A holistic approach to geologic modeling: Revisiting historic ore deposits with 3D modeling technology

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In today’s economic market, it is critical that resourceful economic geologists use both traditional and out-of-the-box exploration methods to discover overlooked and under-explored deposits. Many deposits have been explored by various groups using traditional methods and were later deemed uneconomical. The purpose of this study is to review historic deposit data using three-dimensional (3D) computing technology. 3D technology has been used in mining and petroleum industries for over 30 years, but it has yet to be fully embraced in the mineral exploration profession. Methodologies used in this study highlight innovative scientific tools to increase mineral exploration success.

The use of computers to aid exploration efforts traditionally stops with the production of two-dimensional surface maps and cross sections, which are used for hand-drawn interpretation or publication. More recently, the use of explicit or implicit computer models, generated primarily from drillholes, are starting to be used to visualize structural features and ore shapes. While traditional techniques are important for exploration, the computer modeling process could be expanded upon, but has not been for the following reasons: traditionally used computer modeling packages do not easily handle large datasets; robust software suites are too expensive; too much time is required to learn the software and input data; geologic interpretation and deposit understanding, along with user control, is lost during computer modeling; explicit/implicit modeling results are not reproducible; computer-generated results cannot be easily used or updated in the field; the knowledge generational gap does not allow everyone to utilize computer modeling, so results are not easily shared or trusted. While these reasons appear valid enough to forego the use of computer modeling, this study will show that quality models can be created quickly to enhance drill planning and field mapping efforts, maximizing efficiency and cost savings.

The Revais Creek deposit is located approximately 40 miles north of Missoula, Montana on the Flathead Indian Reservation. Copper, gold, silver and platinum group elements were historically mined along the eastern limb of a dioritic intrusion, where remobilizing fluid concentrated the ore in fracture openings along the contact between the host rock and dioritic intrusion. Previous studies of this deposit relied on traditional field mapping and two-dimensional cross-section techniques to define the ore zone and ore forming processes. Unfortunately, previous studies were unable to utilize all available data due to limitations of two-dimensional mapping. In this study, we will compile all available historic data into one 3D model to investigate not only the deposit’s geometry and potential, but also compare the cost and efficiency associated with computer modeling versus traditional techniques.

By combining new and old mineral exploration techniques we are bridging the generational knowledge gap to fully utilize existing data to paint a picture of the deposit ore genesis and identify ore vector potential targets. A thorough deposit review allows resourceful economic geologists to make informed field observations and interpretations on a limited budget. This study highlights
the economic value of using non-traditional exploration techniques and tools on overlooked and under-explored deposits.