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Proneness of competent over-stressed intact rock to violent fracturing

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ABSTRACT

For most practical rock engineering purposes, stress versus strength conditions around underground openings for which rockmasses fail and their various modes of failure, are reasonably well-understood and predictable. Some rockmasses and particular rock types fail slowly and relatively quietly. However, others can fail rapidly, violently and maybe with the ejection of significant broken rock.

In some countries and in some mines, the latter style of violent fracturing and failure of the rockmass is referred to as ‘strain bursting’. It can be alarming and extremely hazardous to nearby miners and machines. For such situations, the design and installation of appropriate ground support, to provide a safe work place, can be challenging.

At any particular mine site, it’s often generally understood which local rockmasses (rock types) are prone to strain bursting. Competent and strong siliceous rocks and some massive sulphides are often the main offenders. While some neighbouring, equally-competent and strong rocks might also fail, they do it more quietly and without ejection. To understand this contrast, a better understanding of the fracturing process is required other than simple and standard strength versus stress considerations.

Suites of standard intact rock properties from numerous Australian mines have been used to define and help understand different high-stress failure styles for component intact rock; especially those prone to violent fracturing (strain bursting).

Simple considerations of micro-fracturing (defects in the intact material), plus the available energy at failure versus the energy consumed during fracturing, easily distinguishes between over-stressed and competent rock types that fracture violently and those that don’t.