

Overlapping Au-Cu and Zn- Pb-Cu skarns at the Redcap prospect, Chillagoe district, Far North Queensland, Australia

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The Redcap skarn is an unusually gold-rich Zn skarn in the Chillagoe skarn-porphyry district in NE Queensland, Australia. The rock units in the Chillagoe district are Devonian-Silurian Chillagoe Formation limestone, sandstone, conglomerate with interbedded basalt, and late Carboniferous Redcap Dacite rhyolitic, dacitic and andesitic ignimbrite. The sedimentary rocks were overturned to nearly vertical and thrust northeastward on top of the Redcap Dacite rocks. The thrust contact is nearly perpendicular to the bedding. The skarns are focused at the sedimentary contacts and at the thrust fault. The majority of zinc, copper and gold are restricted to two separate skarns along the thrust plane.

Sphalerite is confined in garnet (Ad₅₁₋₉₂)-magnetite skarn, in which pyroxene (Hd₄₋₁₅) is rare. Gold is restricted to pyroxene-rich (Hd₆₄₋₉₉)-pyrrhotite skarn, in which garnet is exceedingly rare. Copper occurs in both. The massive pyroxene skarn with the highest Au-Cu grades is located between the garnet-magnetite skarn and the underlying volcanic rocks. Hedenbergite-rich pyroxene veins cut the garnet-magnetite skarn; in contrast there are no garnet veins cutting the massive pyroxene skarn.

It is unlikely that the protolith type affected the garnet-pyroxene ratios, pyroxene composition and the presence of magnetite and pyrrhotite, because the skarns are oriented nearly perpendicular to the carbonate strata. Alternatively, two separate skarn forming events likely occurred, with the garnet-magnetite-sphalerite skarn predating the gold-bearing pyroxene-pyrrhotite skarn. This would explain why Redcap contains appreciable gold grades while the other sphalerite skarns of the Chillagoe district do not.

Two granodiorite plutons are present in the area. The Belgravia pluton is located 800 meters to the northwest of known skarn and the Ruddygore pluton 2.6 km to the southeast. There is a single rhyolite porphyry dike that cuts wollastonite-garnet skarn.

The hedenbergite component in pyroxene of the gold-bearing pyroxene skarn increase systematically along the Redcap thrust from Hd₆₄ downdip to Hd₉₉ updip. Manganese concentrations in the pyroxenes vary between Jo₀₋₁₁ with a general trend of higher manganese concentration updip. The trend suggests that the causative intrusion for the gold-bearing pyroxene skarn remains undiscovered, downdip to the southwest and at depth. The trend also demonstrates that the nearby plutons and the rhyolite dike are not causative of the pyroxene skarn. The source of the Zn-bearing garnet-dominant skarn remains elusive.