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The Origin of Greisen Fluids of the Foley's Zone, Cleveland Tin Deposit, Tasmania, Australia

PETER JACKSON,
Department of Geology, La Trobe University, Bundoora, Australia 3083

AMARENDRA CHANGKAKOTI,
School of Earth Sciences, University of Melbourne, Parkville, Australia 3052

H. ROY KROUSE,
Department of Physics, University of Calgary, Calgary, Canada T2N 1N4

AND JOHN GRAY
Department of Physics, University of Alberta, Edmonton, Canada T6G 2J1

Abstract

The Cleveland deposit, located in northwest Tasmania, Australia, was a major tin-producing mine until its closure in 1986. The deposit is contained by the Cambrian Creek Formation, which comprises argillite, quartz, and lithic wacke, basalt lava flows, pyroclastic deposits, calcareous wacke, arenites, and unfossiliferous limestone.

Three styles of mineralization occur in the mine sequence. These are carbonate replacement, greisenization of a quartz porphyry dike, and fissure veins. The area in the mine encompassing the dike and the surrounding vein halo is referred to as Foley's zone. Five major alteration facies are recognized within the dike with distinct zonation between the types. These include sericitized feldspar greisen, quartz-muscovite greisen, quartz-muscovite-topaz greisen, quartz-topaz greisen and quartz ultragreisen.

Oxygen, hydrogen, and sulfur isotope data indicate that the hydrothermal fluids producing the bulk of the mineralization in the Foley's zone veins show narrow ranges in isotopic compositions. Measured δD (–65 to –85‰) and calculated $\delta^{18}O$ (7.7–10.3‰) values suggest two possible interpretations. First, the fluids may simply be primary magmatic fluids. Secondly, the fluids may have originated from outside an igneous intrusion and undergone isotopic exchange with a large volume of igneous rock at magmatic temperatures. Sulfur data (1.7–4.1‰) are strongly suggestive of a magmatic origin.