GL03163 - 2 of 2

United States Department of the Interior

GEOLOGICAL SURVEY

Branch of Tectonophysics
2255 North Gemini Drive
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Dear Jim:

Enclosed please find some pretty colored temperature profiles for Phase I of LVF 51-20. Ron Jacobson should be congratulated on obtaining a superb set of temperature logs (16 in all) during and after the drilling. This data set contains a lot of information that will be of considerable interest to Long Valley researchers and which together with the findings of John Eichelberger and associates from core and cuttings, might stimulate additional interest and support for continuation of the well.

The graphs are self-explanatory, but I shall make a few additional comments: The first plot shows runs 1 through 10, obtained while the 26" hole was being drilled, on a single graph. Run 8 was probably the first indication that high temperatures would not be encountered in the well. Runs 9 and 10 were made while the 20" casing was being cemented. The second plot shows runs 11 through 15. Run 11 (Sept 24) was obtained just prior to coring, and the remainder, after completion of the corehole. The uppermost 200 meters or so seems dominated by a shallow hydrologic system with an overlay of transients from drilling and cementing. From about 250 meters to just above the 20" casing shoe, the hole appears to be recovering conductively from drilling and cementing disturbances. The conspicuous bulge at the casing shoe (which is recovering, but with a much longer time-constant) indicates that a lot of cement went into the formation at that depth, either into existing fractures or by a hydrofrac process associated with the grouting operation and its immediate aftermath. Plot 3 shows the four post- coring logs (minus the distracting upper 200m) and the "equilibrium" profile obtained by extrapolation of that time series to infinite time (ln (t-s)/t=0). Plot 4 illustrates how this was done for the 26" diameter hole. The source function is complicated by the numerous zones of lost circulation and by the thermal disturbance due to setting cement. I experimented with a number of drilling durations (s) and eventually settled on 55 days for the upper 575m (circles) and 30 days for the remainder (triangles). Fortunately, the extrapolation is not overly sensitive to the choice of "s". The parameter t is the number of days from spud until the log was performed. Further refinements are certainly possible, but probably wouldn't change things appreciably. The six calculations in the right hand panel merely illustrate the procedure. The calculation was made at 25 ft intervals. The smooth curves obtained for the 26" hole indicate a successful cement job insofar as there is absolutely no indication of vertical fluid movement in the annulus.

The details of the logs within the cored section (final figure) are very interesting indeed. From October 7th onwards, there is evidence for vertical fluid movement in the annulus between 783 and 793 meters, a zone of highly weathered and fractured core. The November 14th log shows several "stairsteps" between the 20" casing shoe and about 812m. The interval centered on about 825 meters appears to be a major circulation loss zone, but had recovered to a large extent by November 14.

Because of pervasive fluid loss within the cored section, it was not possible to derive a smooth "equilibrium" curve by extrapolation of three October curves for the upper portion of the corehole, or all curves from 812 meters to bottom. The "best guess" profile is based on 3 assumptions:

1. The equilibrium profile is a straight line
2. All fluid movement is lateral or downwards
3. Apart from disturbances from vertical fluid movement, the Nov. 14 profile is approaching equilibrium

The resulting line (dashed) is tangent to the high points in the Nov. 14 profile and the calculated "equilibrium" profile (based on "s" values of 4 days to 812m and 2 days below that). The gradient is about 53°C/km. The gradient breaks in the "big hole" occur (according to the preliminary lithology of Vicki McConnell and John Eichelberger) within the early rhyolite at about 450m (42 to 88°C/km) and near the contact between Bishop Tuff and intrusive rhyolite (88 to about 50°C/km). If heat flow is constant with depth, large contrasts in mineralogical composition and/or porosity should be associated with these breaks.

We are presently working on thermal conductivity of core and I have asked Vicki for splits of cutting samples between 800 ft and the bottom of the big hole. As soon as conductivity measurements are completed, we should look at the heat flow results, and consider publishing them jointly, perhaps in collaboration with others who have recently been active in interpreting the thermal/hydrologic regimes of the resurgent dome area.

