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Growth and Metallogeny of the North American Cordillera: A Contrast with the Tethysides

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The North American Cordillera, a classic accretionary-type orogen, is dominated by dozens of terranes added to the western North America margin between ca. 200 and 50 Ma. Prior to accretion, middle to late Paleozoic hydrothermal events in rifted continental margins were associated with formation of clastic-dominated Pb-Zn (e.g., Red Dog, Howards Pass) and polymetallic VMS (Arctic, Bonnifield, Finlayson Lake, Shasta) deposits. The subsequently accreted terranes were mainly Paleozoic and Mesozoic rocks of oceanic arcs and subduction-accretion complexes, some far traveled and amalgamated into microcontinents more than 100 m.y. prior to accretion. In the northern part of the orogen, large Late Triassic VMS (Greens Creek, Windy Craggy) and Triassic-Jurassic porphyry (Schaft Creek, Galore Creek, Highland Valley) deposits formed distal to the continent and were added to the orogen in British Columbia and southeastern Alaska during mid-Mesozoic terrane docking. A subsequent major porphyry-forming event in the mid Cretaceous was synaccretionary, with deposits (Orange Hill, Pebble) forming along the edge of a closing flysch basin and being rapidly translated hundreds of kilometers northward along the edge of North America to southern Alaska. Postaccretionary orogenic gold deposits formed along the length of the orogen, from Nome to central California, from 170 to 50 Ma, in fore-arc and back-arc positions relative to broadly coeval subduction-related batholiths, and during changes in far-field stresses. Inboard of the Cretaceous Sierra Nevada batholith in California, middle Tertiary extension, related to slab rollback, was coeval with formation of Carlin-type gold deposits in Nevada. Late Tertiary Basin and Range extension, likely related to outboard motion on the San Andreas fault system, led to world-class epithermal Au-Ag deposits.

Whereas orogenic gold deposits and associated placers are the most widespread ores in the Cordilleran orogen, the Tethysides is characterized by widespread porphyry Cu ± Mo ± Au deposits, related Au ± Cu epithermal deposits, and MVT-type Pb-Zn deposits. Fragments of northeastern Gondwana rifted away by the early Mesozoic and eventually collided with Eurasia to form much of Turkey, Iran, and Tibet in the late Mesozoic-Cenozoic. Except for, perhaps, the Pontides region, these Gondwanan continental blocks typically lacked the complex oceanic arc development that formed many of the pre-accretionary VMS and porphyry deposits in allochthonous terranes of Canada and Alaska. They lacked an association with elongated belts of subduction-accretion complexes that would have supplied fluids and metals for orogenic gold deposit formation along crustal-scale faults (terrane boundaries) in a postaccretionary period of metamorphic dewatering, strike-slip faulting, and differential uplift to expose belts of mid-crustal rocks. In contrast, collisions of the other Gondwanan fragments (e.g., North China, Tarim, South China, Indochina) with Siberia and Kazakhstan closed large basins containing abundant juvenile material, and the resulting sutures are associated with significant orogenic gold resources in the Central Asian orogenic belt.

Thus, although Tethysides has features of a Cordilleran-type accretionary orogen, the simple suturing of oceanic fragments did not lead to a diverse metallogeny and significant metal endowment. However, the Cenozoic closure of Neotethys by collision between Africa-Arabia and India with Eurasia led to the extensive development of syn- to postcollisional porphyry deposits throughout the Tethysides in areas of preexisting lithospheric fertilization. The vast carbonate platform of the Eurasian foreland provided unique environments for Tertiary formation of the world's most important MVT ores from southwestern Europe to Indochina.