7177' to 6600'; 5-1/2", 20 lb/ft Hydril tubing to surface; cemented to 6685'

Bits – Now coring 3.850" hole | Rotary speed – 310 rpm; WOB – 3-5000 lb; Rate of Penetration - avg. 4 ft/hr

Bit number	Type	In, KB/date	Out, KB/date	Footage
	See pre-September 2 reports for prior bits			
13	Hobic 14 impreg	8550'/20 Aug	8780'/24 Aug	230'
14	Christensen 10GD impreg	8780'/24 Aug	9164'/29 Aug	384'
15	Christensen 12PR impreg	9164'/30 Aug	9292'/2 Sep	128'
16	Christensen 12PR impreg	9292'/2 Sep	9470'/6 Sept	178'
17	Huddy H14 impreg	9470'/6 Sept		

Drilling Assembly: 21' HQ core barrel, 3240' HMQ rods, xo, 4" Hydril 563 tubing

Surveys:	Depth	Inclination	Direction	Bottom-hole Temperature
	See pre-September 2 reports for prior surveys			
	8813'	13.2 ⁰	na	191 ⁰ F
	9006'	13.0 ⁰	na	187 ⁰ F
	9163'	13.2 ⁰	92 ⁰ true	na
	9292'	13.3 ⁰	na	205 ⁰ F

Drilling fluid – Bentonite, dry polymer, soda ash

Flow rate - ~18 gal/min | Pressure - ~300 psi | Returns temp - na⁰F max | Wt – 8.4 lb/gal | Vis - 47 sec
 | Filtrate 6.8 cm³/30 min | PV - 30 cP | YP – 16 lb/100ft² | pH - 10 | Lost circulation - total

Lithology:	9292-9382	Banded metapelite/hornfels with occasional intrusions
	9382-9388	Altered intrusion
	9388-9457	Metapelite hornfels

Summary of events last 24 hours:

Cored eight hours to get 13'. Tried to pull inner tube but it was stuck. Finally got inner tube free (coupling was belled and core catcher spring failed) and recovered 7' of core (out of 13' drilled.) Ran tube back in to try drilling again, but wouldn't drill and was pressuring up. Pull tube but no core. POOH for new bit and to clear possible dropped core. Found one connection in HMQ with pin and box both cracked; laid down both singles. Bit was fairly green and about 2-3' of core was in tube. Inner tube stuck in core barrel, worked it free. Picked up Huddy H14T bit and 2 stands + 2 singles of HMQ rod, RIH. Set down on dropped core at 8083'. Ream and wash to bottom. Recovered dropped core. Coring ahead at 9485' at report time.

Report by: John Finger/Ron Jacobson

DAILY DRILLING REPORT – September 8, 1998
LONG VALLEY EXPLORATORY WELL

Time of report - 0700

Well number – LVF 51-20 | Location - Section 20, T3S, R28E, Mono County, CA

All depth measurements refer to KB; KB = 29' above ground level

Days since spud - 51 | Depth @ 0600 hrs – 9549' | Hole advance last 24 hr -76' | Core recovered - 76'

Last casing – Bushing string: 5", 19.5 lb/ft drill pipe from 7177' to 6600'; 5-1/2", 20 lb/ft Hydril tubing to surface; cemented to 6685'

Bits -- Now coring 3.850" hole | Rotary speed – 310 rpm; WOB – 3-5000 lb; Rate of Penetration - avg. 4 ft/hr

Bit number	Type	In, KB/date	Out, KB/date	Footage
	See pre-September 2 reports for prior bits			
13	Hobic 14 impreg	8550'/20 Aug	8780'/24 Aug	230'
14	Christensen 10GD impreg	8780'/24 Aug	9164'/29 Aug	384'
15	Christensen 12PR impreg	9164'/30 Aug	9292'/2 Sep	128'
16	Christensen 12PR impreg	9292'/2 Sep	9470'/6 Sept	178'
17	Huddy H14 impreg	9470'/6 Sept		

Drilling Assembly: 21' HQ core barrel, 3240' HMQ rods, xo, 4" Hydril 563 tubing

Surveys:	Depth	Inclination	Direction	Bottom-hole Temperature
	See pre-September 2 reports for prior surveys			
	8813'	13.2°	na	191° F
	9006'	13.0°	na	187° F
	9163'	13.2°	92° true	na
	9292'	13.3°	na	205° F
	9512'	15.0°	na	199° F

Drilling fluid – Bentonite, dry polymer, soda ash

Flow rate - ~18 gal/min | Pressure - ~300 psi | Returns temp - na° F max | Wt – 8.4 lb/gal | Vis - 55 sec

| Filtrate 6.8 cm³/30 min | PV - 30 cP | YP – 16 lb/100ft² | pH - 10 | Lost circulation - total

Lithology:	Depth	Description
	9292-9382	Banded metapelite/hornfels with occasional intrusions
	9382-9388	Altered intrusion
	9388-9538	Metapelite hornfels
	9538-9549	Marble

Summary of events last 24 hours:

Cored ahead from 9485' to 9504', then to 9512' with CTDL on board (survey results above). Cut undersized core with new bit (2.450" instead of 2.500") but gage is coming back to normal with more use. Last 5 runs have averaged over 10'. Pulling tube from 9560' at report time.

