THE LATE-ARCHAEAN METALLOGENIC BONANZAIN AUSTRALIA

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As in most Archaean cratons, worldwide, the metallogenic peak in Australia was in the late-Archaean, between ca 2.7 and 2.5 Ga. This coincides, as elsewhere, with peak submarine volcanism, extensive marine transgressions, elevated hydrothermal activity and widespread suboxic conditions in submarine basins, both in external and internal oceans. Global plume events were important in external ocean basins at this time, with high heat-flux leading to massive mantle melting and widespread komatiitic volcanism. This was followed by extensive crustal melting, resulting in some of the most voluminous granitoid terranes on Earth. This led to the development of a rigid lithosphere below circular to ovoid cratons, preserving deposit styles more rapidly eroded in younger more-linear orogens.

In Australia, the Yilgarn Craton is the most richly mineralized granitoid-greenstone terrane, interpreted to represent late Archaean closures of convergent margins to external oceans, whereas the Hamersley Basin is the most richly mineralised late Archaean volcano-sedimentary succession related to rifting and internal-ocean opening. In the Yilgarn, the major ore deposits are ca 2.7 Ga nickel sulfide deposits, formed in komatiite lava channels during extension and volcanism, and orogenic gold deposits, mostly formed at 2.64 - 2.63 Ga during compression or transpression of the earlier-formed volcano-sedimentary successions; similar gold deposits have been discovered recently in the Gawler Craton. The largest Yilgarn VMS deposits are ca 3.0 Ga old, although there are smaller ca 2.7 Ga deposits. Although large stratiform barite deposits occur, there are only small sulfate-bearing VMS deposits, uneconomic Mo-Cu porphyries and small lode-gold deposits in the ca 3.5-3.2 Ga Pilbara greenstone sequences. However, the overlying Hamersley Group contains the extensive BIF-bearing successions that were the precursors to the giant hydrothermal iron ores of the Hamersley Basin.