Indium-bearing polymetallic veins of the Leinster Granite, Ireland

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The occurrence of Energy Critical Elements (ECE's) in primary ore minerals is of great metallurgical interest. Recovery of many ECE's, in particular In, Ga, Ge, Se and Te have come chiefly as a by-product of metal production; these elements are found only at very low levels in the Earth's crust and do not typically form economic deposits on their own. Recent examination of sphalerite-bearing polymetallic veins of the Leinster Batholith in southeast Ireland has revealed significant trace-element signatures with anomalous concentrations of In, Ga and Ge.

The Wicklow region of southeast Ireland was host to numerous Pb-Ag mines, the most prosperous of these situated in the Glendalough area, which operated between 1826 and 1900. These intrusion-related deposits are hosted by Devonian granite-granodiorite of the large Leinster Batholith and consist of polymetallic Zn-Pb sulphide veins and breccias that are superimposed on an earlier phase of Sn-W-bearing greisen veins. Mineralisation comprises sphalerite, galena, native silver, chalcopyrite, pyrite, fluorite, scheelite, and cassiterite, as well as a wide range of trace phases. Alteration consists of intense and widespread silicic alteration punctuated by greisen veins increasing in intensity near historical ore bodies, and resulting in the replacement of the host granite by quartz, sericite and lesser fluorite.

Laser-ablation ICP-MS analyses of sphalerite from the historical Glendalough workings reveal anomalous values of ECE's, specifically In (4700 ppm), Ga (1300 ppm), and Ge (350 ppm); element maps (raster analysis) reveal a strong zonation of ECE's, which correlate strongly with Fe contents indicating limited influence from trace inclusions. Interestingly, analyses of inclusion-free sphalerite grains from the Mount Pleasant Sn-In deposit, the world's largest reserve of indium, reveal similar levels of In (5500 ppm) and Ga (880 ppm), although levels of Ge are notably lower.

Further analyses of polymetallic systems from other plutons reveal anomalous values of ECE's, but with differing trace-element signatures. These results suggest that sphalerite chemistry may offer a unique trace-element fingerprint of hydrothermal systems unique to their host pluton. Understanding the extent of polymetallic vein systems in the Leinster Batholith may have significant implications for the value of associated Sn-W-Mo resources, currently a focus of exploration.