Report by: John Finger/Ron Jacobson

DAILY DRILLING REPORT – September 9, 1998

LONG VALLEY EXPLORATORY WELL

Time of report - 0700

Well number – LVF 51-20 | Location - Section 20, T3S, R28E, Mono County, CA

All depth measurements refer to KB; KB = 29' above ground level

Days since spud - 52 | Depth @ 0600 hrs – 9639' | Hole advance last 24 hr - 90' | Core recovered -90'

Last casing – Bushing string: 5", 19.5 lb/ft drill pipe from 7177' to 6600'; 5-1/2", 20 lb/ft Hydril tubing to surface; cemented to 6685'

Bits -- Now coring 3.850" hole | Rotary speed – 310 rpm; WOB – 3-5000 lb; Rate of Penetration - avg. 4 ft/hr

Bit number	Type	In, KB/date	Out, KB/date	Footage
		See pre-September 2 reports for prior bits		
13	Hobic 14 impreg	8550'/20 Aug	8780'/24 Aug	230'
14	Christensen 10GD impreg	8780'/24 Aug	9164'/29 Aug	384'
15	Christensen 12PR impreg	9164'/30 Aug	9292'/2 Sep	128'
16	Christensen 12PR impreg	9292'/2 Sep	9470'/6 Sept	178'
17	Huddy H14 impreg	9470'/6 Sept		

Drilling Assembly: 21' HQ core barrel, 3240' HMQ rods, xo, 4" Hydril 563 tubing

Surveys:	Depth	Inclination	Direction	Bottom-hole Temperature
		See pre-September 2 reports for prior surveys		
	8813'	13.2°	na	191° F
	9006'	13.0°	na	187° F
	9163'	13.2°	92° true	na
	9292'	13.3°	na	205° F
	9512'	15.0°	na	199° F

Drilling fluid – Bentonite, dry polymer, liquid polymer, soda ash

Flow rate - ~18 gal/min | Pressure - ~300 psi | Returns temp - na°F max | Wt – 8.4 lb/gal | Vis - 50 sec | Filtrate 6.8 cm³/30 min | PV - 30 cP | YP – 16 lb/100ft² | pH - 10 | Lost circulation - total

Lithology:	Interval	Description
	9292-9382	Banded metapelite/hornfels with occasional intrusions
	9382-9388	Altered intrusion
	9388-9538	Metapelite hornfels
	9538-9549	Marble
	9549-9639	Marble interbedded with hornfels

Summary of events last 24 hours:

Core diameter coming back (2.483") to normal, so apparently bit is wearing back to nominal ID (2.500"). Some long runs; got 90' in seven runs. Pumping down inner tube at report time.

Report by: John Finger/Ron Jacobson

DAILY DRILLING REPORT – September 10, 1998
LONG VALLEY EXPLORATORY WELL

Time of report - 0700

Well number – LVF 51-20 | Location - Section 20, T3S, R28E, Mono County, CA

All depth measurements refer to KB; KB = 29' above ground level

Days since spud - 53 | Depth @ 0600 hrs – 9665' | Hole advance last 24 hr - 26' | Core recovered - 26'
 Last casing – Bushing string: 5", 19.5 lb/ft drill pipe from 7177' to 6600'; 5-1/2", 20 lb/ft Hydril tubing to surface; cemented to 6685'

Bits -- Now coring 3.850" hole | Rotary speed – 310 rpm; WOB – 3-5000 lb; Rate of Penetration - avg. 4 ft/hr

Bit number	Type	In, KB/date	Out, KB/date	Footage
See pre-September 2 reports for prior bits				
13	Hobic 14 impreg	8550'/20 Aug	8780'/24 Aug	230'
14	Christensen 10GD impreg	8780'/24 Aug	9164'/29 Aug	384'
15	Christensen 12PR impreg	9164'/30 Aug	9292'/2 Sep	128'
16	Christensen 12PR impreg	9292'/2 Sep	9470'/6 Sept	178'
17	Huddy H14 impreg	9470'/6 Sept	9665'/10 Sep	195'
18	Christensen 10GD impreg	9665'/10 Sep		

Drilling Assembly: 21' HQ core barrel, 3510' HMQ rods, xo, 4" Hydril 563 tubing

Surveys:	Depth	Inclination	Direction	Bottom-hole Temperature
See pre-September 2 reports for prior surveys				
	8813'	13.2 ⁰	na	191 ⁰ F
	9006'	13.0 ⁰	na	187 ⁰ F
	9163'	13.2 ⁰	92 ⁰ true	na
	9292'	13.3 ⁰	na	205 ⁰ F
	9512'	15.0 ⁰	na	199 ⁰ F

Drilling fluid – Bentonite, dry polymer, liquid polymer, soda ash

Flow rate - ~18 gal/min | Pressure - ~300 psi | Returns temp - na⁰F max | Wt – 8.4 lb/gal | Vis - 50 sec
 | Filtrate 6.8 cm³/30 min | PV - 30 cP | YP – 16 lb/100ft² | pH - 10 | Lost circulation - total

Lithology:	Depth	Description
	9292-9382	Banded metapelite/hornfels with occasional intrusions
	9382-9388	Altered intrusion
	9388-9538	Metapelite hornfels
	9538-9549	Marble
	9549-9639	Marble interbedded with hornfels

Summary of events last 24 hours:

Cored to 9665' in very broken rock (26' in seven runs.) Inside gauge of bit is worn out; tripping for bit change at report time.

