Ongoing Transient Deformation from a Shallow Socorro Magma Body?

Andrew V. Newman » Earth and Atmospheric Sciences, Georgia Institute of Technology  
Dave Love » New Mexico Bureau of Geology and Mineral Resources  
Richard Chamberlain » New Mexico Bureau of Geology and Mineral Resources  
Timothy H. Dixon » Marine Geology and Geophysics-RSMAS, University of Miami  
Peter LaFemina » Marine Geology and Geophysics-RSMAS, University of Miami  
Susan L. Bilek » Earth and Environmental Sciences, New Mexico Tech  
Richard Aster » Earth and Environmental Sciences, New Mexico Tech

The Socorro Magma Body (SMB), between Socorro and Belen, New Mexico, lies within the central portion of the Rio Grande Rift Valley and is one of the largest known magma bodies in Earth’s continental crust. The SMB is expressed in several geophysical anomalies, including increased local seismicity, low electric conductivity, and surface uplift. Studies of local microseismicity and deep seismic soundings revealed an unusual crustal reflector about 50 to 70 km wide, and about 19 km in depth, and were interpreted as requiring fluids, most likely melt, in the middle crust beneath Socorro. These data have led to a general acceptance of the Socorro reflector as the prime example of a large active sill-like magma intrusion. Using precision leveling and Interferometric Synthetic Aperture Radar, previous studies have found averaged uplift of about 2 to 4 mm/yr centered on the Socorro seismic reflector at 19 km depth.

We performed three GPS campaigns over 9 to 12 bedrock sites in 2002, 2003, and 2005. Vertical GPS over the southern SMB switch from between +10 and 20 mm with the maximum uplift (20 mm) in 2002, to a similar level deflation the following year. Currently, these data suggest a significant and smaller body transiently inflating at about 5 km depth and corresponding to 0.5-5 million m$^3$ between 2002 and 2003. These results indicate that the SMB may have considerable variation in the spatio-temporal pattern of deformation averaging to a slower long-term inflation.

In fall of 2005, with the help of UNAVCO field engineers, we installed two new continuous GPS sites near the center of transient inflation. In collaboration with Los Alamos National Laboratory and New Mexico Tech, these sites are collocated with two continuously recording broadband seismometers aimed at identifying low-frequency tremors associated with migrating fluids.

References:


The work was supported by LANL-NMT MOU Grant; Georgia Tech, College of Sciences.