Seismic interpretation of a 2D HIGH-RESOLUTION survey in the Proterozoic Cape Smith belt

*Jérémy Gendreau, Polytechnique Montréal, Montréal, Qc, Canada*

*Gabriel Fabien-Ouellet, Polytechnique Montréal, Montréal, Qc, Canada*

*Circé Malo Lalande, Canadian Royalties inc., Montréal, Qc, Canada*

In 2018 and 2019, Canadian Royalties, owner of a property in the Cape Smith Paleoproterozoic rock belt, conducted a series of high-resolution 2D seismic reflection surveys. We interpreted one line in support of an ongoing research on full waveform seismic inversion and imaging. The main objective is to produce an initial model of seismic velocity of the interpreted section. The second objective is to develop a better understanding of the geological context of the area of study. The deposits exploited are associated with mafic to ultramafic intrusions intersecting metabasalt and metasedimentary units from the top to the bottom of the stratigraphic column. We interpreted the pre-stack Kirchhoff time migrated image. We observed a ramp that folds upward of sedimentary and basaltic units in the northern part of the seismic line. The fault accompanying this fold does not agree with the most recent geological map of the area. However, the axis of the fold and the contact between the lithological units observed on the surface map constrain the interpretation. Available acoustic properties measured on core samples were used to predict seismic reflection amplitudes between the geological units. We also used the petrological descriptions of the units to establish theoretical models of their seismic facies, which can be correlated with the data. Observing the same sequence of reflectors and seismic facies also supports the idea of the presence of a thrust fault. The presence of seismic anomalies was observed mainly in the metasedimentary units of the Nuvilik Formation. These anomalies are interpreted as either the Expo Suite footwall contact with the country rocks or caused by a major thrust zone. The addition of drilling data could solidify the interpretation. Analyzing the lines adjacent to the line studied will also provide a better understanding of the regional geological context and better support to the full waveform inversion workflow.