Report by: John Finger/Ron Jacobson

DAILY DRILLING REPORT – September 11, 1998
LONG VALLEY EXPLORATORY WELL
 Time of report - 0700

Well number – LVF 51-20 | Location - Section 20, T3S, R28E, Mono County, CA

All depth measurements refer to KB; KB = 29' above ground level
 Days since spud - 54 | Depth @ 0600 hrs – 9707' | Hole advance last 24 hr - 42' | Core recovered - 42'
 Last casing – Bushing string: 5", 19.5 lb/ft drill pipe from 7177' to 6600'; 5-1/2", 20 lb/ft Hydril tubing to surface; cemented to 6685'

Bits – Now coring 3.850" hole | Rotary speed – 310 rpm; WOB – 3-5000 lb; Rate of Penetration - avg. 4 ft/hr

Bit number	Type	In, KB/date	Out, KB/date	Footage
		See pre-September 2 reports for prior bits		
13	Hobic 14 impreg	8550'/20 Aug	8780'/24 Aug	230'
14	Christensen 10GD impreg	8780'/24 Aug	9164'/29 Aug	384'
15	Christensen 12PR impreg	9164'/30 Aug	9292'/2 Sep	128'
16	Christensen 12PR impreg	9292'/2 Sep	9470'/6 Sept	178'
17	Huddy H14 impreg	9470'/6 Sept	9665'/10 Sep	195'
18	Christensen 10GD impreg	9665'/10 Sep		

Drilling Assembly: 21' HQ core barrel, 3510' HMQ rods, xo, 4" Hydril 563 tubing

Surveys:	Depth	Inclination	Direction	Bottom-hole Temperature
	See pre-September 2 reports for prior surveys			
	8813'	13.2 ^o	na	191 ^o F
	9006'	13.0 ^o	na	187 ^o F
	9163'	13.2 ^o	92 ^o true	na
	9292'	13.3 ^o	na	205 ^o F
	9512'	15.0 ^o	na	199 ^o F

Drilling fluid – Bentonite, dry polymer, liquid polymer, soda ash

Flow rate - ~18 gal/min | Pressure - ~300 psi | Returns temp - na^oF max | Wt – 8.4 lb/gal | Vis - 50 sec
 | Filtrate 6.8 cm³/30 min | PV - 30 cP | YP – 16 lb/100ft² | pH - 10 | Lost circulation - total

Lithology:	Depth	Description
	9292-9382	Banded metapelite/hornfels with occasional intrusions
	9382-9388	Altered intrusion
	9388-9538	Metapelite hornfels
	9538-9549	Marble
	9549-9639	Marble interbedded with hornfels; marble appears porous
	9639-9707	Hornfels

Summary of events last 24 hours:

Ran in hole with new bit and cored to 9707' in four runs. Rock is more competent now, apparently out of the fault that was causing very short runs just before bit trip. Pulled tube from 9707' and found that pipe was stuck. Could not move up or down or rotate. Pulling tube for higher pump rate at report time.

Report by: John Finger/Ron Jacobson

DAILY DRILLING REPORT – September 12, 1998
LONG VALLEY EXPLORATORY WELL

Time of report - 0700

Well number – LVF 51-20 | Location - Section 20, T3S, R28E, Mono County, CA

All depth measurements refer to KB; KB = 29' above ground level

Days since spud - 55 | Depth @ 0600 hrs – 9707' | Hole advance last 24 hr - 0' | Core recovered - 0'

Last casing – Bushing string: 5", 19.5 lb/ft drill pipe from 7177' to 6600'; 5-1/2", 20 lb/ft Hydril tubing to surface; cemented to 6685'

Bits -- Now coring 3.850" hole | Rotary speed – 0 rpm; WOB – 0 lb; Rate of Penetration - avg. 0 ft/hr

Bit number	Type	In, KB/date	Out, KB/date	Footage
See pre-September 2 reports for prior bits				
13	Hobic 14 impreg	8550'/20 Aug	8780'/24 Aug	230'
14	Christensen 10GD impreg	8780'/24 Aug	9164'/29 Aug	384'
15	Christensen 12PR impreg	9164'/30 Aug	9292'/2 Sep	128'
16	Christensen 12PR impreg	9292'/2 Sep	9470'/6 Sept	178'
17	Huddy H14 impreg	9470'/6 Sept	9665'/10 Sep	195'
18	Christensen 10GD impreg	9665'/10 Sep		

Drilling Assembly: 21' HQ core barrel, 3510' HMQ rods, xo, 4" Hydril 563 tubing

Surveys:	Depth	Inclination	Direction	Bottom-hole Temperature
See pre-September 2 reports for prior surveys				
	8813'	13.2 ⁰	na	191 ⁰ F
	9006'	13.0 ⁰	na	187 ⁰ F
	9163'	13.2 ⁰	92 ⁰ true	na
	9292'	13.3 ⁰	na	205 ⁰ F
	9512'	15.0 ⁰	na	199 ⁰ F

Drilling fluid – Bentonite, dry polymer, liquid polymer, soda ash

Flow rate - ~18 gal/min | Pressure - ~300 psi | Returns temp - na⁰F max | Wt – 8.4 lb/gal | Vis - 50 sec
 | Filtrate 6.8 cm³/30 min | PV - 30 cP | YP – 16 lb/100ft² | pH - 10 | Lost circulation - total

Lithology:	Depth	Description
	9292-9382	Banded metapelite/hornfels with occasional intrusions
	9382-9388	Altered intrusion
	9388-9538	Metapelite hornfels
	9538-9549	Marble
	9549-9639	Marble interbedded with hornfels; marble appears porous
	9639-9707	Hornfels

Summary of events last 24 hours:

Pumped a polymer sweep around stuck pipe then fresh water. Worked stuck pipe. Pipe came free while pumping water with 40,000 lb of over pull. Lowered inner tube on wire line. Sat down at ~ 8200'. POOH. Pin failed at 8132'. Pick up spear and RIH. Stab into top of fish, pull up with 40,000 lb, fish comes free. POOH with fish, inspect core barrel and bit, both OK. Running back in hole with coring assembly at report time.

