

Mineralization and Fluid Inclusion Study of the Shizhuyuan W-Sn-Bi-Mo-F Skarn Deposit, Hunan Province, China

HUAN-ZHANG LU,[†]

*Sciences de la terre/CERM, Université du Québec à Chicoutimi, Chicoutimi, Québec G7H 2B1, Canada,
and Institute of Geochemistry, Chinese Academy of Sciences, Guiyang, China, 550002*

YIMAO LIU,

Guangzhou Institute of Geochemistry, Chinese Academy of Sciences, Guangzhou, Guangdong Province, China, 510640

CHANGLIE WANG, YOUZHI XU,

Southern Hunan Geological Team, Chenzhou, Hunan Province, China, 423000

AND HUAQIN LI

Yichang Institute of Geology and Mineral Resources, Yichang, Hubei Province, China, 443003

Abstract

The Shizhuyuan deposit, China, is a world-class W-Sn-Bi-Mo-F skarn deposit hosted by Devonian limestone in the thermal aureole of the Qianlishan granite complex. The Qianlishan complex comprises five separate intrusions, including fine-grained porphyritic biotite granite (182–187 Ma, granite 1), medium-grained biotite-K feldspar granite (158–163 Ma, granite 2), fine-grained biotite and K feldspar granite (granite 3), granitic porphyry (144–146 Ma, granite 4), and diabase (142 Ma). The upper part of the granite complex is characterized by extensive greisen alteration. Skarn zones distributed around the intrusions are mainly calcic, consisting of garnet, garnet-pyroxene, vesuvianite-garnet, and wollastonite-vesuvianite, progressively outward from the intrusion. Following the primary skarn formation, some of the skarn zones underwent retrograde alteration. The high garnet/pyroxene ratio and the diopside-rich and andradite-rich compositions of the pyroxene and garnet indicate that the skarn belongs to the oxidized type.

Mineralization consists of Sn-Be veinlet ore (type I) in marble and porphyry, massive W-Bi-Mo-Sn skarn ore (type II), stockwork W-Sn-Bi-Mo-F ore (type III), and W-Sn-Mo-Bi greisen ore (type IV), mainly associated with granite 2. Emplacement of granite 2 was accompanied by late, intense fracturing characterized by stockwork mineralization (type III), which was superimposed on massive skarn and greisen zones. The stockwork ore consists mainly of greisen and skarn veins and veinlets with scheelite, wolframite, molybdenite, cassiterite, bismuthinite, and fluorite. The Sm-Nd method has been used to analyze the Sm-Nd concentration, and data for pyroxene and garnet in the massive skarn (type II ore) associated with granite 2 yields an isochron age of 157 Ma. This age corresponds closely to the age of granite 2.

Fluid inclusion studies of four types of ore samples reveal four types of inclusions: aqueous two-phase inclusions, H₂O-CO₂ inclusions, gas-rich inclusions, and daughter mineral-bearing inclusions containing halite or calcite. Homogenization temperatures of fluid inclusions in skarn minerals range from 350° to 535°C. The homogenization temperatures of fluid inclusions in greisen and stockwork are lower than that in skarn, and range from 200° to 360°C. The fluid inclusion data indicate that there are two types of fluids associated with the massive skarn and greisen, having salinities from 26 to 41 wt percent NaCl equiv, and from 1 to 21 wt percent NaCl equiv, respectively. The high-salinity inclusions are daughter mineral bearing, whereas the low-salinity inclusions are dominantly aqueous with a few gas-rich inclusions. The results suggest the evolution of the ore-forming fluids either by immiscibility or by mixing between a high-temperature, high-salinity magmatic water and a low-temperature, low-salinity fluid such as meteoric water, consistent with previously published isotopic studies.

The Shizhuyuan deposit is a multi-element skarn, highly enriched in W, Sn, Bi, Mo, and F. This is interpreted to reflect multiple sources and stages of mineralization, which, in turn, may account for the large size of the Shizhuyuan deposit.

[†] Corresponding author: e-mail, hzlu@uqac.quebec.ca