SEG 100 Conference: Celebrating a Century of Discovery

ST.029
Road to the Future: What Ore Deposit Study Should Focus on Beyond 2020

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The future trends for ore deposit study should depend on the demands from our society and industry, which have clearly changed in the past decade and will continuously evolve in the future. In general, three major challenges on mineral exploration have been raised for all economic geologists, including (1) deep exploration, (2) high-efficiency exploration, and (3) environmentally friendly exploration, which we must take into serious consideration. The most crucial thing for the researchers is to determine what we should focus on in ore deposit study and what we can do to help when facing these challenges for mineral exploration.

Deep exploration is becoming increasingly important due to limited exposed metal sources on the surface and at shallow level. The combination of multiple newly developed methods will be critical for increased success during deep exploration. Except for improvement of geophysics such as DF-IP and WA-EM, approaches to geochemical vectoring using physical and chemical characteristics of alteration minerals are emerging and have good potential to be very useful in the future (e.g., chlorite and alunite in porphyry-epithermal systems). More accurate estimation of ore formation depth and erosion rates coupled with a well-defined preservation history should be paid much more attention as this will provide fundamental information for mineral exploration on both deposit and regional scales (e.g., new studies on the Paleozoic porphyry Cu deposits in NW China).

Tremendous knowledge from ore deposit studies has been accumulated in the past 100 years. However, applications of this valuable information were largely based on personal experience and limited highly technical approaches with low efficiency, compared with astonishing development in other fields such as environment and life sciences during the last decade. Obviously, a robust and more efficient AI-assisted exploration guiding system should be built in the future. Such a system will not work without careful establishment of an accurate database for each deposit type. This can only be achieved by the involvement of well-trained professional economic geologists. Among all the processes needed to build these data sets, before turning to AI assistance, establishing a comprehensive combination of valid identifying criteria (i.e., identification system) for each deposit type is crucial (e.g., breakthrough by GoldSpot on Au exploration in Canada and new approaches on porphyry Cu deposits in China).

Mineral exploration and mining can have negative impacts on the environment and are facing serious restrictive policies even in many developing countries. An evaluation system is required to more accurately justify if a newly discovered deposit is viable considering its environment impacts. Again, the involvement of economic geologists will be necessary in this work as each deposit type will have distinctive metal associations and mining approaches, which will be complicated by different landforms and weather conditions. Clearly, developing the subsystems for each deposit type in specific regions will be fundamental to establish an entire environment-protected mining evaluation system (e.g., new attempts on porphyry-epithermal deposits in strongly weathered mountain areas in SE China).