Report by: John Finger/Ron Jacobson

DAILY DRILLING REPORT – September 13, 1998
LONG VALLEY EXPLORATORY WELL

Time of report - 0700

Well number – LVF 51-20 | Location - Section 20, T3S, R28E, Mono County, CA

All depth measurements refer to KB; KB = 29' above ground level

Days since spud - 57 | Depth @ 0600 hrs – 9768' | Hole advance last 24 hr - 61' | Core recovered - 61'
 Last casing – Bushing string: 5", 19.5 lb/ft drill pipe from 7177' to 6600'; 5-1/2", 20 lb/ft Hydril tubing to surface; cemented to 6685'

Bits -- Now coring 3.850" hole | Rotary speed – 285 rpm; WOB – 3000 lb; Rate of Penetration - avg. 4 ft/hr

Bit number	Type	In, KB/date	Out, KB/date	Footage
		See pre-September 2 reports for prior bits		
13	Hobic 14 impreg	8550'/20 Aug	8780'/24 Aug	230'
14	Christensen 10GD impreg	8780'/24 Aug	9164'/29 Aug	384'
15	Christensen 12PR impreg	9164'/30 Aug	9292'/2 Sep	128'
16	Christensen 12PR impreg	9292'/2 Sep	9470'/6 Sept	178'
17	Huddy H14 impreg	9470'/6 Sept	9665'/10 Sep	195'
18	Christensen 10GD impreg	9665'/10 Sep		

Drilling Assembly: 21' HQ core barrel, 3510' HMQ rods, xo, 4" Hydril 563 tubing

Surveys:	Depth	Inclination	Direction	Bottom-hole Temperature
		See pre-September 2 reports for prior surveys		
	8813'	13.2 ^o	na	191 ^o F
	9006'	13.0 ^o	na	187 ^o F
	9163'	13.2 ^o	92 ^o true	na
	9292'	13.3 ^o	na	205 ^o F
	9512'	15.0 ^o	na	199 ^o F

Drilling fluid – Bentonite, dry polymer, liquid polymer, soda ash

Flow rate - ~18 gal/min | Pressure - ~300 psi | Returns temp - na^oF max | Wt – 8.4 lb/gal | Vis - 50 sec
 | Filtrate 6.8 cm³/30 min | PV - 30 cP | YP – 16 lb/100ft² | pH - 10 | Lost circulation - total

Lithology:	Depth	Description
	9538-9549	Marble
	9549-9639	Marble interbedded with hornfels; marble appears porous
	9639-9707	Hornfels

Summary of events last 24 hours:

Completed running in hole to 9707'. Circulated mud back into wellbore (had used water to try washing away possible gel seal around sticking.) Cored ahead in generally competent rock (marble and hornfels). Rotating core pipe with rotary table while retrieving core. Pumping tube down at report time.

Report by: John Finger/Ron Jacobson

DAILY DRILLING REPORT – September 14, 1998
LONG VALLEY EXPLORATORY WELL

Time of report - 0700

Well number – LVF 51-20 | Location - Section 20, T3S, R28E, Mono County, CA

All depth measurements refer to KB; KB = 29' above ground level

Days since spud - 57 | Depth @ 0600 hrs – 9817' | Hole advance last 24 hr - 49' | Core recovered - 49'
 Last casing – Bushing string: 5", 19.5 lb/ft drill pipe from 7177' to 6600'; 5-1/2", 20 lb/ft Hydril tubing to surface; cemented to 6685'

Bits -- Now coring 3.850" hole | Rotary speed – 285 rpm; WOB – 3000 lb; Rate of Penetration - avg. 4 ft/hr

Bit number	Type	In, KB/date	Out, KB/date	Footage
		See pre-September 2 reports for prior bits		
13	Hobic 14 impreg	8550'/20 Aug	8780'/24 Aug	230'
14	Christensen 10GD impreg	8780'/24 Aug	9164'/29 Aug	384'
15	Christensen 12PR impreg	9164'/30 Aug	9292'/2 Sep	128'
16	Christensen 12PR impreg	9292'/2 Sep	9470'/6 Sept	178'
17	Huddy H14 impreg	9470'/6 Sept	9665'/10 Sep	195'
18	Christensen 10GD impreg	9665'/10 Sep		

Drilling Assembly: 21' HQ core barrel, 3510' HMQ rods, xo, 4" Hydril 563 tubing

Surveys:	Depth	Inclination	Direction	Bottom-hole Temperature
	See pre-September 2 reports for prior surveys			
	8813'	13.2°	na	191° F
	9006'	13.0°	na	187° F
	9163'	13.2°	92° true	na
	9292'	13.3°	na	205° F
	9512'	15.0°	na	199° F
	9790'	15.6°	91° true	na

Drilling fluid – Bentonite, dry polymer, liquid polymer, soda ash

Flow rate - ~18 gal/min | Pressure - ~300 psi | Returns temp - na°F max | Wt – 8.4 lb/gal | Vis - 65 sec
 | Filtrate 6.8 cm³/30 min | PV - 30 cP | YP – 16 lb/100ft² | pH - 10 | Lost circulation - total

Lithology:	Depth	Description
	9538-9549	Marble
	9549-9639	Marble interbedded with hornfels; marble appears porous
	9639-9707	Hornfels
	9707-9817	Marble with occasional hornfels

Summary of events last 24 hours:

Cored ahead in generally competent rock (marble and hornfels) with long runs from 9768'. Some problems with mud mixing, were getting intermittent slugs of low-viscosity mud, which was causing torque, low rotary speed, and low ROP. Circulated out low-vis mud and had good drilling, but with low ROP. Coring at 9830' at report time.

