THOR I and II

Robert Abbott, Leiph Preston, David Tang, Tori Finlay, Stephanie James

THOR I and II are projects to image the shear- and p-wave velocity of Yucca Flat (YF) in advance of the DAG shots. We acquired two transects of active-source seismic data in 2015. The transects are oriented along the geologic strike of YF, roughly NS-EW, and intersect at DAG emplacement hole U2ez. The north-south transect (THOR I) is approximately 25 km long, and the east-west transect (THOR II) is approximately 12.5 km in length. The active source was the Seismic Hammer, a 13,000-kg weight-drop operated by HK Exploration. Source points consisted of stacked hammer shots, spaced every 200 meters. These source points were recorded by over 370 three-component, 2-Hz geophones. The geophones were placed every 10 m for the first two km, every 20 m for kilometers two to four, and every 100 m thereafter. The array rolled along with the source.

P-wave tomograms indicate that we achieve ray-path coverage down to the Paleozoic (Pz) basement rocks underlying YF. Velocities range from under 1200 m/s to ~2000 m/s for the alluvium, to over 6 km/s for the Pz. Tertiary volcanic rocks overlying the Pz are also imaged and have intermediate velocities (~2.3 to ~4 km/s). In the alluvium, we observe a general decrease in velocity with decreasing latitude. Large-scale features, such as a basement high observed in gravity data, are also imaged.

2-D shear-waves profiles were constructed by stitching together multiple 1-D profiles. The 1-D profiles were created using the Refraction-Microtremor (ReMi) method. ReMi data quality was heavily influenced by the degree of nearby cratering and cracking, with data quality in areas of sparse or zero cratering being excellent. In areas of cratering, the maximum resolved depth was about 400 m. This depth is approximately the same as the Tertiary volcano horizon along much of the array.

Sandia National Laboratories is a multi-program laboratory managed and operated by Sandia Corporation, a wholly owned subsidiary of Lockheed Martin Corporation, for the U.S. Department of Energy’s National Nuclear Security Administration under contract DE-AC04-94AL85000.