Copper Metallogenesis in Upper Palaeozoic sedimentary rocks from the Irish Variscides

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A renewed effort to understand the genesis of ore deposits in the Irish Midlands and Southwest Ireland sprung from novel targets of exploration companies. This study focuses on historically mined, sediment-hosted (SSC) and vein-type copper deposits. We aim to identify the dominant structural and geochemical controls of Cu mineralisation in Upper Palaeozoic sedimentary sequences. Central to this is determining whether there is a possible genetic link between the Cu deposits of SW Ireland and those of the southern sector of the Irish Midland Orefield.

The project has produced detailed maps of the mineralised vein systems and their structural relationship, as well as a comprehensive petrographical study and fluid inclusion analysis of selected samples from the Allihies mines (West Cork). Stable isotope geochemistry has been recorded for $\delta^{34}S$ in chalcopyrite, as well as δD and $\delta^{18}O$ ratios in quartz. The structural and petrographical observations are compared with those from vein-hosted and sediment-hosted deposits of Mizen Head and Sheep's Head peninsulas. Interpretation of GIS-supported satellite imagery and drone footage served as a key tool for visualization of large scale structures.

Initial findings indicate that the mineralized veins follow a general E–W to SE–NW trend, related to the development of orogenic (Variscan) and post-orogenic fault systems. Most of the copper lodes consist of quartz with syn-genetic chalcopyrite, minor bornite, chalcocite and tetrahedrite. The homogenisation temperatures ($T_{h\ LV\text{-}L}$) of the quartz-hosted fluid inclusions range between 110 and 210 °C. $\delta^{34}S$ ratios are between -15.5 and -11.4‰, the values for δD_{SMOW} range from -27.3 to -22.0‰, and the measurements for $\delta^{18}O_{SMOW}$ gave results from 12.8 to 13.9‰.These isotope ratios indicate a sedimentary to metamorphic fluid-rock interaction [1].

[1] Hoefs (2015) *Springer International Publishing Switzerland*, Stable Isotope Geochemistry (Seventh Edition).