Report by: John Finger/Ron Jacobson

DAILY DRILLING REPORT – September 15, 1998
LONG VALLEY EXPLORATORY WELL
 Time of report - 0700

Well number – LVF 51-20 | Location - Section 20, T3S, R28E, Mono County, CA

All depth measurements refer to KB; KB = 29' above ground level
 Days since spud - 58 | Depth @ 0600 hrs – 9832' | Hole advance last 24 hr - 15' | Core recovered - 15'
 Last casing – Bushing string: 5", 19.5 lb/ft drill pipe from 7177' to 6600'; 5-1/2", 20 lb/ft Hydril tubing to surface; cemented to 6685'

Bits -- Now coring 3.850" hole | Rotary speed – 285 rpm; WOB – 3000 lb; Rate of Penetration - avg. 4 ft/hr

Bit number	Type	In, KB/date	Out, KB/date	Footage
See pre-September 2 reports for prior bits				
13	Hobic 14 impreg	8550'/20 Aug	8780'/24 Aug	230'
14	Christensen 10GD impreg	8780'/24 Aug	9164'/29 Aug	384'
15	Christensen 12PR impreg	9164'/30 Aug	9292'/2 Sep	128'
16	Christensen 12PR impreg	9292'/2 Sep	9470'/6 Sept	178'
17	Huddy H14 impreg	9470'/6 Sept	9665'/10 Sep	195'
18	Christensen 10GD impreg	9665'/10 Sep		

Drilling Assembly: 21' HQ core barrel, 3510' HMQ rods, xo, 4" Hydril 563 tubing

Surveys:	Depth	Inclination	Direction	Bottom-hole Temperature
See pre-September 2 reports for prior surveys				
	8813'	13.2°	na	191° F
	9006'	13.0°	na	187° F
	9163'	13.2°	92° true	na
	9292'	13.3°	na	205° F
	9512'	15.0°	na	199° F
	9790'	15.6°	91° true	na

Drilling fluid – Bentonite, dry polymer, liquid polymer, soda ash

Flow rate - ~18 gal/min | Pressure - ~300 psi | Returns temp - na°F max | Wt – 8.4 lb/gal | Vis - 65 sec
 | Filtrate 6.8 cm³/30 min | PV - 30 cP | YP – 16 lb/100ft² | pH - 10 | Lost circulation - total

Lithology:	Depth	Description
	9538-9549	Marble
	9549-9639	Marble interbedded with hornfels; marble appears porous
	9639-9707	Hornfels
	9707-9817	Marble with occasional hornfels

Summary of events last 24 hours:

Coring was very slow to 9832'; tried a nut on the bit, but it still didn't strip. Tried to pull inner tube but it was stuck and wireline pulled out of rope socket. POOH wet. Core had jammed in inner tube and belled case. RIH and wash to 9821'. Condition mud. Pulling out of hole for logging at report time.

Report by: John Finger/Ron Jacobson

DAILY DRILLING REPORT – September 16, 1998
LONG VALLEY EXPLORATORY WELL

Time of report - 0700

Well number – LVF 51-20 | Location - Section 20, T3S, R28E, Mono County, CA

All depth measurements refer to KB; KB = 29' above ground level

Days since spud - 59 | Depth @ 0600 hrs – 9832' | Hole advance last 24 hr - 0' | Core recovered - 0'

Last casing – Bushing string: 5", 19.5 lb/ft drill pipe from 7177' to 6600'; 5-1/2", 20 lb/ft Hydril tubing to surface; cemented to 6685'

Bits -- Now coring 3.850" hole | Rotary speed – 285 rpm; WOB – 3000 lb; Rate of Penetration - avg. 4 ft/hr

Bit number	Type	In, KB/date	Out, KB/date	Footage
See pre-September 2 reports for prior bits				
13	Hobic 14 impreg	8550'/20 Aug	8780'/24 Aug	230'
14	Christensen 10GD impreg	8780'/24 Aug	9164'/29 Aug	384'
15	Christensen 12PR impreg	9164'/30 Aug	9292'/2 Sep	128'
16	Christensen 12PR impreg	9292'/2 Sep	9470'/6 Sept	178'
17	Huddy H14 impreg	9470'/6 Sept	9665'/10 Sep	195'
18	Christensen 10GD impreg	9665'/10 Sep	9832'/15 Sep	167'

Drilling Assembly: 21' HQ core barrel, 3510' HMQ rods, xo, 4" Hydril 563 tubing

Surveys:	Depth	Inclination	Direction	Bottom-hole Temperature
See pre-September 2 reports for prior surveys				
	8813'	13.2 ⁰	na	191 ⁰ F
	9006'	13.0 ⁰	na	187 ⁰ F
	9163'	13.2 ⁰	92 ⁰ true	na
	9292'	13.3 ⁰	na	205 ⁰ F
	9512'	15.0 ⁰	na	199 ⁰ F
	9790'	15.6 ⁰	91 ⁰ true	na

Drilling fluid – Bentonite, dry polymer, liquid polymer, soda ash

Flow rate - ~18 gal/min | Pressure - ~300 psi | Returns temp - na⁰F max | Wt - 8.4 lb/gal | Vis - 65 sec
 | Filtrate 6.8 cm³/30 min | PV - 30 cP | YP - 16 lb/100ft² | pH - 10 | Lost circulation - total

Lithology:	Depth	Description
	9538-9549	Marble
	9549-9639	Marble interbedded with hornfels; marble appears porous
	9639-9707	Hornfels
	9707-9832	Marble with occasional hornfels

Summary of events last 24 hours:

Pulled out of hole. Ran 10 stands of 4" pipe back in (to counteract pump pressure) and rigged up to do PTS log with the memory tool configured for surface readout. Did a complete hole traverse to TD with no flow and pulled tool back into casing. Injected at three flow rates (50, 80, and 110 gpm) until downhole pressure stabilized at each flow rate, then ran a traverse to bottom while pumping 110 gpm. Temperature log showed that most fluid was going out of the hole at about 8500', but we could not confirm this with the spinner because it was jammed by a rock. Pulled PTS tool out of hole and rigged up for televiwer log. Completing BHTV log at report time.

