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The Spinifex Ridge 3.3 GA Porphyry-style Mo-Cu deposit, East Pilbara, Western Australia, The World's Oldest

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The Spinifex Ridge (Coppins Gap) Mo-Cu deposit is located north of the Mount Edgar batholith in the 3.52-2.85 Ga East Pilbara granite-greenstone terrane. The Mo-Cu mineralization (650 million tons at 0.05% Mo and 0.08% Cu) is associated with a suite of magnetite-bearing, high-level quartz-plagioclase porphyries and porphyritic granodiorites intruded into 3.45 to 3.32 Ga basalts and rhyolites. The mineralization consists of a complex series of multiphase stockwork veins. Quartz-potassium feldspar-carbonate veins with molybdenite and chalcopyrite are most abundant where both granodiorite and quartz-plagioclase porphyries are present. Although regional and contact metamorphism partly overprint early magmatic-hydrothermal alteration at Spinifex Ridge, potassic alteration is preserved as potassium feldspar veins and replacement of plagioclase by potassium feldspar within the high-grade core of the deposit, and as pervasive biotite alteration of both porphyries and basalts at the periphery of the high-grade core. Both phyllic and propylitic alteration are also associated with the mineralization. Re-Os dating of molybdenite samples confirms the timing of mineralization at Spinifex Ridge. Molybdenite ages of 3298 $\pm$ 11 and 3284 $\pm$ 11 Ma are indistinguishable within their 2-sigma uncertainties, and agree with SHRIMP U-Pb zircon ages for granodiorites in the Mount Edgar batholith (3314 $\pm$ 13 Ma, Coppin Gap suite; 3304 $\pm$ 10 Ma, Boodallana suite). Multiple sulphur isotope analyses of molybdenite also confirm a magmatic-hydrothermal source for sulphur. Together these observations confirm that Spinifex Ridge is an Archaean porphyry-style Mo-Cu deposit and the world's oldest world-class ore deosit.