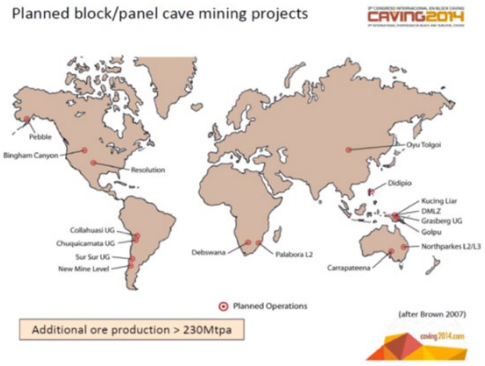
The Cave Mining 2040 Consortium for research into cave mining

Cave Mining 2040 (CM2040) is a collaboration of several Mining Industry members to develop activities to transform the cave mining industry. Supported by Mining3, the CM2040 Consortia has been working for the past 4 years, as Horizon 1, to develop solutions that reduce lead times and capital investment by transforming cave mining as it is presently practised, to methods that improve its viability, safety, cost, production, and profitability, while improving its societal and environmental acceptance.

Current Sponsors (Horizon 1)

The Cave Mining 2040 Collaboration Consortium (CM2040) comprising BHP, Newcrest, OzMinerals, Anglo Gold Ashanti, Merdeka Copper Gold and Vale, has jointly funded cave mining research as Horizon 1 of the research roadmap. A wide variety of researchers and collaborators have been involved. A summary report is available for the Horizon 1 ooutcomes.



Planning of the Horizon 2 Consortium:

With the imminent completion of Horizon 1 milestones in 2022, the Cave Mining 2040 Horizon 2 Consortium truly intends to Transform Cave Mining Globally. With mining at greater depth caving will become increasingly important. The consortium is inviting new participants to join us in the next stage of research following the current phase of research.

Mining companies with an interest in Cave Mining or mining at depth are invited to join the consortium for the next horizon of Cave Mining 2040 research.

For enquiries contact Mining3 at

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Cave Mining Research to date - CM2040 Horizon 1 study areas (2018 – 2022):

An exhaustive list of natural geological, geothermal challenges spanning deposit depth, size, shape and more, as well as man-made challenges including ore-body access, productivity costs, safety, and longevity and sustainability of business. These generic priority areas were collectively referred to as *'The Cave Mining 2040 Horizon 1 Study Areas'*.

The Cave Mining 2040 'Horizon 1 Project' comprised of six study areas (**each briefly outlined below**) likely to have short to mid-term impacts on cave mining methods during the next 10 years and ultimately contribute to the overall transformation of cave mining variants, which are conventional, macro, sublevel caving and Inclined caving. As the research work progressed, the names of some of the study areas were changed to suit.

1. Total deposit knowledge
An adequate level of orebody knowledge—including the 'total' deposit knowledge (TDK) i.e., geological, geotechnical, and hydrogeological characteristics—is the foundation upon which cave mining will be transformed in the future. The ultimate objective of TDK research is the ability to produce a 3D mining 'uncertainty' model of an ore deposit (quantifying the characteristics of orebody not fully measured).

2. Rapid Cave Establishment
Reducing the high capital investment required to establish a caving mine requires a paradigm shift in how future deep ore deposits are accessed and caves are established. The cave establishment study area is focused on safety, speed, efficiency and reducing the up-front capital requirement.

3. Macro-block design and sequencing optimisation
The development of mining strategies for caving ore deposits with large footprints using the concept of macro-blocks has the potential to provide significant benefits. By considering in situ and induced rock-mass conditions and geological structures, while maintaining extraction level stability, macro blocks will potentially delay ingress of waste, as well as reduce up-front Capital expenditure.

4. Mine design for new and emerging technologies
By redesigning the extraction level arrangement to maximise ore recovery, we also enable the cost-effective use of emerging technologies and reduce the amount of required horizontal and vertical mining development, as well as ensure the effective and cost-effective implementation of automated production systems. Because the extraction level must remain in place for an extended production period, overall layout design, ground support and roadway conditions are critical factors. By initially investing in high-performing, large-scale, lasting infrastructure, the day-to-day operational costs can be lowered throughout the life of the cave.

5. Cave Front/Back Tracking Using Active and Passive Microseismic Data

Knowledge of where the cave is at any time is important for miner safety (to limit risk of catastrophic air blast a consequence of cave back sudden failures) and for production (to know in advance if the cave is moving towards waste rock). One of the most useful techniques currently used for cave front tracking is passive Microseismic monitoring.

6. Sublevel caving Benchmark
Sublevel caving is a method often evaluated in parallel with block and/or panel caving options. It requires multiple levels of development and ongoing ring blasting for production. Sublevel caving allows for a more selective extraction but typically achieves lower production rates than block and panel caving methods.