Electrical resistivity models reveal mineralization and fault systems in the Valley of the Lakes, south-central Mongolia

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SUMMARY

The Valley of the Lakes, south-central Mongolia, is located between the uplifted Hangai Dome and the Gobi-Altai Mountains, within the Central Asian Orogenic Belt. It includes many interesting features, including the South Hangai fault system that represents an ancient suture zone and terrane boundary. This zone is possibly an extension of the Mongol–Okhotsk suture that resulted from the closure of the Mongol–Okhotsk Ocean. The adjacent obducted Bayankhongor Ophiolite Belt is possibly the longest continuous ophiolite belt in the world. This region is important because it is associated with the Bayankhongor Metallogenic Belt that is an economically significant zone for ore extraction in Mongolia, including important sources of gold and copper.

Electrical resistivity is a key parameter for mineral exploration. Because faults and suture zones are regions of fractured, weakened crust they often have circulating fluids that act to increase their electrical conductivity. Additionally, economic mineralization is commonly associated with a conductive signature from associated sulfide minerology. We present magnetotelluric data acquired in an array across central Mongolia (Comeau et al., 2018; Käufl et al., 2018; Becken et al., 2018; this abstract volume). The magnetotelluric data were used to generate 3-D electrical resistivity models of the shallow crustal structure, which was previously poorly understood.

Because the cratonic upper crust is highly resistive (>1000 ohm-m) the low-resistivity (<30 ohm-m) South Hangai fault system is easily detected. It is revealed to be a major crustal-scale structure. A clear transition in crustal electrical properties was observed across the suture zone and may reflect both the rheological and petrological differences across accreted terranes. Furthermore, anomalous, low-resistivity zones in the crust are spatially associated with the surface expressions of known mineralization and resource extraction projects. By combining our electrical resistivity results with other geological and petrological data we attempt to gain insights into the potential mineral resources of this unique region and their origin.

Keywords: Magnetotellurics, Mongolia, Valley of the Lakes, Hangai, fault zones, mineralization