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Gold 2020 - Current Understanding and Ongoing Questions

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Since the *SEG 2000 Gold Conference* and *Reviews Volume*, our understanding of the genetic models for major global gold producer types has not advanced significantly, whereas understanding for some lesser-understood deposit types (e.g., Carlin-type, IOCG) continues to be just as poor today. There have been major changes in the past few decades regarding what we mine today, particularly as the gold price has led us to economically favorable development of many more giant sub-gram ore systems and large refractory deposits. Furthermore, improved analytical techniques have led to vast amounts of published geochemical data on all gold deposit types, some helpful and some definitely not, commonly in lieu of necessary, more detailed geological field study of a deposit or district.

Models for shallow intrusion-related (e.g., porphyry, skarn, epithermal) and deeper metamorphic-related (e.g., orogenic) gold are well-accepted. The mainly Cenozoic intrusion-related deposits are products of oceanic and continental arc development in the circum-Pacific and Tethyan belts. The Neoarchean, Paleoproterozoic, and <700 Ma orogenic gold deposits are widely related to metamorphism in Precambrian greenstone belts and younger orogens. Although these widespread ore types formed throughout Earth history, preservation processes control their ultimate present-day spatial-temporal distributions. Many issues critical to explorationists continue to require address, such as defining extent/edges of hydrothermal systems (particularly to aid in vectoring to ores), controls on high-grade ore zones, controls on element abundances (particularly as demand increases for by-product critical elements), and issues of provinciality that may identify more prospective gold belts. When considering a mineral systems approach, we know much about conduits and traps for these major deposit types, but fluid/metal source continues as an issue of some debate. Importantly, are there oxidized intrusions that release multiple pulses of magmatic-hydrothermal aqueous-carbonic fluids to form series of fault-fill and extensional vein systems along the length of a deep crustal fault system? Despite evidence for metamorphic fluid involvement, almost every major orogenic gold deposit has been related somewhere in the recent literature to magmatic processes. So, can fluid exsolution from an oxidized magma lead to formation of orogenic gold deposits? This has important regional targeting implications regarding whether to favor areas with structural traps near greenschist zones or near a particular plutonic suite.

Unlike other gold deposit models, the Carlin model is a local model for the well-studied deposits in Nevada. It provides thorough descriptive data to explore for such 40 Ma replacement-style ores in the Basin and Range, but because it has not been developed from widespread global examples, a genetic model is still not clear. Magmatic, meteoric, and metamorphic fluids have all been suggested as part of the ore-forming process, but the ores are significantly different from those defined as high-sulfidation epithermal, low-sulfidation epithermal, and epizonal orogenic, respectively. Deposits elsewhere in the world defined as Carlin types, such as in China and southeast Asia, are not the same as what is present in Nevada, and it would be a mistake to try to define a global Carlin gold model that includes these examples.