Projected population pressures and societal demands for environmental sustainability, coupled with the need for carbon-neutral lifestyles to address climate change, require new and innovative strategies for mineral exploration. Bloomberg (2018) projects that by 2030 there will be 280 million electric cars which will require more cobalt, copper and lithium than has ever been produced (NCES 2018). Demands for other elements will also continue to increase, e.g. rare earth elements to support technology and so-called green energy solutions as well as base and precious metals to supply societal and industrial needs. While recycling technology is rapidly becoming more efficient, the need to discover new ore deposits will certainly remain. Most easily discovered deposits have already been exploited, meaning that we need to expand exploration into underexplored peripheral "brownfield" environments and also into the remote, geologically poorly understood, underexplored "greenfield" regions where entirely new mining districts remain to be discovered. The unpredictability and expense of greenfield exploration in remote regions requires the adoption of a "Mineral Systems" approach to mineral exploration (McCuaig et al 2010).

The Mineral Systems approach (McCuaig et al, 2010) employs a more regional and lithospheric-scale approach than the classic ore deposit scale of previous mineral exploration practices, which has powerful potential applications for regional geophysical programs such as EON-ROSE (**E**arth-System **O**bserving **N**etwork - **R**éseau d'**O**bservation du **S**ystème terrestr**E**) and EarthScope. Inspired by EarthScope, EON-ROSE plans to install >1400 Earth System Observatories across the Canadian landmass to provide near-real time, open access data. These powered and telemetered stations will include co-located magnetometers GNSS receivers, broadband seismometers, infrasound and pressure sensors, weather packages and permafrost monitors. During the summer of 2019 the first "nested" array (similar in context to the EarthScope FlexArray programs) was deployed at Mt Meager (150 km north of Vancouver, BC) to assess the potential to produce geothermal energy and monitor volcanic activity. In the Canadian context, EON-ROSE is seeking collaboration from the mineral exploration community to justify the significant expense of such a national program, unlike the scientifically motivated NSF funding for EarthScope. EON-ROSE collaboration with industry will also provide valuable geoscientific results to de-risk mineral exploration programs in remote regions of Canada.

In the southwest US, Griffin et al. (2013) superimposed giant and super-giant ore deposits on a high resolution 90-km deep seismic velocity image, available courtesy of EarthScope, to demonstrate the strong correlations between super-giant copper-gold deposits such as the Bingham Canyon Cu-Au deposit and underlying lithospheric-scale structures (Figure 1). In the Mineral Systems context, these underlying lithospheric-scale conduits through the sub-continental lithospheric mantle (SCLM) channel ore-forming fluids from the SCLM to form ore deposits within the overlying crust. Densified broadband and nodal seismometer, magnetometer, and gravity sensor deployments for EON-ROSE will outline images of these conductive channels in the SCLM across Canada; ultimately to achieve imaging comparable to that under the giant IOCG-U (iron oxide, copper, gold-uranium) Olympic Dam deposit in Australia (Figure 2; Heinson et al. 2018). An industry – academic collaboration will start deploying a proof-of-concept "nested" array during the summer of 2020 to establish further buy-in from the mineral-exploration community. Such government-industry-academic mineral exploration collaborations have been very successful in Australia, providing a return on investment ratio of 20:1 through new discoveries such as the Khamsin and Carrapateena copper-gold mines (ECS, 2014).

