INTEGRATED 3D MINERAL EXPLORATION IN THE FLIN FLON BELT, CANADA

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The Flin Flon belt in central Canada is the largest Paleoproterozoic volcanogenic massive sulfide (VMS) district in the world. It hosts 25 deposits with aggregate tonnage of greater than 150 Mt of sulfide in past or producing mines with an additional 70 Mt in unproduced deposits. The Flin Flon belt also hosts a world-class trove of seismic data including high-resolution multi-component 2D and 3D data from the Flin Flon and Lalor /Snow Lake) mine camps as well as Lithoprobe deep crustal data acquired in the 1990's. These data form the basis of a new government-industry collaboration intended to provide insight into the distribution of ore deposits within the region and will be a showcase for methods to discover next-generation buried ore deposits. New data acquisition within the project will include regional airborne magnetic, electromagnetic and gravity surveys and 2D high-resolution seismic planned for winter 2020.

The project work will utilize these geophysical data to develop new approaches to integrate geological and geophysical data. The goal is to build a 3D geological model of the Flin Flon region that will inform future exploration particularly in areas buried beneath sedimentary cover. The underlying concept is to use knowledge developed in 'brownfield' areas (i.e., Flin Flon and Lalor/Snow Lake mine camps) to guide model construction in the surrounding 'greenfield' areas. A regional 3D knowledge cube will be constructed over a 40,000 km^2 region extending beyond mineable depths. The resolution of the model will be adaptive, driven by data density/quality.

A key objective of the project is to integrate existing/new 2D crooked line seismic profiles with surface and drillhole geology to constrain 3D geology to mid-crustal depths but with a focus on the upper 5 km. 2D profiles include existing mining camp profiles from Flin Flon and Lalor/Snow Lake mining camps and Lithoprobe data. Whereas previous regional crustal-scale interpretations of 2D Lithoprobe data exist for the belt, the focus within this project will be to further exploit these data for 3D information. Several approaches are envisaged: 1) data reprocessing to focus on improved imaging of the upper 5 km using current processing techniques, 2) tomographic inversion for near-surface velocity variations; 3) prestack analysis including cross-dip and/or 3D migration; 4) 3D post-stack migration; 5) 2D seismic constraints supplemented by geological information. Results obtained to date will be presented.