

The Timing of Mineralization in the Archean North Pilbara Terrain, Western Australia

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Abstract

Mineralizing events in the North Pilbara terrain of Western Australia occurred between 3490 and 2700 Ma and include the oldest examples in the world of many ore deposit types. These events were pulsed and associated with major volcano-plutonic episodes (volcanic-hosted massive sulfide, porphyry Cu, Sn-Ta pegmatite, mafic-ultramafic-hosted Ni-Cu-PGE, and epithermal deposits) and deformation events (lode Au deposits). In many cases, the mineralizing events are associated with extension, either in rifts, pull-apart or back-arc basins, or as the consequence of doming associated with granitoid diapirism.

Although mineralizing events occurred throughout the evolution of the North Pilbara terrain, the largest deposits are related to the development of the Mallina basin, which is located between the older East and West Pilbara granite-greenstone terranes. Four volcano-plutonic and three deformation events occurred in and around the Mallina basin between 2950 and 2840 Ma. Mineralization in the East and West Pilbara granite-greenstone terranes is less intense and occurred over a much longer period.

Compared to other Archean granite-greenstone terrains, the North Pilbara terrain is poorly endowed; the only known world-class deposit in this region is the Wodgina Ta-Sn pegmatite deposit, but large iron ore deposits are being mined in the northeastern North Pilbara terrain. The long history of crustal development and slow rate of crustal growth may be responsible for the diversity of mineral deposits and could account for the apparent poor endowment of the North Pilbara terrain.