I've been very impressed with the professionalism of the Sandia group over the course of this project to date. It's been a real pleasure working with all of them, and I hope we can successfully launch Phase II.

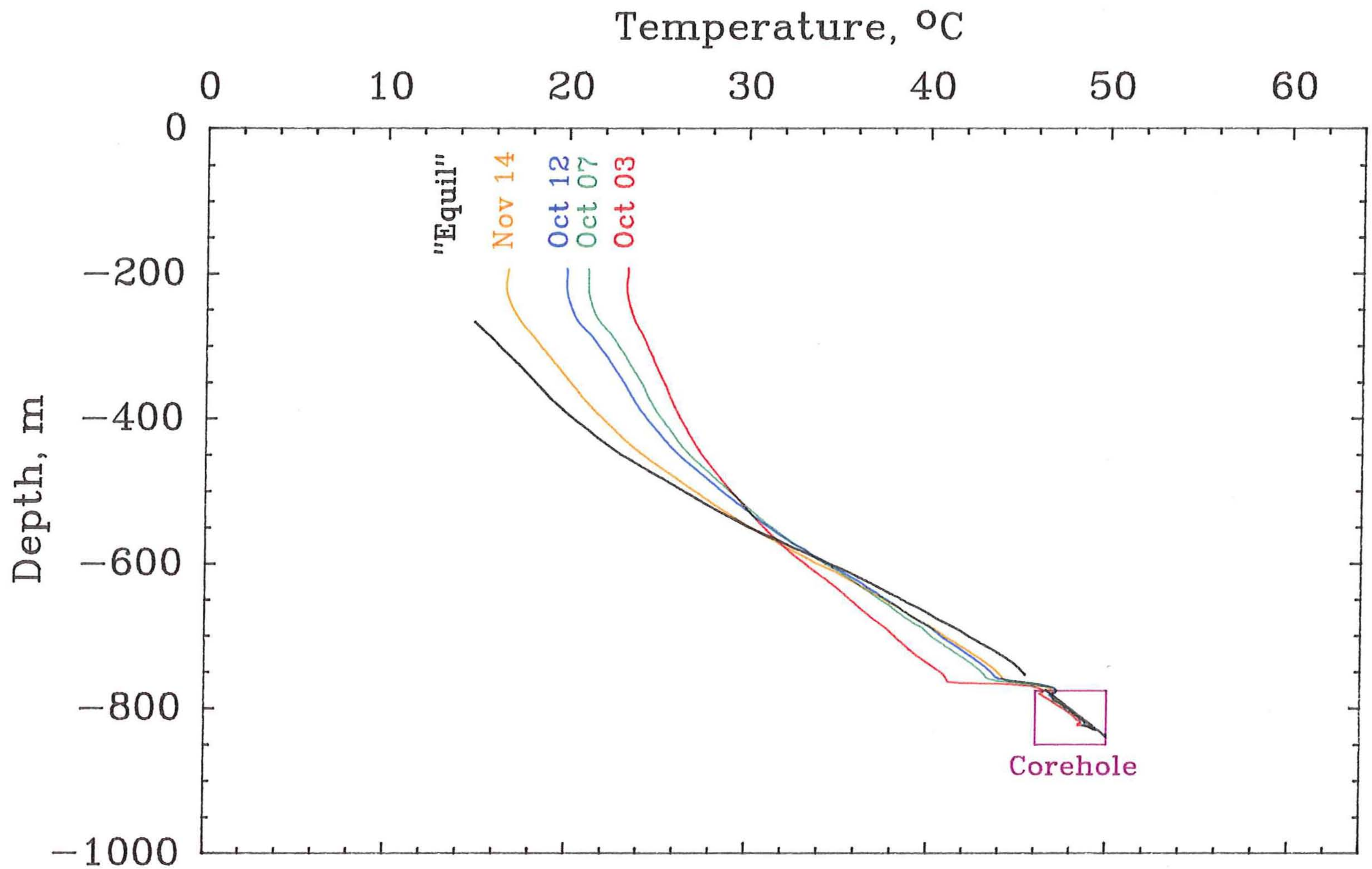
Best wishes,

John

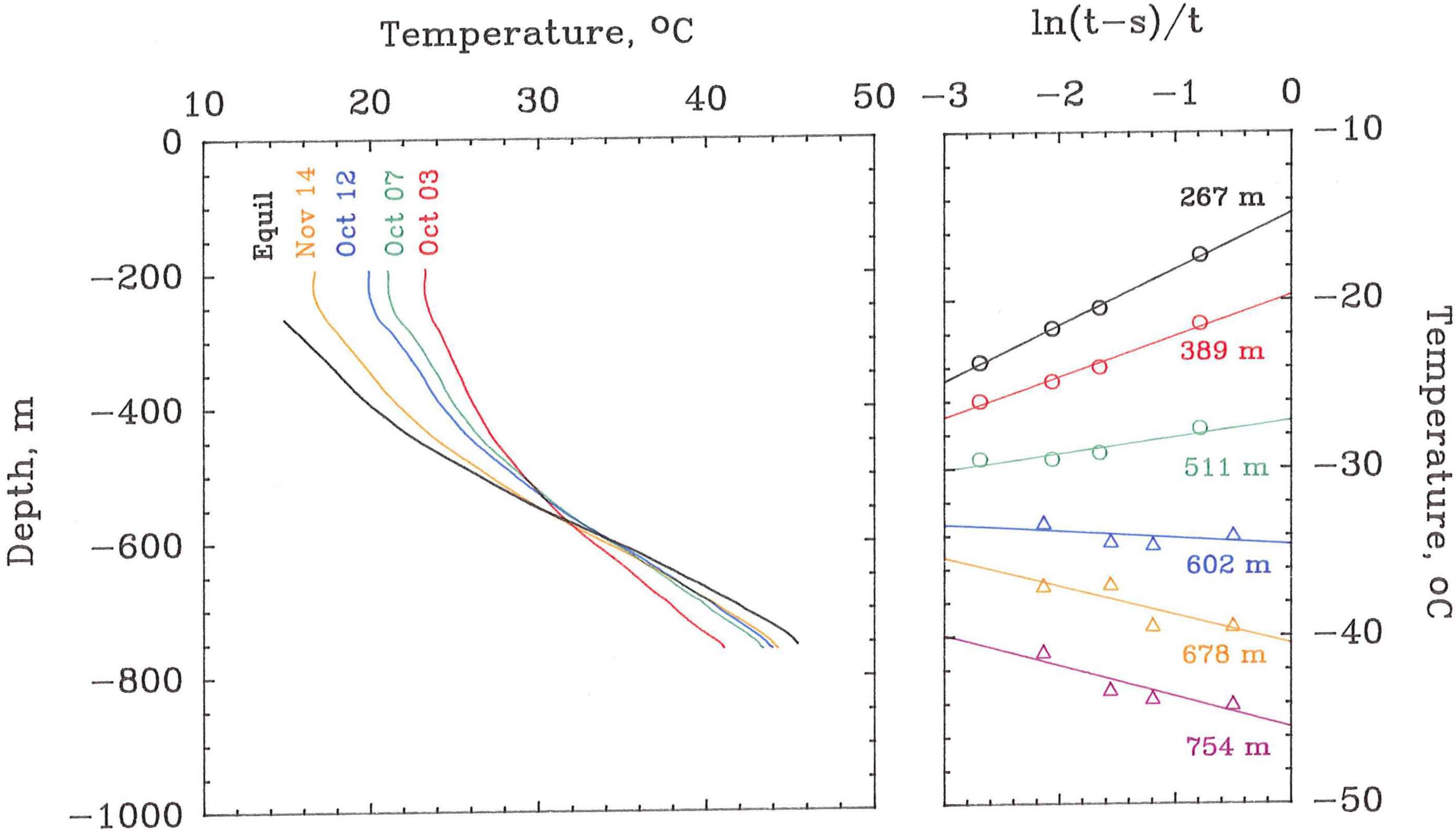
John H. Sass
