

U-Pb Ages Constraining Batholith Emplacement, Contact Metamorphism, and the Formation of Gold and W-Mo Skarns in the Southern Cross Area, Yilgarn Craton, Western Australia

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Abstract

Gold mines in the Archean Southern Cross greenstone belt, central Yilgarn craton, have produced more than 220 metric tons (t) of gold. The deposits are characterized by a pyroxene-rich gangue and have been interpreted as synmetamorphic amphibolite facies replacement deposits and as postmetamorphic intrusion-related skarns.

We present ion microprobe U-Pb zircon data constraining the age of amphibolite facies contact metamorphism in the aureole of the Ghooli Dome, the largest granitoid batholith intruding the Southern Cross belt. Drill cores from the Copperhead gold mine provided zircons from an altered quartz porphyry sill, located 300 m southwest of the Ghooli Dome, and zircons from the monzogranite gneiss at the border of the batholith. The porphyry sill contains embayed igneous zircons dated by a concordant U-Pb age of 2912 ± 5 Ma and euhedral zircons of metamorphic crystal habitus dated by a second concordant age of 2772 ± 5 Ma. The igneous zircons are slightly younger than those recovered from another sill of quartz porphyry, sampled at the Southern Star mine, which define a single concordant U-Pb age of 2934 ± 7 Ma.

The metamorphic zircons in the porphyry at Copperhead record the same age as the igneous zircons (2775 ± 10 Ma) in the monzogranite gneiss of the Ghooli Dome. This pluton extends more than 40 km to the southeast of Copperhead and also forms the batholith border at the Corinthian and Fraser's mines. These gold deposits, too, are hosted by amphibolite facies greenstones contact metamorphosed at 2772 ± 5 Ma. The Corinthian skarn (2620 ± 6 Ma) formed 150 m.y. after high-grade metamorphism and, consequently, cannot be classified as synmetamorphic or metamorphogenic.

A review of field relationships and of published geochronometric data suggests that the gold skarns in the Southern Cross area are related in space and time to a suite of magnetite series granite-pegmatite complexes. These granites, dated regionally at 2.66 to 2.60 Ga, are also associated with gold-bearing W-Mo skarn-greisen or skarn systems of up to 6-km strike length. The numerous skarns exposed in the deeply eroded (14 km paleodepth), central Yilgarn craton are members of a recently recognized group of intrusion-related gold deposits which are part of continental-margin tungsten-tin provinces.