Seismic and Gravity Investigations of the Caja del Rio Geothermal Area, New Mexico

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Abstract: The SAGE (Summer of Applied Geophysical Experience) program collected new seismic and gravity data in 2012 in the Caja del Rio area of northern New Mexico. The area, about 25 km NW of Santa Fe, has been identified as a potential geothermal resources area based on relatively high temperature gradients in drill holes. The SAGE 2012 data collection was part of an integrated geophysical study of the area initiated in 2011. Seismic data consisted of a 6.4 km SE to NW profile (80 three-component stations, 20 m station spacing, using a Vibroseis source – 20 m spacing for reflection VPs; 800 m spacing for refraction VPs) with both refraction and CMP reflection coverage. The surface conditions (dry unconsolidated cover over a thin volcanic layer) increased surface wave energy and limited the signal-to-noise level of the refraction and reflection arrivals. The refraction data were modeled with first arrival travel time methods. The reflection data were processed to produce a CMP stacked record section. Strong, NW-dipping reflectors, interpreted as from the Espinaso formation, are visible at about 1.4 seconds two-way time. One hundred and sixty-four new gravity measurements (detailed data at 500 m spacing along the seismic profile and regional stations) were collected and combined with existing regional data for modeling. Interpretation of the seismic and gravity data was aided by refraction velocities, the existence of a nearby regional seismic reflection profile from industry, and lithologies and well-logs from a deep well. The sedimentary basin interpreted from the seismic and gravity data, along with existing geological and geophysical information, consists of a thick section of Tertiary rift fill (capped by a thin layer of volcanic rocks), over Mesozoic and Paleozoic rocks, with a total basin thickness of about 3 km.

SAGE Sponsorship

Los Alamos National Laboratory (LANL), National Science Foundation (NSF), U.S. Department of Energy (DOE), Society of Exploration Geophysicists (SEG) Foundation (Endowment – founding donor Geophysical Pursuit), and SAGE Affiliates and Industry supporters.

