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Tracing the Metal Sources of Iberian W-Sn Deposits Through Sr-Nd Radiogenic Isotopes

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Tungsten and Sn mineralization occurs worldwide and over much of geologic time. These mineralizations are spatially associated with felsic granitic intrusions and form a wide range of magmatic-hydrothermal deposits. However, the genetic link between specific suites of granitic rocks and the formation of hydrothermal wolframite- and cassiterite-bearing perigranitic quartz vein systems is still debated in most major Sn-W metallogenic provinces.

This study focuses on the isotopic geochemistry (Sr, Nd) of Sn-(Ta-Li) and W-(Sn) vein-type deposits within the Iberian Variscan Massif (Spain and Portugal) by doing novel isotopic analyses on pure mineral concentrates of cassiterite, wolframite, and scheelite.

The measured $^{87}Sr/^{86}Sr$ ratios and ε_{Ndi} values were recalculated to an initial common age of 300 Ma to correspond with the peak of Sn-W mineralization events in the region. The Sr isotopic results obtained underscore the complexity of fluid-rock interaction processes, and highlight the heterogeneity of the crustal sources involved in the genesis of these deposits. In contrast, the Nd isotope results more accurately trace the fluid and metal sources. Initial ε_{Ndi} values in samples from both the W-(Sn) and Sn-(Ta-Li) deposits in the northern area of the Iberian Variscan Massif range between -6.8 and -8 and support that Nd is primarily derived from the local dominant S_1 granites. The wolframite samples from a few W-(Sn) deposits, however, show initial ε_{Ndi} values higher than -4 suggesting a more juvenile Nd component likely derived from the local I-type granitoids. In the southern zone of the Iberian Massif, the W-(Sn) and Sn-(Ta-Li) deposits exhibit initial ε_{Ndi} signatures between -3.8 and -7.4, pointing to local S_2-type granites as the main source.