SCIENTIFIC DRILLING IN THE VALLES-TOLEDO CALDERA COMPLEX AND ITS HIGH TEMPERATURE GEOTHERMAL SYSTEMS

GARDNER, J.N. (Los Alamos National Laboratory, Los Alamos, NM, 87545); HULEN, J.B. (University of Utah Research Institute, Salt Lake City, UT 84108); GOFF, F. (Los Alamos National Laboratory, Los Alamos, NM, 87545); NIELSON, D.L. (University of Utah Research Institute, Salt Lake City, UT 84108); ADAMS, A., CRISWELL, C.W., GRIBBLE, R., MEEKER, K., MUSGRAVE, J.A., SHEVENELL, L., SMITH, T., SNOW, M.G., AND WILSON, D. (all of Los Alamos National Laboratory, Los Alamos, NM 87545)

Research bore Valles Caldera #1 (VC-1) was continuously cored to 856 meters in the southwestern moat zone of the 1.12 Ma Valles caldera, and penetrated 333 meters of post-caldera volcanic and volcaniclastic rocks. The base of the VC-1 volcanic sequence is a breccia of South Mountain Rhyolite (0.507 Ma), which lies beneath 35 meters of volcaniclastic conglomerate. Over the conglomerate is a sequence of ignimbrites and interbedded rhyolites, which form a group of moat volcanic products that are chemically and petrogenetically distinct from other post-caldera rhyolitic rocks. VC-1 also penetrated an active hydrothermal outflow plume from the caldera. Deep geothermal fluids from the caldera breach the ring fracture and leak along the northeast-trending Jemez fault zone, mixing with meteoric fluids along the way. Active for about 1 million years, the outflow plume gives rise to the fluids that emerge today as the well known hot springs of the Jemez Springs-Soda Dam area.

VC-2a and VC-2b were continuously cored to 528 meters and 1.762 kilometers, respectively, on the western flank of the Valles caldera's resurgent dome. Each hole sampled interbedded sequences of caldera-fill volcaniclastic rocks and densely welded intracauldron Bandelier Tuff. The sequence in VC-2a is: 0-22 m landslide, volcaniclastic sandstone, and accretionary lapilli tuff; 22-65 m upper tuffs; 65-80 m debris flow and volcaniclastic sandstone; 80-356 m Tshirege Member tuffs; 356-362 m volcaniclastic rocks; 362-477 m Otowi Member tuffs; and 477-528 m (T.D.) lower tuffs. The sequence in VC-2b is: 0-174 m landslide, debris flows, volcaniclastic sandstones, accretionary lapilli tuffs, and an intermediate (?) composition, subvolcanic intrusion; 174-366 m Tshirege Member tuffs; 366-372 m volcaniclastic sandstone; 372-599 m Otowi Member tuffs; 599-742 m lower tuffs; 742-798 m Santa Fe Group sandstone and Cochiti Formation debris flows; 798-1558 m Paleozoic sedimentary rocks; and 1558-1762 m (T.D.), quartz monzonite. Stratigraphy and extremely lithic-rich (up to 90%) zones in the tuffs suggest that the VC-2a and -b drill sites may be proximal to vents. The Tshirege (?) tuffs also show intrusive, or possibly invasive, relations with the underlying volcaniclastic rocks. Structural correlations between the core holes indicate the earlier Toledo caldera (1.45 Ma; Otowi Member tuffs) experienced no structural resurgence similar to the Valles caldera. The hydrothermal system penetrated by these bores consists of a shallow vapor-rich cap, which has evolved from an earlier 200°C liquid-dominated system, stratigraphically separated from underlying, stacked, liquid dominated reservoirs up to at least 300°C.

IV

X

Jamie N. Gardner
Los Alamos Nat. Lab.
ESS-1, MS D462
Los Alamos, NM 87545
USA

(505)667-1799

Jeff,
Could you pass along a copy to Dennis? Thanks, Jamie