

SEISMOLOGY: A Project, An Organization

by Susan Fox Hodgson

The Salton Seismic Imaging Project

The Salton Seismic Imaging Project (SSIP) is underway in California's Imperial Valley—a major area for geothermal development—and in the Coachella Valley. SSIP is funded jointly by the National Science Foundation and the US Geological Survey (USGS). The team of USGS and collaborating scientists undertaking the project is led by John Hole of Virginia Tech, Joann Stock of CalTech, and Gary Fuis of the USGS.

Earthquake scientists believe the rupture of the southern section of the San Andreas fault, from California's Coachella Valley to the Mojave Desert, is the greatest natural hazard California will face in the near future. SSIP will help us to more fully understand and mitigate the effects of such an event.

The SSIP images of underground structures and sediments in the Imperial and Coachella Valleys and adjacent mountain ranges will help indicate the earthquake hazards posed to cities in the area. The images will explain the underground geometry of the San Andreas fault, the sediment depths, and the speed of earthquake waves as they pass through the basins—factors determining how hard the earth will shake in a major quake. Both this information and the seismic data should interest geothermal developers.

First SSIP Results

The seismic data were gathered during March 2 to 18, 2011, from 126 borehole explosions detonated along seven profiles in the Salton Trough region—extending from the Palm Springs area to the southwestern tip of Arizona. About 2,800 seismometers were deployed at over

4,200 locations throughout the Salton Trough region, and 48 ocean-bottom seismometers were deployed at 78 locations beneath the Salton Sea.

Dr. Gary Fuis said scientists have analyzed seismic-refraction data for two of the seven lines and developed preliminary models from the analyses. The seismic-refraction data remain to be analyzed for the other five lines and all the lines still must be analyzed for low-fold reflection data. The main results will be available in about a year, and the USGS will continue updating the SSIP website as the models become available.

IRIS Participation

Dr. Fuis said the seismic data will remain private until the spring of 2013, according to IRIS guidelines. (*IRIS* stands for *Incorporated Research Institutions for Seismology*.) He said that the project borrowed about 3,000 seismographs from IRIS and several IRIS data analysts came to the field to help manage seismograph programming and to upload data. For more SSIP information, contact Dr. Fuis at: fuis@usgs.gov.

Looking at IRIS

The *Incorporated Research Institutions for Seismology*, often called IRIS, is a consortium of



over 100 members—US universities with active geophysics/seismology programs. IRIS manages and operates high-quality geophysical facilities, enabling discoveries in seismology and the earth sciences. It