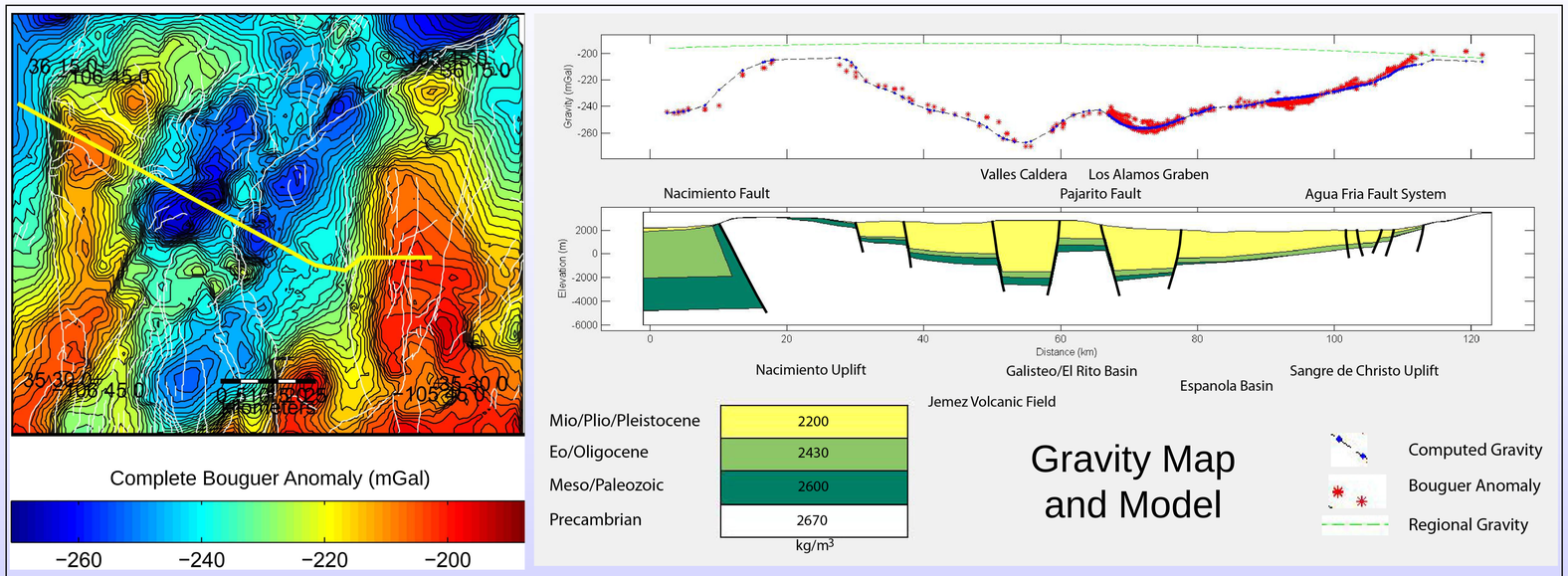

Figure 1. *Left* – Complete Bouguer anomaly map; yellow line is gravity profile. *Right* – Gravity model along profile.

Fault and Geology Maps

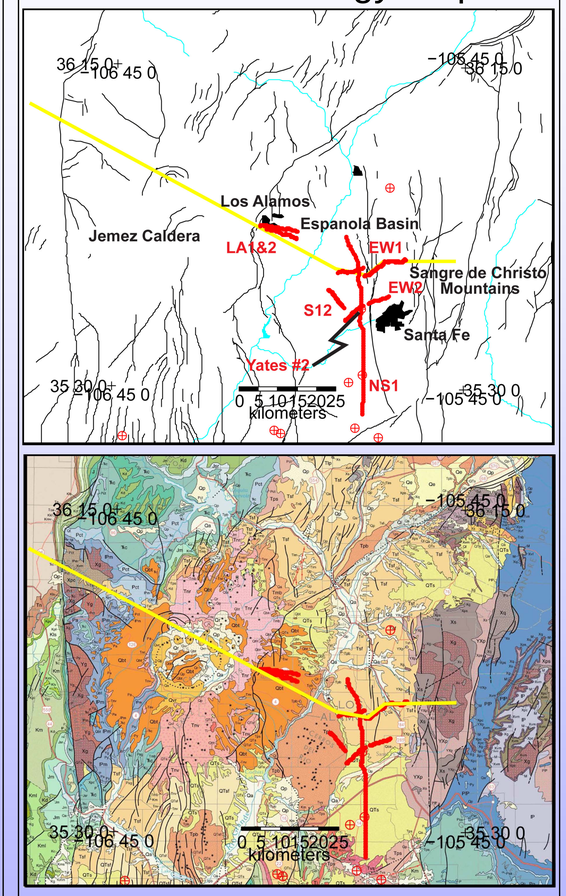

Figure 2. *Upper* – Fault map of northern RGR. *Lower* – Geological map. Red lines are seismic profiles. Yellow line is gravity profile. Crossed circles are deep drill holes.