Science Coordinator

Enclosures

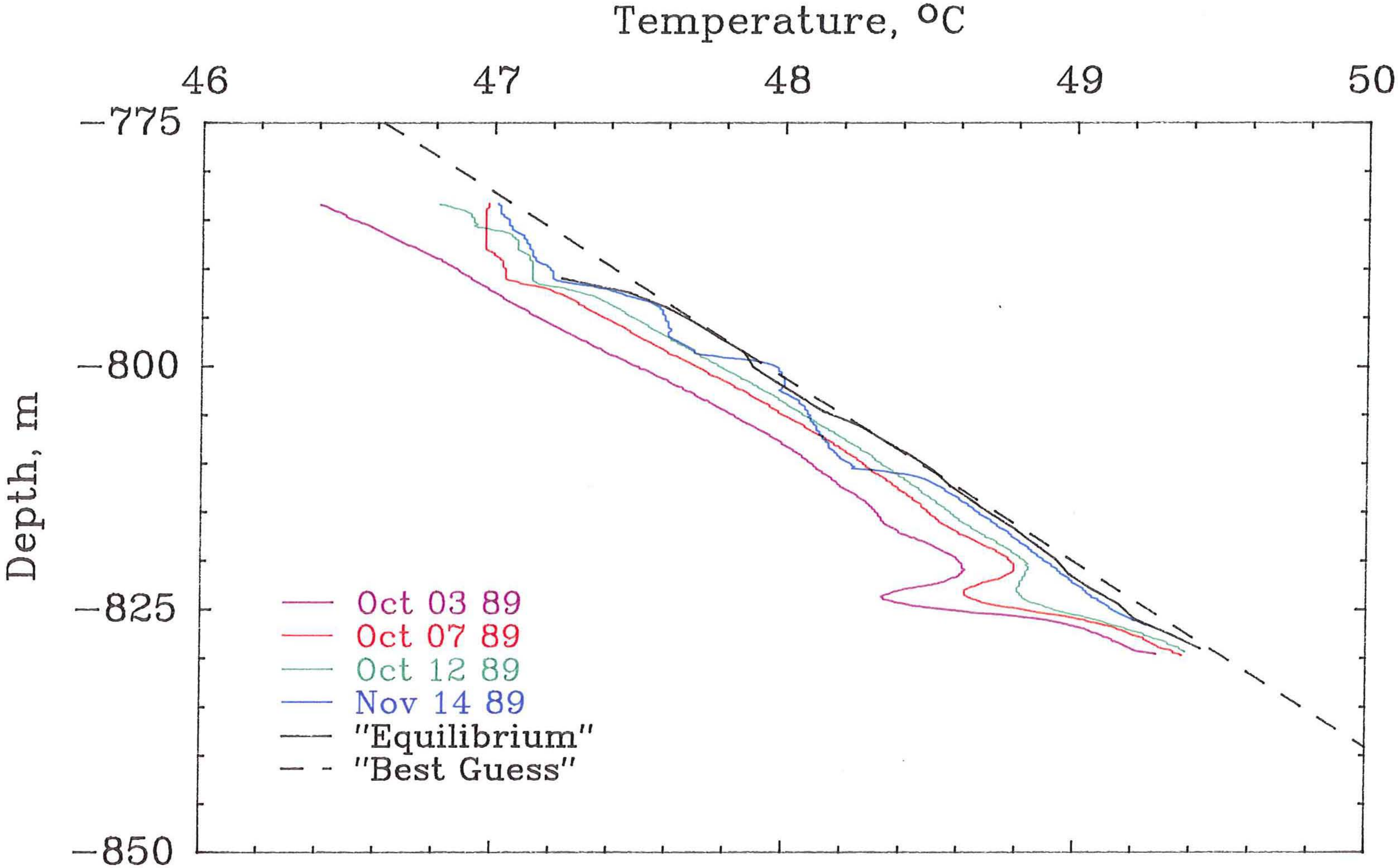
cc: with enclosures
Bob Hamilton
Gladys Hooper
Art Lachenbuch
✓ Ray Wallace
Harold Wollenberg



