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DOI

[10.5194/egusphere-egu24-5602](https://doi.org/10.5194/egusphere-egu24-5602)

Publication date

2024

Document Version

Final published version

Citation (APA)

Rigaud, R., Comeau, M. J., Batmagnai, E., Kruglyakov, M., Kuvshinov, A., Becken, M., Tserendug, S., & Demberel, S. (2024). *Regional Magnetotelluric Studies across Mongolia: Report on New Measurements, New Models, and Implications for Intracontinental Deformation, Deep Mineral Systems, and Intraplate Volcanism*. Abstract from EGU General Assembly 2024, Vienna, Austria. <https://doi.org/10.5194/egusphere-egu24-5602>

Important note

To cite this publication, please use the final published version (if applicable). Please check the document version above.

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EGU24-5602, updated on 27 Mar 2024

<https://doi.org/10.5194/egusphere-egu24-5602>

EGU General Assembly 2024

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Regional Magnetotelluric Studies across Mongolia: Report on New Measurements, New Models, and Implications for Intracontinental Deformation, Deep Mineral Systems, and Intraplate Volcanism

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We are investigating the lithospheric properties and lithospheric architecture beneath Mongolia with three-dimensional models of the electrical resistivity generated from magnetotelluric measurements. In addition, thermo-mechanical numerical modelling, with geophysically-guided constraints, is being used to provide valuable insights by testing the mechanical viability of different hypotheses for the temporal evolution and dynamic processes within this region.

Mongolia is located between the relatively stable Siberian craton and the extensional regime near the Baikal rift zone to the north and to the south the North China and Tarim cratons that have a northward-directed compressional regime. Due to its location, it is an excellent region to study intracontinental deformation. Furthermore, enigmatic continental intraplate basaltic volcanism of the Cenozoic age exists across Mongolia. In addition, this region contains economically important mineral zones (copper and gold), with the origin and evolution of the mineral systems linked to the whole-lithosphere architecture, crust-mantle interactions, and mantle convection dynamics.

Magnetotelluric data has been collected across Western, Central, and Eastern Mongolia. Three field campaigns in 2016, 2017, and 2018 collected more than 328 sites on an array (50 km spacing) and along three dense profiles (3-15 km spacing) that focused on the Hangai Dome (plateau) and Gobi-Altai (Arkhangai, Bayankhongor) over an area of approximately 800 km (north-south) by 400 km (east-west). Between 2020 and 2022, the array was extended to the east with 77 sites collected across central-east Mongolia (Bulgan, Selenge, Tuv, Uvurkhangai, Dundgovi; 400 by 200 km), including 34 sites along an 810 km long north-south profile crossing the Mongol-Okhotsk suture zone. In late 2022, 79 measurements were acquired in northern Mongolia across the Hovsgol region and Darhad (200 by 200 km) with an array and several profiles, which connect to data west of Lake Baikal. In early 2023, 38 sites were collected in central-east Mongolia (Umnugovi; 200 by 200 km), completing the eastern array. Later in 2023, a major field campaign was launched that

successfully collected 150 measurements in western Mongolia (Zavkhan, Uvs, Govi-Altai, Khovd) over an area of approximately 500 by 400 km. This included an array (50 km spacing) and three dense profiles (5-10 km spacing). This gives approximately 700 magnetotelluric measurements collected over a total area of approximately 1000 km (north-south) by more than 1150 km (east-west).

This is a large area that approaches the scope of several other regional and national magnetotelluric survey programs. What's more, this dataset fills an important gap between the existing magnetotelluric data across China and the Tibetan Plateau with several profiles across the Siberian Craton, in principle completing a remarkable transect of 4000 km across a variety of tectonic domains.

In this presentation, we will report on the new measurements. They will be integrated into the previously collected dataset, and new models will be generated that incorporate all data. We will also present new models of western, central and eastern Mongolia that provide insights on the properties, structure, and evolution of the Hangai Dome, the Mongol-Okhotsk suture and the Central Asian Orogenic Belt.