

SEG 2026 Conference in Salt Lake City, United States

Evaluating Ga Mineralisation at the Tempiute W-Cu-Ag-Zn-Ga Skarn System, Nevada, USA

Toby Ancell¹, Ben Williamson¹, Lawrence Carter^{2,3}, Dale Cameron³, Stuart Kearns¹, Ben Buse¹, Oliver Friesen³
¹University Of Bristol, Bristol, United Kingdom, ²LC Geoscience Ltd, Cornwall, United kingdom, ³Guardian Metal Resources, London, United Kingdom

Gallium (Ga) is classified as a critical metal by the European Union and US government due to its essential role in semiconductors, photovoltaic cells, and 5G telecommunications. It is mainly derived as a by-product of bauxite processing for aluminium, but this is unlikely to meet increasing demand. A potential source is oxidised calcic tungsten skarn systems; however, the form and distribution of Ga are poorly understood. To address this, we conducted a detailed mineralogical and geochemical study of the Tempiute W-skarn district, Lincoln County, Nevada, USA.

The main hypothesis tested is that Ga is hosted in Fe³⁺-rich garnet and magnetite through Ga³⁺ → Fe³⁺ isovalent substitution. Thirty samples from across the skarn were analysed in transmitted light and by SEM-EDS to determine mineralogy and paragenesis. Ga concentrations were determined by electron probe microanalysis, with a detection limit of 21–24 ppm.

The analysed samples show a paragenetic sequence from prograde garnet–clinopyroxene crystallisation to scheelite and then sulphide mineralisation. From a total of 82 analyses, the three successive garnet generations identified (Grt I–III) have Ga concentrations of 58–215 ppm, compared to whole-rock values of up to 105 ppm. Ga concentrations are highest in grossular (Al³⁺)-dominated rather than andradite (Fe³⁺)-rich zones, which suggests that Ga³⁺ mainly substitutes for Al³⁺ rather than Fe³⁺. All 24 magnetite and 10 pyrite analyses returned Ga below detection limits. Whole-rock Ga concentrations (up to ~85 ppm of the 105 ppm maximum) can be reconciled by the presence of ~70 vol.% garnet.

A strong positive correlation between Ga and Sn ($r = 0.554$) in the analysed garnet generations, and positive correlations between Ga, W, and V in whole rocks ($\rho_s = 0.49, 0.59$), indicate that Ga mineralisation was produced by magmatic-hydrothermal fluids during skarnification and tungsten mineralisation at Tempiute.