Report by: John Finger/Ron Jacobson

DAILY DRILLING REPORT – September 17, 1998
LONG VALLEY EXPLORATORY WELL

Time of report - 0700

Well number – LVF 51-20 | Location - Section 20, T3S, R28E, Mono County, CA

All depth measurements refer to KB; KB = 29' above ground level

Days since spud - 60 | Depth @ 0600 hrs – 9832' | Hole advance last 24 hr - 0' | Core recovered - 0'

Last casing – Bushing string: 5", 19.5 lb/ft drill pipe from 7177' to 6600'; 5-1/2", 20 lb/ft Hydril tubing to surface; cemented to 6685'

Bits --na

Bit number	Type	In, KB/date	Out, KB/date	Footage
	See pre-September 2 reports for prior bits			
13	Hobic 14 impreg	8550'/20 Aug	8780'/24 Aug	230'
14	Christensen 10GD impreg	8780'/24 Aug	9164'/29 Aug	384'
15	Christensen 12PR impreg	9164'/30 Aug	9292'/2 Sep	128'
16	Christensen 12PR impreg	9292'/2 Sep	9470'/6 Sept	178'
17	Huddy H14 impreg	9470'/6 Sept	9665'/10 Sep	195'
18	Christensen 10GD impreg	9665'/10 Sep	9832'/15 Sep	167'

Surveys:	Depth	Inclination	Direction	Bottom-hole Temperature
	See pre-September 2 reports for prior surveys			
	8813'	13.2°	na	191° F
	9006'	13.0°	na	187° F
	9163'	13.2°	92° true	na
	9292'	13.3°	na	205° F
	9512'	15.0°	na	199° F
	9790'	15.6°	91° true	na

Drilling fluid – na

Lithology:	Depth	Description
	9538-9549	Marble
	9549-9639	Marble interbedded with hornfels; marble appears porous
	9639-9707	Hornfels
	9707-9832	Marble with occasional hornfels

Summary of events last 24 hours:

Rig down BHTV and pull out of hole.

at report time.

Report by: John Finger/Ron Jacobson

DAILY DRILLING REPORT – September 18, 1998
LONG VALLEY EXPLORATORY WELL

Time of report - 0700

Well number – LVF 51-20 | Location - Section 20, T3S, R28E, Mono County, CA

All depth measurements refer to KB; KB = 29' above ground level

Days since spud - 61 | Depth @ 0600 hrs – 9832' | Hole advance last 24 hr - 0' | Core recovered - 0'

Last casing – Bushing string: 5", 19.5 lb/ft drill pipe from 7177' to 6600'; 5-1/2", 20 lb/ft Hydril tubing to surface; cemented to 6685'

Liner – 2-3/8" EUE tubing from 9822' to 7594', xo, HMQ core rods from 7593' to 6593', and 4", 11.6 lb/ft Hydril tubing to surface.

Bits --na

Surveys:	Depth	Inclination	Direction	Bottom-hole Temperature
	See pre-September 2 reports for prior surveys			
	8813'	13.2 ⁰	na	191 ⁰ F
	9006'	13.0 ⁰	na	187 ⁰ F
	9163'	13.2 ⁰	92 ⁰ true	na
	9292'	13.3 ⁰	na	205 ⁰ F
	9512'	15.0 ⁰	na	199 ⁰ F
	9790'	15.6 ⁰	91 ⁰ true	na

Drilling fluid – na

Lithology:	9538-9549	Marble
	9549-9639	Marble interbedded with hornfels; marble appears porous
	9639-9707	Hornfels
	9707-9832	Marble with occasional hornfels

Summary of events last 24 hours:

Picked up float collar, 2224' of 2-3/8" EUE tubing, 1000' of HMQ, and 6591' of 4" Hydril. RIH with this liner and hang from casing head. Circulate so that we have heavy mud outside and water inside liner. Rigging down top drive at report time.

Report by: John Finger/Ron Jacobson

DAILY DRILLING REPORT – September 19, 1998
LONG VALLEY EXPLORATORY WELL
Time of report - 0700

Well number – LVF 51-20 | Location - Section 20, T3S, R28E, Mono County, CA

All depth measurements refer to KB; KB = 29' above ground level

Days since spud - 62 | Depth @ 0600 hrs – 9832' | Hole advance last 24 hr - 0' | Core recovered - 0'

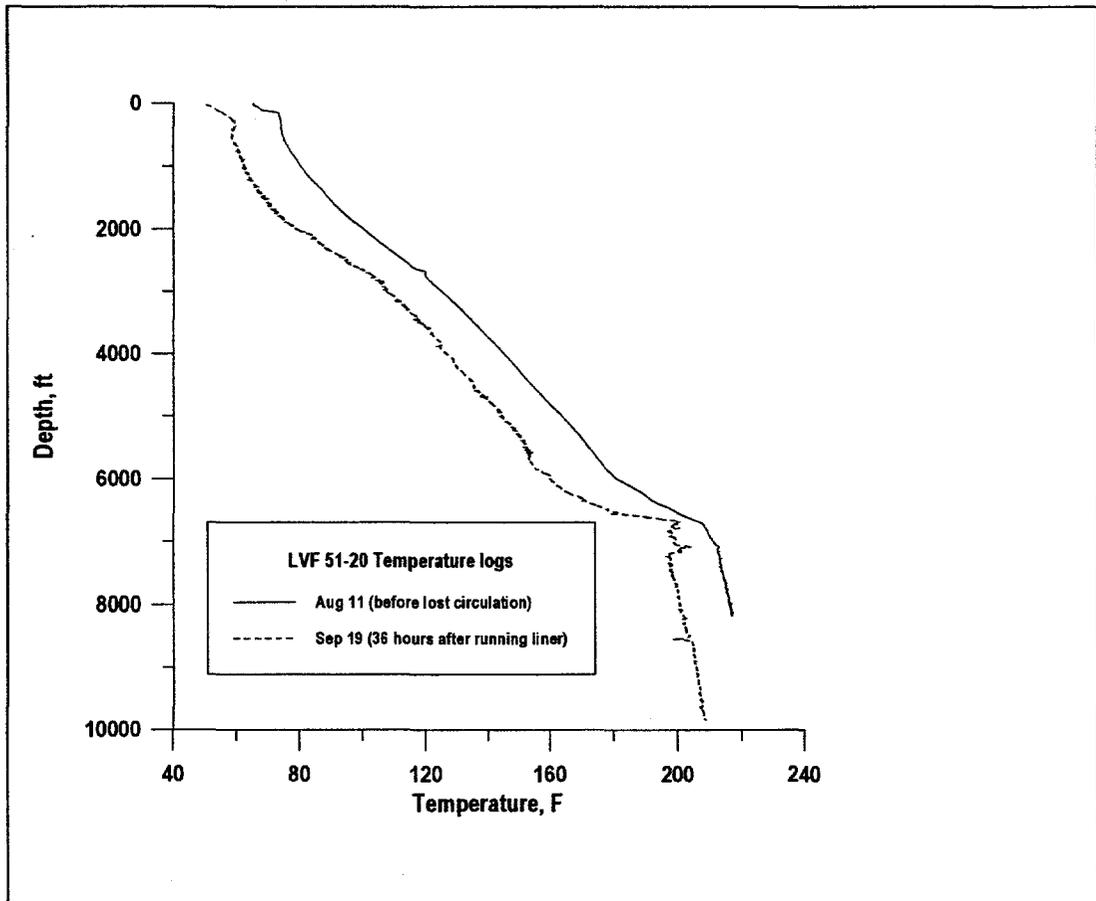
Last casing – Bushing string: 5", 19.5 lb/ft drill pipe from 7177' to 6600'; 5-1/2", 20 lb/ft Hydril tubing to surface; cemented to 6685'