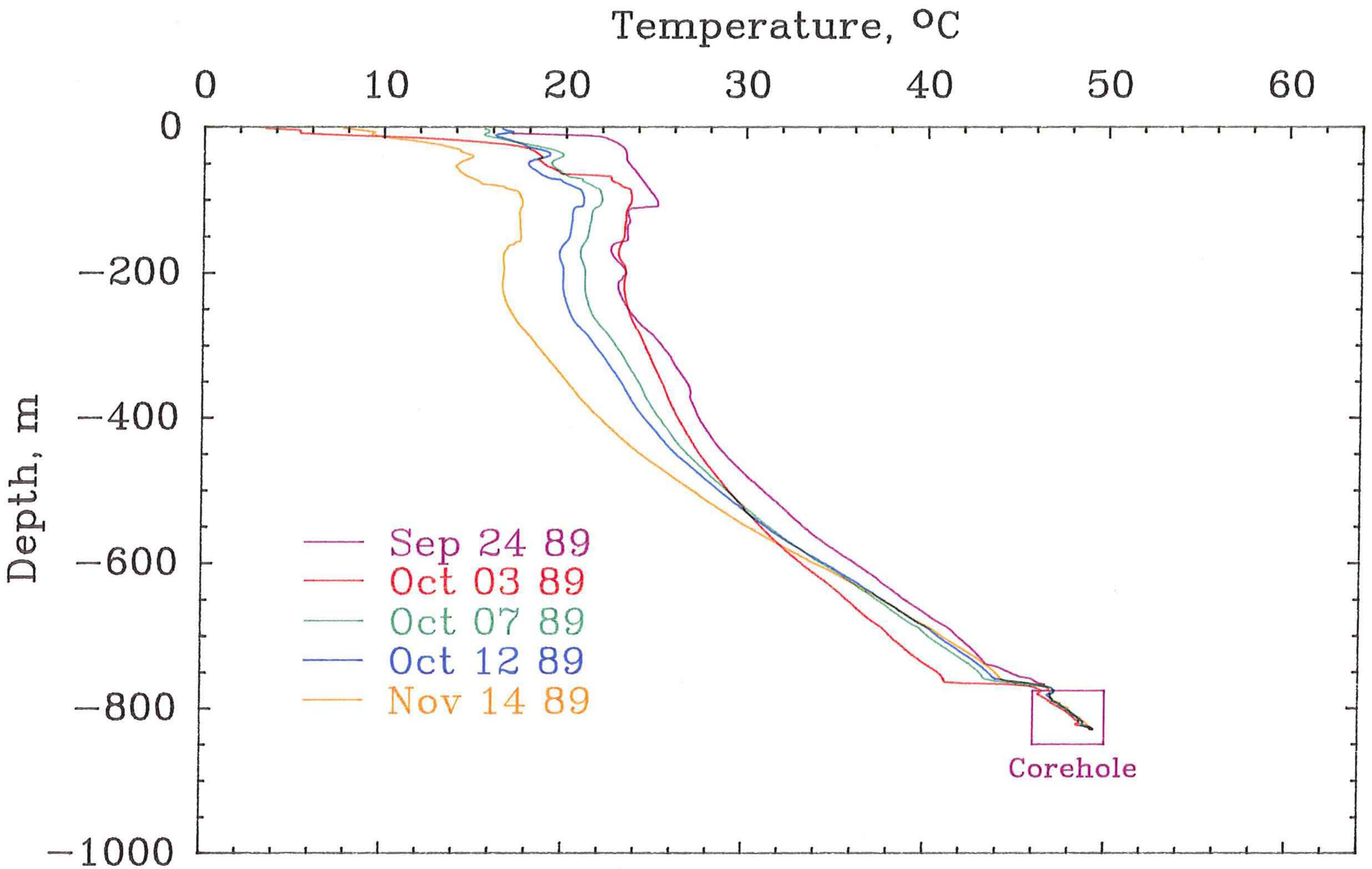
Post-coring logs, 200 meters on down



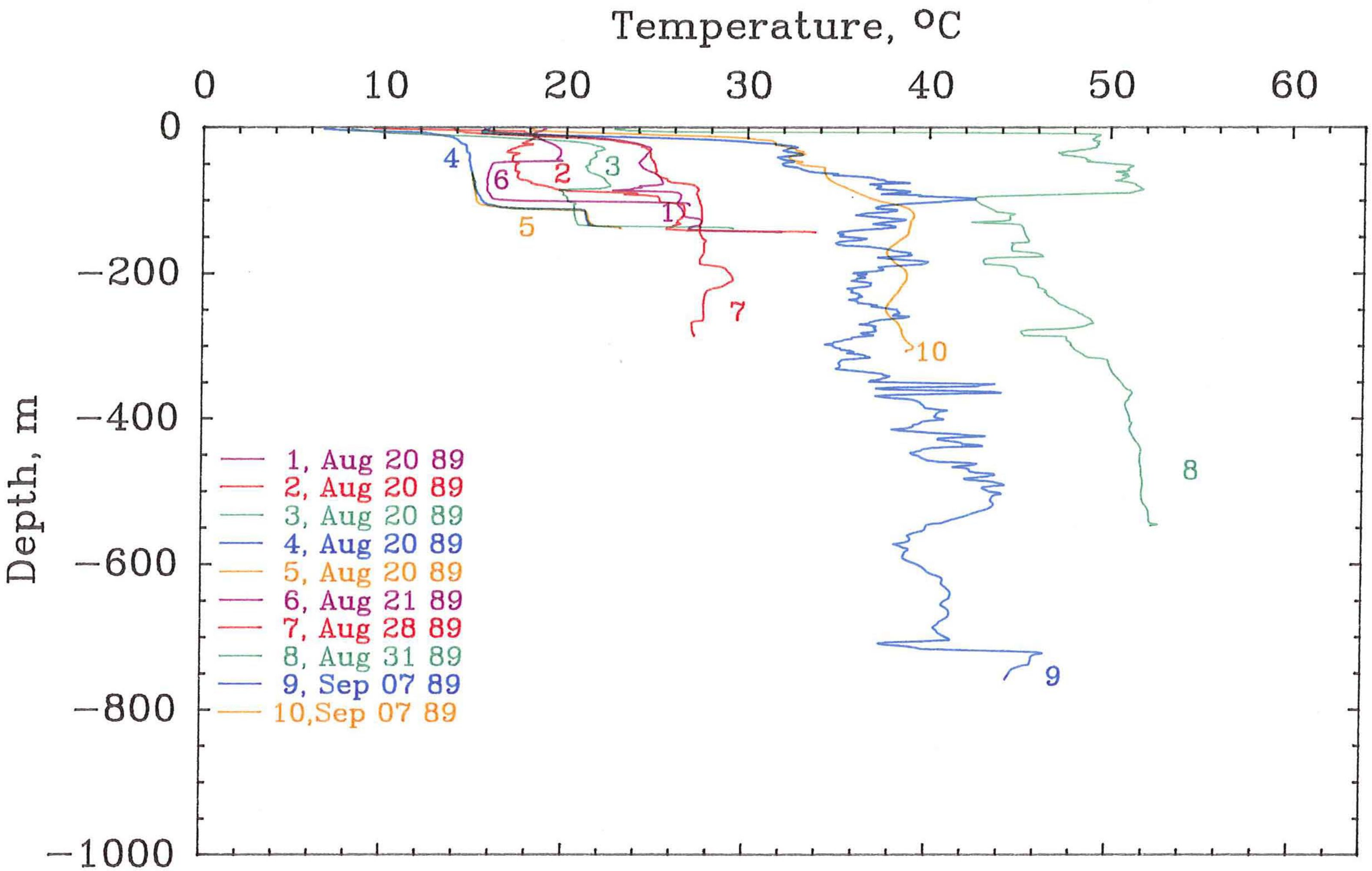
Temperature, oC
10
20
30
40
50
0
-200
-400
-600
-800
-1000
Depth, m
Equil
Nov 14
Oct 12
Oct 07
Oct 03
ln(t-s)/t
-3
-2
-1
0
-10
-20
-30
-40
-50
Temperature, oC
267 m
389 m
511 m
602 m
678 m
754 m



Post−coring logs, cored section of hole



Logs post−completion of 26″ hole



Logs run prior to completion of 26″ hole