**Unveiling ore system architecture through 3D seismic imaging and geological modelling**

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Deep mineral exploration is extremely challenging. At any stage of exploration there are rarely unequivocal clues about the location of prospective targets below the depths reached by drilling. Clearly, a deductive integrated approach is needed that departs from what we know about the geology closer to the surface. Through a decade of research funded by the Geological Survey of Canada's Targeted Geoscience Initiative, we claim that 3D integrated seismic imaging and geological modelling within and around mine camps is an important avenue towards progress. Seismic reflective methods are optimal in the sense that they cannot only be used for directly targeting ore, but also for imaging high-resolution details of the ore-hosting geological structure. This combination of direct and indirect targeting potential is unique in comparison to other geophysical exploration methods. Nevertheless there are significant limitations to the use of seismic methods, as their effectiveness is biased towards stratified substrates with favourable imaging geometries. Moreover, seismic interpretation, when used on its own, leads to many false positives. The latter is due to the fact that acoustic impedance contrast generating a seismic reflection or diffraction can, in addition to ore-host rock contacts, be explained by many other geological phenomena. This is where the integrated modelling approach pays its dividends. Mine camps provide us with natural laboratories for integrating seismic and multivariate drillhole datasets, allowing us to predict the seismic response of ore in context of the geological setting, thereby reducing the number of false positives. Although this research is primarily focused on general knowledge of the seismic response of ore systems, the results are directly applicable to deep exploration in the mine camp itself. Moreover, the integrated approach does not only yield insights into post-mineralization structural controls but also into primary architectural elements of the ore system, including ore-hosting lithofacies and hydrothermal conduits. This is an important area of research, given that beyond the seismic properties of ore, much remains to be discovered about seismic properties of these more distal ore system elements. This presentation shows examples from base metal camps in Canada where integrated seismic imaging and modelling have enhanced insights into the structural setting and seismic response of ore systems to the benefit of deep exploration

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