

Seismic signature of gold mineralization from laboratory rock physics and petrology characterization

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Gold deposits are becoming deeper or are still concealed under a deeply weathered terrain. Therefore, exploratory and mining planning activities require detailed structural imaging to reduce associated drilling costs. Among imaging techniques, seismic methods are an appealing geophysical tool to consider and adapt for mineral settings as they indeed simultaneously join resolution and depth of investigation.

Direct detection of gold is difficult because the ore is in low concentration in the rock. However, gold deposits are commonly associated with characteristic alteration zones when related to particular host rocks. Identifying this indirect indicator of gold mineralization could be used for targeted drilling.

To better understand the elastic properties and their changes with alteration in gold deposits environments, we characterized in the laboratory more than 100 core samples from 2 mines sites in Western Australia: Karari and Thunderbox mines. Rock Physics laboratory measurements include bulk and grain densities, porosities, and ultrasonic P- and S-wave velocities, in the axial and radial directions of the cores. Mineralogical characterizations, conducted on a subset of representative samples of different alteration zones and lithologies, comprise XRD analyses for mineral identification and automated mineral mapping. These experimental data were used as input in different rock physics models to find one that is consistent with our data. The overall goal is to understand the effects of mineralogy and texture on the elastic properties of the samples.

The first results indicate that the texture of the host rocks, namely foliation and porosity (even 2%), is the primary control of the elastic properties variation. These results will help to predict the seismic properties of typical alteration zones associated with lode gold deposits, and to infer whether textural changes, mineralogical changes or larger scale structural features will give a response in the seismic signal.

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