

Discrete late Jurassic Sn mineralizing events in the Xianghualing Ore District, South China: Constraints from cassiterite and garnet U-Pb geochronology

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ABSTRACT

Numerous skarn-type Sn deposits have been identified in the Nanling Range (South China), of which the Shizhuyuan W-Sn-Bi-Mo, Xianghualing Sn, Jinchuantang Sn-Bi, and Hehuaping Sn deposits are the largest. The Xianghualing deposit, which is the focus of this study, hosts a resource of 0.17 Mt Sn grading 0.93–1.39 wt% SnO₂. Whether the distal skarn-type mineralization and the cassiterite-sulfide vein-type orebody in the Xianghualing district are genetically related to the Laiziling granitic pluton, which produced the proximal skarn-type Sn mineralization, however, is still unknown. The Xianghualing Sn mineralization occurs exclusively as cassiterite and has been subdivided into four ore-types: (1) lenticular proximal skarn ore (Cst I) containing the mineral assemblage cassiterite-pyrrhotite-chalcopyrite-actinolite-wollastonite; (2) layered distal skarn ore (Cst II) containing the mineral assemblage cassiterite-pyrrhotite-chalcopyrite-actinolite; (3) vein cassiterite-sulfide ore (Cst III) distal from the skarn and associated granite containing the mineral assemblage cassiterite-arsenopyrite-pyrrhotite-muscovite-fluorite; and (4) veinlet Sn-Pb-Zn ore (Cst IV) distal from the skarn and associated granite containing the mineral assemblage cassiterite-galena-sphalerite-topaz-quartz. Here, we report the results of in situ laser ablation inductively coupled plasma mass spectrometric (LA-ICP-MS) U-Pb age determinations for garnet from the Xianghualing skarn and the above four types of cassiterite. Our age determinations indicate that there were two independent magmatic-hydrothermal events at ~160 and 156–150 Ma, both of which led to Sn mineralization. The first Sn mineralization event at ~160 Ma (Cst IV U-Pb ages of 159.6 ± 1.4 to 158.5 ± 0.8 Ma) is interpreted to have been associated with a speculative unexposed granitic pluton, which is coeval with the nearby Jianfengling granite intrusion. The second Sn mineralization event at 156–150 Ma (Cst I to Cst III U-Pb ages of 155.9 ± 0.7 to 152.3 ± 1.1 Ma and garnet U-Pb ages of 153.6 ± 7.6 to 151.5 ± 3.5 Ma) is genetically related to the adjacent Laiziling granitic intrusion (152.8 ± 1.2 Ma, zircon U-Pb age). This event was responsible for the bulk of the Sn resource (>95%). Our age determinations provide convincing evidence for superimposed Jurassic Sn mineralizing systems at Xianghualing. They also show the value of combining garnet and cassiterite U-Pb age determinations to constrain the timing of skarn and Sn mineralization and distinguish discrete Sn mineralizing events in a protracted metallogenic history.

Keywords: Cassiterite U-Pb dating, Garnet U-Pb dating, Xianghualing Sn deposit, Late Jurassic, South China