Integrated seismic imaging of crystalline crust in Canada's Superior Archean province: Progress with the Metal Earth project

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The Metal Earth project acquired ~1000 km of deep seismic reflection profiles in Canada's Superior Archean province. These surveys cover from Rainy River near the Manitoba-Ontario border in the Wabigoon geological subprovince to Chibougamau in eastern Quebec in the Abitibi geological subprovince. Along the same transects, Gravity and Magnetotelluric (MT) data were also acquired for the purpose of integrated interpretation of geophysical data. Metal Earth regional-scale transects, covering upto 70 km offsets, target mineralizing fluid pathways throughout the crust, whereas higher spatial-resolution reflection surveys target structures at mine camp scales. Because Metal Earth was proposed to map and compare entire Archean ore and geologically similar non-ore systems, regional sections cover the entire crust to the Moho in the Abitibi and Wabigoon greenstone belts. The processing workflow of Metal Earth's crustal-scale seismic data was focused on robust static solutions, detailed velocity analysis, minimal trace smoothing, and high-resolution imaging. Where the new sections overlap with previous Lithoprobe surveys, a clear improvement in reflector detection and definition is observed. Improvements are here attributed to the increased bandwidth of the signal, better estimates of seismic wave speeds used in processing, and especially more accurate migrations of the data. The inverted Gravity, Magnetic, and MT models were integrated into the interpretation of seismic images, revealing possible mineralizing fluid pathways extending to the surface which could be considered as potential mineral prospecting targets. I will present the latest integrated geophysical interpretation of the Superior province from the Metal Earth and Lithoprobe seismic data, utilizing electrical resistivity, density, and seismic reflectivity models to identify the nature of anomalies.