

U-Pb geochronology of wolframite in the Massif Central, France

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U–Pb geochronology of wolframite ((Fe,Mn)WO₄) is complicated by variable but low U (<200 ppm) and ²⁰⁶Pb/²⁰⁴Pb (<300), heterogenous common Pb composition and mineral and fluid inclusions that are rich in U and/or Pb. In-situ methods such as laser ablation inductively coupled mass spectrometry (LA-ICP-MS) coupled with chemical imaging are required for many samples to obtain the best results in this complex mineral. However, the measured U/Pb ratios obtained by LA-ICP-MS require a large corrections due to instrumental mass fractionation, and these corrections are generally made through the normalisation with matrix-matched reference materials.

In this study, we re-evaluate the U-Pb composition of a wolframite commonly used for normalisation purposes (MTM-1) in LA-ICP-MS. Using μ XRF imaging and LA-ICP-MS U–Pb concentrations and isotopic compositions we show that this wolframite has been chemically altered, shows large variations in U concentration and has a heterogeneous common Pb composition. The combination of these new constraints and the reinterpretation of previously published isotope dilution thermal ionisation mass spectrometry (ID-TIMS) data from the same sample[1] permit the redefinition of the crystallisation age of this wolframite that is ~5% younger than previously thought.

We present U–Pb ages of six deposits from the French Massif Central that have been previously dated by ID-TIMS[1]. LA-ICP-MS U-Pb data are more widely distributed on a ²³⁸U/²⁰⁶Pb vs. ²⁰⁷Pb/²⁰⁶Pb diagram and better define a Discordia lower intercept age and upper intercept ²⁰⁷Pb/²⁰⁶Pb_i compared to ID-TIMS data of the same samples. Lower intercept ages from the FMC range between *ca* 325 Ma to 295 Ma, and these new ages reduce the previous estimate of the duration of W mineralization in the FMC to a 30 Ma.

The chemical and isotopic heterogeneity of wolframite highlights the importance of pre-screening imaging methods (e.g., μ XRF) and in-situ techniques such as LA-ICP-MS in U–Pb geochronology of wolframite.

[1] Harlaux, Romer, Mercadier, Morlot, Marignac and Cuney (2018), *Minera Deposita*, 53(1), 21-51