Seismology

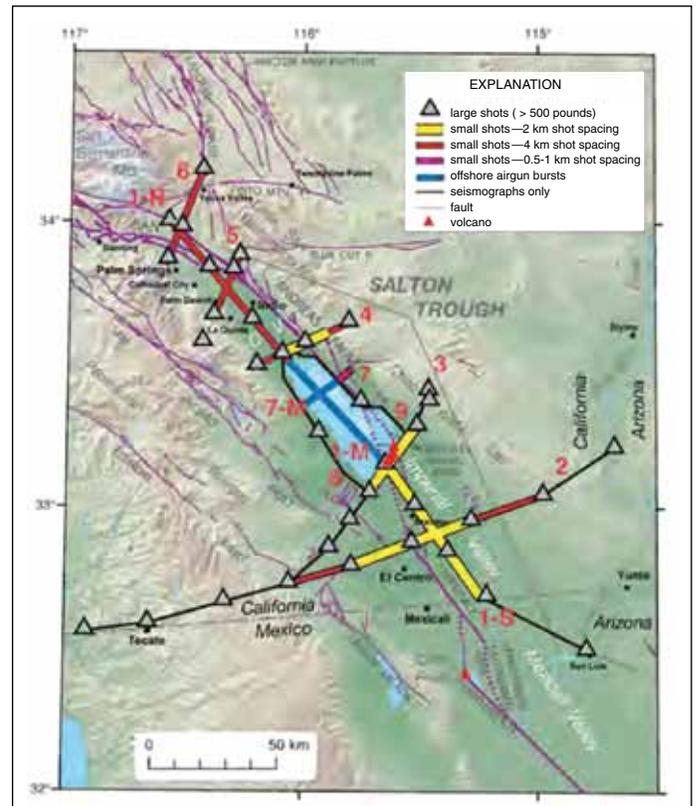


Southern California consists of two tectonic plates, the Pacific and the North American, moving past each other. The boundary between the two plates is quite crooked. Heavy-red lines indicate the San Andreas and related faults. As the two plates move past each other along these faults, in the directions of the small-white arrows, earthquakes occur. The purple lines indicate locations between these faults where the earth is being pulled apart, creating a deep valley or even new ocean. Volcanoes and underground magma in these areas create geothermal energy and hot springs. (CPG stands for Cerro Prieto geothermal area; BSZ stands for Brawley Seismic Zone and geothermal area.)

In the Transverse Ranges, where the San Andreas fault undergoes a "big bend," the plates are pushing against each other (heavy-white arrows), building mountains that are uplifted along thrust faults (the thin-red lines with teeth). Thus mountain building and valley subsidence occur very near to each other in this part of Southern California. CAPTION AND ILLUSTRATION BY THE USGS.

collaborates with many other organizations and institutions throughout the world—and among these are US, Foreign, and Educational IRIS Affiliates.

The Public Outreach Manager, Perle Dorr, says IRIS helps to operate the Global Seismographic Network, including over 150 real-time seismological- and geophysical-sensors offering uniform coverage around the earth. IRIS has the world's largest seismic-data archive—available to all, free of charge. These data have been recorded by global- and regional-seismic networks from around the world and go into the IRIS archive—telemetered to the data-management center.



Layout of SSIP. The gray triangles are larger shots. Smaller shots are located at 1.2 to 2.5 mile spacing along the red and yellow lines, and seismographs are located at 325 to 650 foot spacing along red, yellow, and black lines. (CV stands for Coachella Valley.) CAPTION AND ILLUSTRATION BY THE USGS.

Besides operating seismic networks, IRIS lends seismic instruments to university researchers and others for projects around the world. Hundreds of instruments are deployed annually, many to remote areas. Many energy-project developers use them, including oil and gas companies and geothermal researchers and developers. For some projects, researchers may keep their data private for two years.

Education and public outreach are important to IRIS and informative brochures and publications are available. The IRIS website itself is fascinating, currently mentioning a 7.1 earthquake on February 2 in the Republic of Vanuatu. Readers of the 2011 July/August *GRC Bulletin* may recall the three geothermal leases in Vanuatu under exploration by KuTH Energy Ltd.

IRIS financial support comes from the National Science Foundation, federal agencies, universities, and private foundations. For more information about IRIS, visit: www.iris.edu. Ms. Dorr may be reached at: 202.682.2220, or perle.dorr@IRIS.edu.

USGS Seeks Info on Southern CA Quakes

The US Geological Survey (USGS) will award up to \$7 million in grants and cooperative agreements for earthquake research in 2013. The USGS awards about 90 research grants to universities, state geological surveys, and private institutions. Key projects include cataloging earthquakes in Southern California to better educate emergency responders, the public, and the media about earthquakes. Seismic-hazard estimates will be given to communities and critical institutions to use for engineering structurally sound buildings and roads. Ground shaking data will be distributed—helping to minimize damage.

Applications are due May 17, 2012. Interested researchers can apply online at: grants.gov, using the funding opportunity number: G12AS20013.

Transtensional Plate Boundaries & Geothermal

Seismicity in the Salton Trough is the topic of a paper published in the *2011 GRC Transactions*. Titled: *Geothermal Potential of Transtensional Plate Boundaries*, the paper is written by Scott Bennett of the University of California, Davis, Geology Department. “Geothermal resources are commonly found in regions of active extension (e.g. western North America),” Mr. Bennett notes. “Lithospheric thinning associated with extension can lead to elevation of geotherms to a shallower depth. This steepened-geothermal gradient can create the potential for a geothermal resource. Although areas of continental extension are prospective for geothermal resources, many existing geothermal resources are found in regions influenced by active *transtension*. Here I propose a rationale for why the geothermal potential may be enhanced along transtensional plate boundaries.” ■



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