Liner – 2-3/8" EUE tubing from 9822' to 7594', xo, HMQ core rods from 7593' to 6593', and 4", 11.6 lb/ft Hydril tubing to surface.

Summary of events last 24 hours:

Released Nabors, DOSECC, and Tonto. Crane on site at report time Friday. Laid down DOSECC top drive, Tonto mud tanks, kelly, and other rig components. Ran temperature log (below) which shows the amount of hole cooling after lost circulation. This is the final Daily Drilling Report from the Long Valley Coring Project.

Report by: John Finger/Ron Jacobson



APPENDIX C

This Appendix contains a detailed list of the components that comprise the DOSECC Hybrid Coring System. The complete system can be transported in three standard shipboard containers, plus a smaller container for the machine shop and spare parts.

DOSECC DHCS Coring System

Equipment:

Drawworks: Nil

Engines: 1 - Detroit Series 60 Model # 6064-GK33 450 HP
Electronic Engine Management System
24 VDC Electrical & Air Compressor

Pumps: 2 - FMC Triplex Plunger Pump Model # M1620
Hydraulically Driven 90 GPM @ 350 RPM 1990 PSI Max.

1 - FMC Triplex Piston Pump Model # L1122B
Hydraulically Driven 40 GPM 1000 PSI Max.

Mud Mixing Pump: Hydraulic Power for remote 12 HP Mixer available

Boilers: Nil

Derrick:: Nil

Substructure: Nil

Rotary Drive: Hydraulic Top Drive
185,000 lb. Dynamic Capacity 250,000 lb. Static
0 - 900 RPM Variable Torque
4" IF Pin Down Floating Spindle
King 2.5 BL Swivel
Kelly Valve 5000 psi 4" IF Pin Down
4 - 1.125" Dia. Guide Cable Arms

Feed Cylinder: 25' Stroke 12" Bore 5.5" Rod Cylinder
250,000 lb. Capacity
Elevator Upper Connection 3.7" Dia. x 6.26 Dia.
Load Cell Lower Connection to Top Drive Frame

Wireline Winch: Hydraulically Driven
Capacity 20,000 feet of 0.472" Cable
323 Feet/Min. Bare Drum
440 Feet/ Min. Full Drum
20,454 lb. Pull Bare Drum
15,244 lb. Pull Full Drum
c/w Hydraulic Fail-safe Brake
Manual Band Brake

Power Pack: Container Enclosed Skid Mount
500 Gallon Reservoir
Dual Air/ Oil Coolers
High Pressure / Return 5 Micron Filtration

Control Console: Electronic Control for all Coring Functions
Skid Mounted for Rig Floor Placement

Instrumentation: Wireline Counter, Rate and Weight Indicator
String/Bit Weight
Rotation RPM
Pump GPM (2)
Hydraulic Feed Pressure, Mud Pump Pressure
Drill Head Position / Feed Rate
Digital Display and Recording

Accessories: Cavins Model "C" Air Slips
Dressed for 3 1/2" & 5" Rods

Eckels 4 1/2 Hydraulic Tubing Tongs
Dressed for 4-1/8" Rods

Support Equipment: Shop Container c/w
Hydraulic Hose Crimper
Hand & Power Tools
Lighting and Power Distribution
Drill Press & Bench Grinder
Storage Shelving
Torch Set
Bolts, Nuts and Misc. Spares

Parts Container c/w
Lighting
Storage Shelving

APPENDIX D

This Appendix contains the cost records for the Long Valley Coring Project. On the daily cost sheets, some of the third-party charges do not reflect sales tax and handling fees from the drilling contractor, so the total cost shown here is slightly less than actual expenditures. The proportion of total funding spent on various activities is, however, accurate.

