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Re-Assessing the Controls on Magmatic-Hydrothermal W-Sn-Cu-As-Zn-Pb Mineralisation and Zonation Associated with the Cornubian Batholith, SW England

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SW England hosts a world-class W-Sn-Cu-As-Zn-Pb ore field associated with the Early Permian granites of the Cornubian Batholith [1]. There has been a substantial hiatus in research on the lode systems of the region following the cessation of deep tin mining in 1998. The resurgence of exploration drilling for W, Sn, Cu, and Li, and deep geothermal energy, has provided a timely opportunity to provide a re-assessment of mineralisation processes using modern analytical techniques.

The project integrates studies of the principal ore-stage parageneses using transmitted/reflected-light optical microscopy, SEM, QEMSCAN, and electron microprobe with LA-ICP-MS analysis of fluid and melt inclusions. This aids in constraining the compositional variability of primary exsolved magmatic-hydrothermal fluids and their potential relations to different granite types [2], sampled in deep geothermal sites to depths of 5 km. Additionally, work is completed to evaluate the effects of structurally related fluid migration and mixing with meteoric fluid and/or basinal brines on controlling precipitation and variation in mineral assemblages.

Current drill campaigns have provided samples from historic lode structures including "The Great Flat Lode" intercepted by Cornish Metals at Carn Brea. This provides significant insights into the controls on the heterogeneous distribution of metals around “emanative centres” that indicate a complex relationship between episodic magmatism, separation of magmatic volatile phases, faulting and fluid mixing. As part of this, we will be addressing magmatic-hydrothermal mineral zonation (W-Sn ± As proximal and Cu, Zn, and Pb distal) and the development of one of the best examples of a copper-rich tin system [3].

This project is in collaboration with the Natural History Museum, Cornish Lithium, Cornish Metals, Cornwall Resources, and Cornish Tin.

[1] Jackson, N.J. et al. (1989) Economic Geology 84:1101-1133

[2] Simons, B.J. et al. (2017) Lithos 278–281:491–512.

[3] Sillitoe, R.H. and Lehmann, B. (2022) Mineralium Deposita, 57:1-11