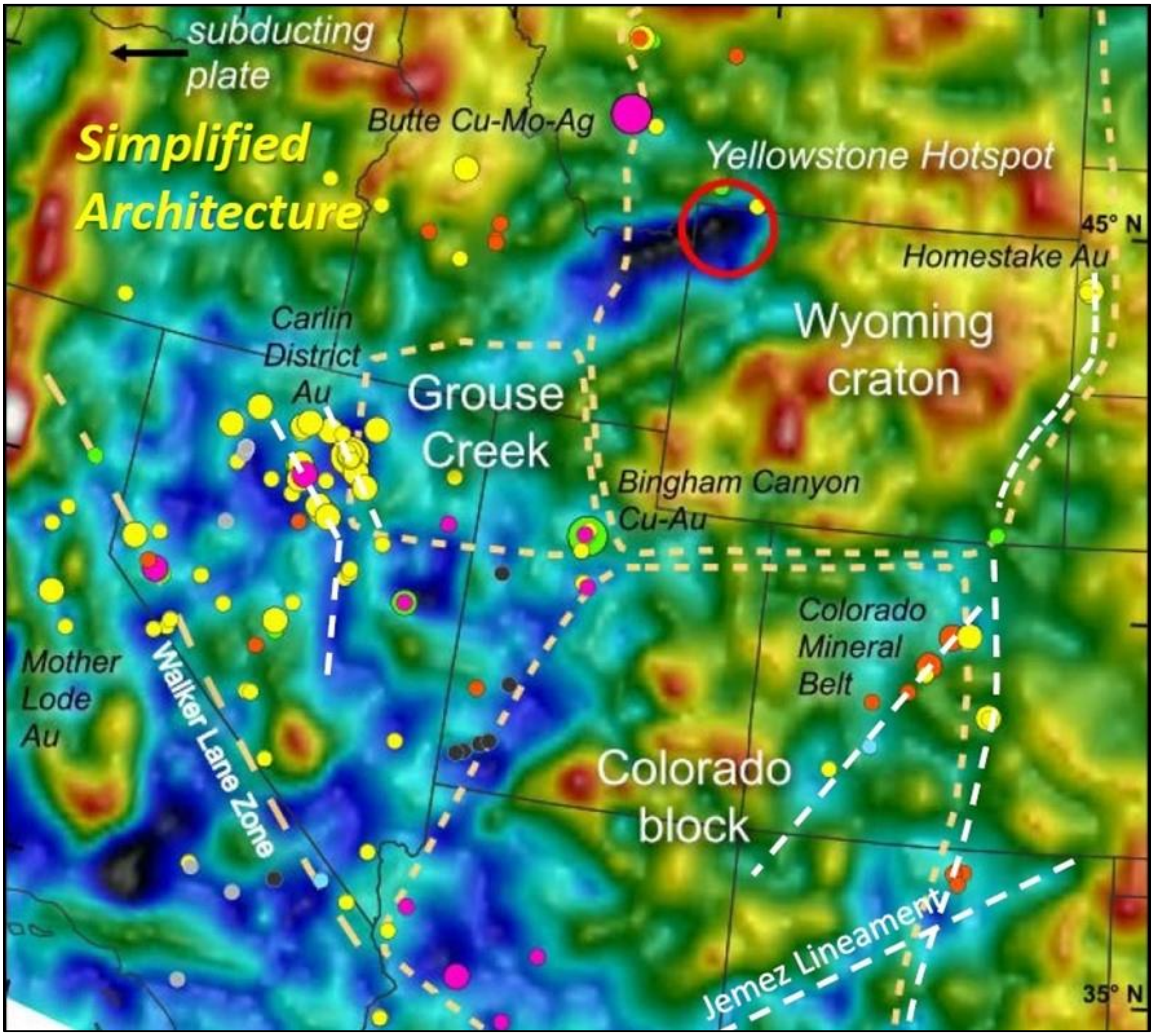

Figure 1: 90 km depth seismic velocity map (using EarthScope data) of the southwestern US with giant and super giant ore deposits superimposed demonstrating relationship of super giant deposits (e.g. Bingham Cu-Au; yellow – Au, green – Cu-Au-Mo, pink – Cu-Mo-Ag-Au, orange – Mo, light blue – REE, light grey – W(Sn), dark grey – Fe) with underlying trans-lithospheric scale structures. Note that these ore deposits are concentrated in low velocity zones (blue) and on the shoulders of high velocity regions (red). Modified after Griffin et al. (2013).

