Bay Area Geophysical Society Seminar Series

Magnetotelluric for deep crustal exploration of geothermal systems

Dr. Jared Peacock

Research Geophysicist

USGS - Geology, Minerals, Energy, and Geophysics Science Center

October 26th, 2023 5 PM PST -- Hybrid Talk In-person in Yosemite conference room at USGS Moffett field office (350 N. Akron Rd, building 19, Moffett Field, CA 94035), and on Zoom

Abstract:

Methods designed to identify favorable areas for geothermal and mineral resources have traditionally been focused on near-surface information, namely data that can be compiled into a 2D map. However, these methods fail to account for the third dimension: depth. As a result, they do not incorporate deep crustal and mantle features like heat sources. Geophysical methods with multi-scale capabilities, such as magnetotellurics (MT), provide tools to image deeper structures and bottom-up control on location of near surface hydrothermal systems in 3D. This study briefly demonstrates the advantage of understanding bottom-up control on hydrothermal and mineralsystems to aid assessment and characterization. A regional 3D electrical resistivity model of the Great Basin is developed from MT data that images the near surface down to the mantle. From the 3D model, electrical conductance (depth integrated electrical conductivity) maps are created at logical depth intervals to

identify anomalies. The conductance maps image discrete zones of high-conductance between 15-20 km depth indicative of fluid collection at the brittle-ductile transition; high-conductance zones around Moho depths (30-50 km) suggestive of partial melt; high-conductance zones in the upper mantle indicative of higher temperature and larger melt fraction, and low-conductance zones indicative of lithospheric material descending in the mantle. One anomalous zone of low-conductance in the mantle is under the north central Nevada, suggesting vertical mantle flow transport of heat to the crust related to sinking lithospheric material.

Author:

Jared Peacock is a research geophysicist at the Geology, Minerals, Energy, and Geophysics Science Center in Menlo Park, CA. He received his Ph.D. from the University of Adelaide and B.S. and M.S. from the Colorado School of Mines, all in geophysics. Since joining the USGS In 2013, his expertise is in magnetotellurics, focusing on characterizing volcanic, geothermal, and mineral systems in 3D.

Zoom meeting information:

Zoom ID: 850 5114 8511
Password: BAGS4ever