# Bottom-up and top-down control on resources in the Great Basin, western United States

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## SUMMARY

Most mineral and geothermal systems have been identified using near–surface data and observations in a top-down approach. However, as the global economy incorporates new technologies novel methods for identifying new resources need to be developed such as a bottom-up approach. Magnetotellurics (MT) is sensitive to where fluids are or have been and has the unique capability of being able to image the subsurface from a few meters to hundreds of kilometers providing important information on the lithosphere and upper mantle. The Great Basin in the western U.S. is home to a plethora of mineral and geothermal resources undercover. Here, bottom-up control begins in the mantle where mantle structures control how heat is transferred into the crust. Then, lower crustal structures control how mantle heat influences where fluids infiltrate the crust bringing heat and minerals into the middle and upper crust. Top-down control how heat and minerals reach the near surface is related to current tectonics and existing structures. Understanding the various controls on resource location provides a foundation to search for patterns in geophysical data for possible resources under cover. A 3D resistivity model images patterns of the complex top-down and bottom-up relationships. In the mantle, a resistivity anomaly controls mantle flow and how heat penetrates the lower crust. Thin lenses of melt are imaged as conductive material near the Moho. Conductive anomalies image topography in the brittle-ductile transition representing deep through going faults that act as straws for fluids to transport heat and minerals into the middle and upper crust. These faults are often self-annealing allowing only heat to be transported to the upper crust and are imaged as moderate conductors. Near-surface conductive anomalies image deep basins with existing fluids that absorb the heat to create a geothermal system, often undercover.

**Keywords:** Great Basin, bottom-up, top-down, magnetotellurics

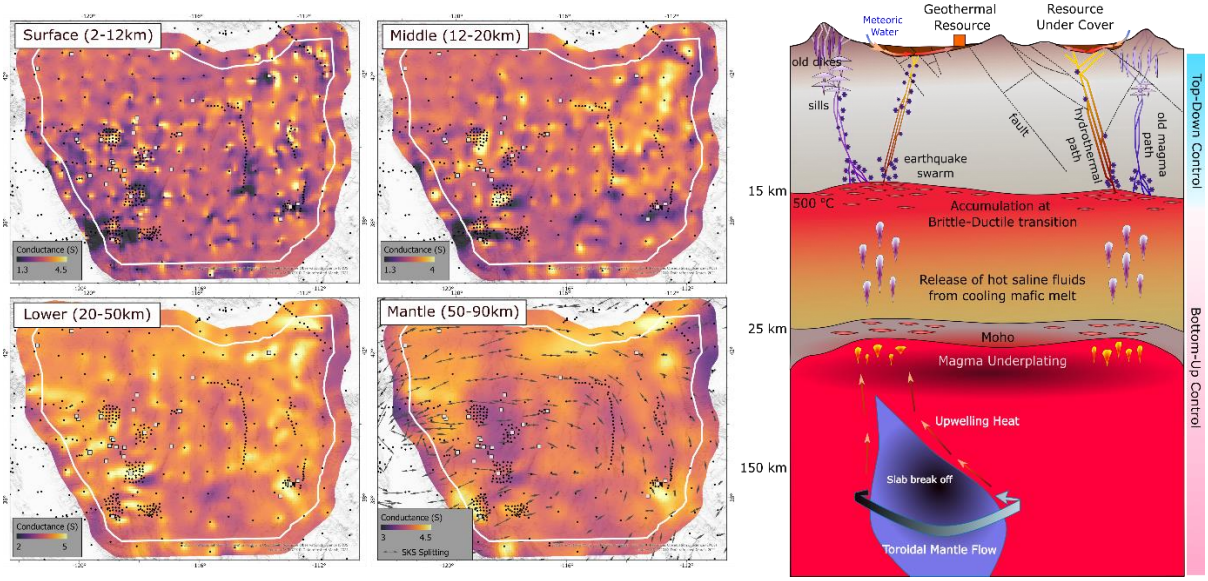


**Figure 1.** Electrical conductance maps for the various zones of top-down and bottom-up influence next to a conceptual model of the Great Basin, western United States.