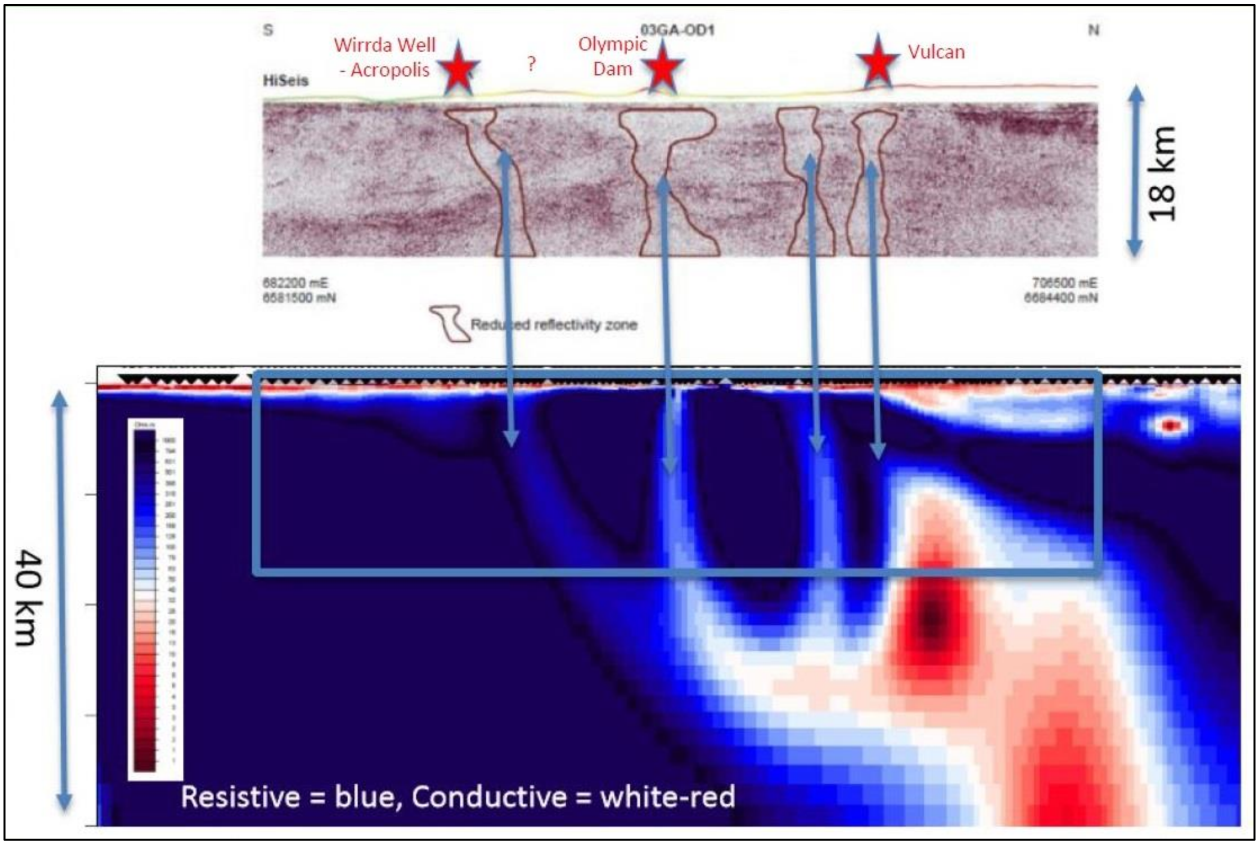

Figure 2: Reprocessed seismic data (top) linked to the conductivity model derived from magnetotelluric data (bottom) beneath the IOCG (iron oxide , copper, gold) Olympic Dam mine in southern Australia. The the pale blue "fingers" have been called part of the "hand of God" , and are zones of high conductivity that are inferred to have been formed by fluid flow that formed the deposits (Wise et al. 2016).

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