DAILY COST SUMMARY - LVF 51-20									
ACTIVITY			SUB-TOTALS	TOTAL TO DATE	PERCENT TOTAL	DATE	20-Jul	21-Jul	22-Jul
PRE-SPUD				449,115	34.7%	19-Jul			
Daily depth									
Total depth				9832			7178	7178	7178
RIG 202 EXPENSES				492,198	38.0%				
Daily Rental			307,917			2917	5,000	5,000	5,000
Standby									
Manpower			161,786				3,600	3,600	3,600
Fuel			22,495				4,183		
DHCS EXPENSES				106,485	8.2%				
Daily Rental			100,800						
Standby									
Personnel expenses			3,100						
Maintenance			2,584						
TONTO EXPENSES				141,000	10.9%				
Daily Rental			141,000						1250
Standby									
							20-Jul	21-Jul	22-Jul
DRILLING FLUIDS				57,563	4.4%				
Mud and Additives			51,921				1,339		
Engineer			1,750				350		
Fluid Cleaning									
CEMENT									
TOOLS				29,466	2.3%				
Bits			15,815						
Reamer Shells			1,361						
Misc. Parts			4,986						
Core boxes			3,460						
Downhole Motors									
Directional Tools/Service									
WIRELINE LOGGING				4,362	0.3%				
DRILLING ENGINEERING									
FLUID AND WASTE DISPOSAL									
TRUCKING				2,221	0.2%				
SITE PREP/MAINT.									
WELDING				531	0.0%				
RENTAL				5,100	0.4%		metal stock		
MISCELLANEOUS				7,270	0.6%		510		
TOTALS				1,295,309			14,982	8,600	9,850

23-Jul	24-Jul	25-Jul	26-Jul	27-Jul	28-Jul	29-Jul	30-Jul	31-Jul	1-Aug
				12	28	27	113	102	
7178	7178	7178	7178	7190	7218	7245	7358	7460	7460
5,000	5,000	5,000	5000	5000	5000	5000	5000	5000	5000
2,976	2976	3038	2976	2976	2976	2976	2976	2976	2664
		1800	1800	1800	1800	1800	1800	1800	1800
1850	2450	2450	2450	2450	2450	2450	2450	2450	2450
23-Jul	24-Jul	25-Jul	26-Jul	27-Jul	28-Jul	29-Jul	30-Jul	31-Jul	1-Aug
965					965	965		965	
454								907	
								705.35	2210
	1588							inv 8111c	stab. outer tub
560					154			1250	
					core boxes			Tonto HS	
							50	50	50
								7270	
								mini-frac	
11,805	12,014	12,288	12,226	12,226	13,345	13,191	12,276	23,373	14,174

2-Aug	3-Aug	4-Aug	5-Aug	6-Aug	7-Aug	8-Aug	9-Aug	10-Aug	11-Aug
55	84	94	35	59	96	43	85	108	55
7515	7599	7693	7728	7787	7883	7926	8011	8119	8174
5000	5000	5000	5000	5000	5000	5000	5000	5000	5000
2664	2664	2664	2664	2352	2664	2664	2664	2664	2664
	4629								
1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
		705							
		214							
2450	2450	2450	2450	2450	2450	2450	2450	2450	2450
2-Aug	3-Aug	4-Aug	5-Aug	6-Aug	7-Aug	8-Aug	9-Aug	10-Aug	11-Aug
2,249	1,070			2,519			2,067		
175	175			175			175		
		5560							
es									
50	50	50	50	125	125	125	125	125	125
14,388	17,838	18,444	11,964	14,421	12,039	12,039	14,281	12,039	12,039

12-Aug	13-Aug	14-Aug	15-Aug	16-Aug	17-Aug	18-Aug	19-Aug	20-Aug	21-Aug
70	46	74	82	27	35	17	16	9	51
8244	8290	8364	8446	8473	8508	8525	8541	8550	8601
5000	5000	5000	5000	5000	5000	5000	5000	5000	5000
2664	2664	2664	2664	2664	2664	2664	2664	2664	2352
			4625						
1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
2450	2450	2450	2450	2450	2450	2450	2450	2450	2450
12-Aug	13-Aug	14-Aug	15-Aug	16-Aug	17-Aug	18-Aug	19-Aug	20-Aug	21-Aug
	2,355	168			2,002	692	2,515	1,297	1,207
	175	175							
		965				965			
			420	72	31	90	360		
			inv 8127c						
125	125	125	125	125	125	125	125	125	125
12,039	14,569	13,347	17,084	12,111	14,072	13,786	14,914	13,336	12,934

1-Sep	2-Sep	3-Sep	4-Sep	5-Sep	6-Sep	7-Sep	8-Sep	9-Sep	10-Sep
34	72	13	49	60	54	16	76	90	26
9209	9281	9294	9343	9403	9457	9473	9549	9639	9665
5000	5000	5000	5000	5000	5000	5000	5000	5000	5000
2508	2664	2664	2352	2352	2352	2352	2352	2352	2352
1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
									2395
									2370
2450	2450	2450	2450	2450	2450	2450	2400	2400	2400
1-Sep	2-Sep	3-Sep	4-Sep	5-Sep	6-Sep	7-Sep	8-Sep	9-Sep	10-Sep
779	1,194	429	1,763	1,535	1,583	704	1,518	1,288	808
	1250				965				
83		49	83		147				1872
									257
									UPS+truck
125	125	125	125	125	125	125	125	125	125
12,745	14,483	12,517	13,573	13,262	14,422	12,431	13,195	12,965	19,379

PRE-SPUD COSTS

Electrician	4,740
Welder	8,250
Mechanic	2,550
Crane	1,700
Mob/De-mob Nabors	120,000
M/D Tonto	12,940
M/D DHCS	39,200
Support core logging	100,000
Computer equipment	7,674
Buy Hydril tubing	96,821
Cement	19,554
Float shoe and collar	1,369
Back-off/re-entry sub	3,250
Crossovers (Hydril)	8,076
Crossovers (Tonto)	2,914
Spear grapple	1,347
Slip/seal/hanger	2,532
Casing crew	16,198
TOTAL	449,115

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