Signatures and controls on the size of Tin-Tungsten-Rare Metal-Lithium deposits: new evidence from SW England

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The resurgence in tin and tungsten prices, as well as new interest in rare metals has prompted a re-evaluation on the genesis of Sn-W deposits. This has been aided by advances in geochemistry and investment in the UK in regional geophysics and geochemistry, notably the TellusSW survey of NERC [1].

Since the late major exploration phase in the 1960-80s it has been recognised that the source granites are composite and emplaced over ~290-270 Ma [1,2,3,4]. The different intrusive phases appear to be related to differing deposit types. Tungsten is mainly found in earlier greisen and vein deposits, notably in small individual intrusive bodies. In contrast, most of the significant Sn production is from B-rich veins, which appear related to a later B-rich granite phase. Some of the Sn veins are co-located and crosscut by Cu±Zn veins, which are of limited economic interest. The youngest intrusive phases are F-rich and although containing Sn, W, Li and rare metal (Nb, Ta) phases are sub-economic unless mined as a by-product of kaolin production.

For Sn exploration, the key is to recognise major veins swarms or replacement deposits associated with B-bearing granites. This is difficult as many B-rich feeder veins are of hairline width and several of the mineralised areas appear active over diverse periods of granite intrusion. Mapping of tourmaline alteration in meta-sediments is time consuming but one other useful indication of B veining is alteration of tuffs or weak limestones to axinite. Regional Cs geochemistry suggests that Cs is a good indicator of the passage of B-rich fluids where these fluids have reacted with basic rocks.

[1] TellusSW (2014) www.tellusgb.ac.uk. [2] Simons et al (2016) *Lithos* **260**, 76-94. [3] Simons et al. (2017) Lithos **278,** 491-512. [4] Chen et al. (1993) J. Geol. Soc. **150**, 1183-91.