Goldschmidt 2026 Abstract
https://doi.org/10.46427/gold2026.37354

Andradite-rich garnet as a record of fluid history and tungsten transport within the Kara Mine, Tasmania

KATHLEEN R STEPIEN[1], SARAH C PENNISTON-DORLAND[1], MEGAN EVE NEWCOMBE[1], PHILIP M. PICCOLI[1], RICHARD D ASH[1], JIANHUA WANG[2] AND JADE STAR LACKEY[3]

[1]University of Maryland
[2]Earth and Planets Laboratory, Carnegie Institution for Science
[3]Pomona College

The Kara Mine, Tasmania, is a skarn that is mined for iron and tungsten. The skarn formed during contact metamorphism of limestone and marble intruded by Devonian granitoids. Garnet is abundant throughout the skarn and typically exhibits a high andradite component >0.93. This work evaluates two garnet crystals from a single hand sample, comparing core-rim profiles of H_2O, δD, major, and trace elements within the crystals. This study is one of the first to explore in situ variations in H_2O and δD within natural garnet crystals using Fourier Transform Infrared spectroscopy and Nanoscale Secondary Ion Mass Spectrometry. The water contents of these garnet grains range from approximately 1,000 µg/g in the grain rims up to 7,000 µg/g in the grain cores. The water within these garnet crystals is in the form of structurally bound OH. This study explores potential coupled substitution mechanisms to facilitate water incorporation in the analyzed grains. Correlations are identified between H, F, and W concentrations within the measured grains, which have implications for the fluid composition and transport of W within the Kara skarn. The F and W concentrations feature maximum values of approximately 5,000 and 180 µg/g, respectively, within the grain cores. The grains display δD profiles with values that range between -210 and -150‰, which suggest a meteoric fluid source. The two δD profiles display opposite trends which could be explained by a diffusive process, such as intra-crystalline diffusion or diffusion-limited uptake. This work explores the likelihood of these diffusive processes to produce the observed profiles and will also discuss the potential implications for the formation of the Kara skarn and the processes endowing iron and tungsten in the deposit.