

## Changing World—Changing Exploration

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The world continues to change, most recently through global connectivity and digital technology that have been termed the “Fourth Industrial Revolution.” This revolution is already impacting energy use, transportation, and employment. When combined with new materials and associated applications, there is potential for disruptive changes to metal markets and, hence, mining and exploration.

These developments build on existing trends that already affect mining, such as population growth, basic human needs, emerging economies, and heightened expectations for quality of life and a clean environment. Predicting how these factors will play out in the short to long term is challenging. Potential decline in metal demand would clearly reduce exploration expenditure, while rapid increases in metal use, or supply constraints, could cause metal-specific exploration booms, as happened with rare earth elements in 2010–11. Neither support consistent exploration efforts.

Mining and exploration have always adapted to fluctuating demand. The first primitive miners responded to early metal use, and new mines and more sophisticated tools developed over the subsequent 5,000 years. The rate of change increased with the industrial revolution, new bulk mining methods, and dramatic changes in processing. Exploration responded with explorers going to new places and with new ideas and technology, and many excellent discoveries followed. While a spirit of adventure and field skills have remained consistent ingredients for success, many aspects of modern exploration would be unrecognizable to practitioners operating 35 years ago. Change will continue, but predicting the end result in 35 years is as difficult as it would have been to predict the present 35 years ago. Given current trends in exploration, the following will be important areas for change:

*Business and partnerships:* The effectiveness of funding strategies and partnerships among exploration-focused juniors and mid-tier or major producers has declined. New business models are needed. National companies and downstream technology companies both need to secure resources, a need that may offer exploration investment opportunities. Lastly, gaining community support will require models involving shared benefits and innovative partnerships.

*Technology and tools:* New mobile analytical equipment and sensors will generate increasing amounts of field data, which, if used in conjunction with traditional techniques, will accelerate programs and decision-making. Rapid drilling technology from fewer, smaller drill pads with real-time data will result in more targets being tested for less dollars and less impact.

*Data:* The data explosion also threatens to hinder effective exploration if not managed appropriately. Intelligent methods for QA-QC, integration, and interrogation will help significantly if geared toward results.

*Exploration strategy:* In spite of new ore deposit models, we struggle to understand system footprints, the clusters of deposits they contain, and the potential for quality discoveries.

Brownfields and greenfields exploration require different applications, and greenfields in particular needs renewed impetus, which is only likely with new business and funding models.

In spite of global change and all its ramifications, quality discoveries are clearly required. These still create the most value with the least impact. It remains to be seen whether we can harness change to improve our odds of making these discoveries.