

Evidence for Diachronous Archean Lode Gold Mineralization in the Yilgarn Craton, Western Australia: A SHRIMP U-Pb Study of Intrusive Rocks

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Abstract

The currently accepted model for the Archean lode gold deposits of the Yilgarn craton postulates that they represent a coherent group of epigenetic deposits, the majority of which formed during a craton-scale, broadly synchronous hydrothermal event late in the tectonothermal evolution of the granite-greenstone terranes at ca. 2640 to 2630 Ma.

Felsic rocks from the southern Eastern Goldfields, which host or are cut by gold mineralization, have SHRIMP II U-Pb zircon ages of 2673 ± 3 Ma at Mount Charlotte, 2669 ± 17 Ma at Mount Percy, 2663 ± 3 Ma at Racetrack, and 2657 ± 8 Ma at Porphyry. All these ages are consistent with gold mineralization at ca. 2640 to 2630 Ma.

Intermediate to felsic dikes cut typical syn- to postmetamorphic lode gold mineralization at the Mount McClure and Jundee deposits in the Yandal greenstone belt in the north of the Kurnalpi terrane. The dikes give ages of 2656 ± 4 , 2663 ± 4 , and 2668 ± 10 Ma from Mount McClure, and 2656 ± 7 Ma from Jundee, requiring that mineralization and peak regional metamorphism in the belt occurred prior to ca. 2660 Ma. However, both the characteristics of the Jundee and Mount McClure deposits and the relative timing of mineralization with respect to the metamorphic and structural history of the belt are similar to that seen for gold deposits elsewhere in the Yilgarn craton. This implies that mineralization at Jundee and Mount McClure was produced prior to 2660 Ma by similar processes to those seen elsewhere in the Yilgarn at 2640 to 2630 Ma.

Peak metamorphism in the western, higher metamorphic grade terranes of the Yilgarn was not reached until ca. 2630 Ma, some 10 to 30 m.y. after peak metamorphism in the Kalgoorlie terrane and more than 30 m.y. after metamorphism in the Yandal belt. In addition, almost all of the published robust ages supporting gold mineralization at ca. 2640 to 2630 Ma are from the west of the craton. Consideration of the new data from the Yandal belt in conjunction with previously published geochronology throws doubt on the hypothesis that lode gold mineralization occurred approximately synchronously across the Yilgarn craton. Rather, it suggests that mineralization, along with regional metamorphism, is earlier by at least 30 m.y. in the northeastern Yilgarn craton.