

IDENTIFYING LITHOSPHERIC BOUNDARIES AND THEIR IMPORTANCE FOR MINERAL DISCOVERY

*Stephan Thiel¹, Stacey McAvaney², Anthony Reid³, Graham Heinson⁴, Kate Robertson⁵
Geological Survey of South Australia, School of Physical Sciences, University of Adelaide.
stephan.thiel@sa.gov.au¹, Geological Survey of South Australia.
stacey.mcavaney@sa.gov.au², Geological Survey of South Australia, School of Physical
Sciences, University of Adelaide. anthony.reid@sa.gov.au³, School of Physical Sciences,
University of Adelaide. graham.heinson@adelaide.edu.au⁴, Geological Survey of South
Australia, kate.robertson@sa.gov.au⁵*

Domain boundaries under cover have commonly been recognised through tracing of potential field anomalies such as extensive magnetic boundaries representing margins of upper crustal packages in conjunction with density contrast. Here, we extend the investigation of domain mapping to include isotope geochemistry and deep-probing magnetotelluric data. These data sets map the deeper crustal and mantle lithosphere. We demonstrate with examples across the Kalinjala Shear Zone, South Australia, and the Eastern Gawler craton, that major lithospheric domain boundaries exert a primary control on the location of mineral deposits near the surface.

We show examples of correlating of magnetotelluric models derived from the Australian Lithospheric Magnetotelluric Project (AusLAMP) and higher density broadband magnetotelluric deployments along profiles with isotope geochemistry across major lithospheric boundaries in South Australia. As one example, the Kalinjala Shear Zone in the southern Gawler craton can be better constrained using the additional geochemical and magnetotelluric data sets and solve a long-standing debate about the northern extension of the Kalinjala Shear Zone towards the prospective Olympic domain hosting major IOCG deposits. These insight motivate future exploration programs which focus on in-fill broadband deployments for MT and isotope mapping to trace the lithosphere boundaries to the surface to reduce risk for mineral exploration.