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A novel method to predict hydraulic fracturing breakdown pressure.

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Hydraulic fracturing is increasingly becoming utilized within Underground hard rock mines such as block caves and Sub Level Caves as a way to promote controlled cave propagation, increase resource recovery, and seismic hazard through the manipulation of rock mass properties through fracture surface creation and limiting of stress concentration.
While hydraulic fracturing is not a new application, it is still in its infancy in mining projects such as cave mining. It is used on entirely different scales, under different stress regimes and with varying motives. Therefore, more research needs to be carried out in understanding the fundamentals of fracture growths that can help improve hydraulic fracturing applied in mining projects.

Predicting breakdown pressure is an important part of the designing of hydraulic fracturing with accurate prediction being the baseline of designing and implementing a successful preconditioning campaign in all industries, but especially so in block cave mining.
The most commonly used breakdown pressure theoretical model is the conventional breakdown model and is based on tensile strength and confining stresses acting upon the borehole. This might be imprecise within hard rock mining environments and increasingly so at depth of higher stresses.

This work compares indirect tensile strength results and their fracture toughness, from both conventional Brazilian Disc Testing and the recently developed Adelaide University Snapback Indirect Tensile Testing (AUSBIT).
By using lateral strain control to stabilise the brittle material responses, AUSBIT allows for the capture of true post-peak behaviour, i.e. controlled fracture propagation can be achieved.

The captured post-peak behaviour allows practitioners to measure a more reflective tensile strength and fracture toughness from just one testing method, Alongside this are laboratory hydraulic fracture experiements on the same rock unit, which in turn is used to propose a new Hard Rock Breakdown Pressure prediction based on the conventional method which incorporates fracture toughness when checked against the results of the lab fracture experiments, and other lab studies.

The results of this work factors in a progressive toughness of a rock at depths, and creates a more accurate predictor of breakdown pressure in underground hard rock mines under varying stress conditions.