Seismic Reflection Record Sections

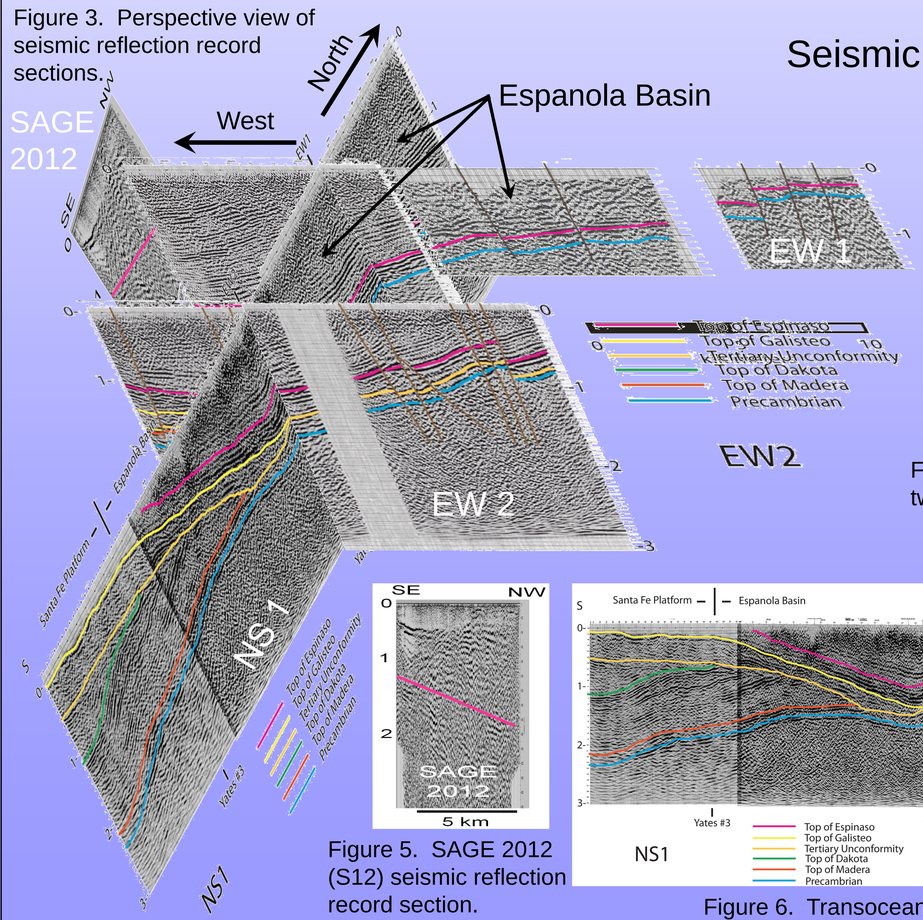

Figure 3. Perspective view of seismic reflection record sections.

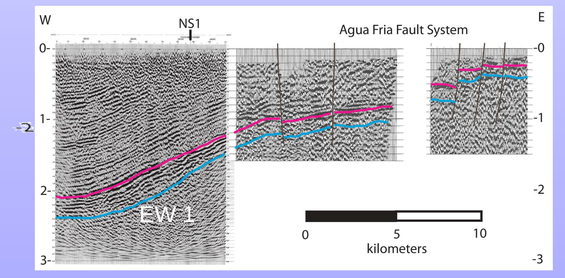

Figure 4 Transocean (left section) and SAGE 1985 (right two sections) EW 1 seismic reflection record sections.

Figure 5. SAGE 2012 (S12) seismic reflection record section.

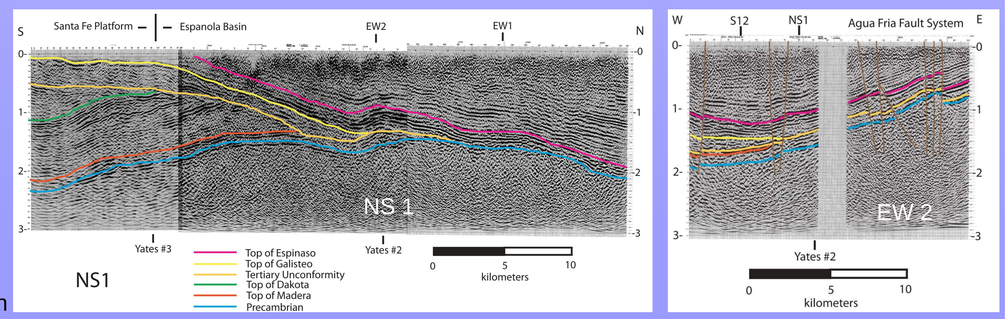

Figure 6. Transocean NS 1 and EW 2 seismic reflection record sections.

SAGE Recognition

- American Geophysical Union – Excellence in Geophysical Education Award, 1998.
- Society of Exploration Geophysicists – Special Commendation Award, 2000.

More About SAGE

Web Site at: http://www.sage.lanl.gov/

The Leading Edge, June 2012 Issue

- SAGE 2010 Geophysics Highlights: http://web.ics.purdue.edu/~braile/sage/SAGE2010Highlights.pdf
- SAGE 2011 Geophysics Highlights: http://web.ics.purdue.edu/~braile/sage/SAGE2011Highlights.pdf