

Cassiterite U-Pb Geochronology and Trace Element Fingerprints of the Gaofeng Tin Deposit, Dachang District, South China

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The Dachang tin district, hosting 1.10 Mt Sn metal (~1%), is the second largest tin deposit in China. The district consists of the Dafulou, Huile, and Kangma Sn (Zn) vein-type deposits in the eastern zone, the Lamo Cu-Zn skarn-type and Chasha W-Sb vein-type deposits in the central zone, and the Tongkeng-Changpo, Bali, and Gaofeng stratiform-like cassiterite-sulfide deposits in the western zone. Skarn- and vein-type deposits are spatially related to the Cretaceous Longxianggai granitic pluton, while the stratiform-like orebodies are several hundred meters distal from the granitic pluton.

The Gaofeng cassiterite-sulfide deposit comprises 100# and 105# orebodies. These two stratiform-like massive orebodies are mainly hosted by Mid-Devonian reef limestone. Alteration of the country rock hosting the Sn-Pb-Zn orebodies is dominated by marmorization and silicification, with weak tremolite alteration. Cretaceous granite porphyry and diorite porphyry dikes cross cut the tin orebodies, while the hidden biotite granite was emplaced at deep level and not detected by drilling. Due to the weak spatial relationship between the stratiform-like massive orebodies and granitic pluton, and lacking robust age constraints on the tin mineralization, the Gaofeng tin deposit was previously considered as a SEDEX type deposit.

Cassiterite is the main ore mineral of these orebodies. In-situ U-Pb dating and trace element fingerprints of cassiterite by LA-ICPMS can directly refine the timing of the stratiform-like massive ores and figure out their genesis. Three cassiterite samples from the stratiform-like cassiterite-sulfide ores yield U-Pb Concordia lower intercept ages of 91.6 ± 2.3 Ma (95% confidence level, $n = 23$, MSWD = 1.19, 100#), 93.6 ± 1.5 Ma (95% confidence level, $n = 29$, MSWD = 0.82, 100#), and 92.8 ± 2.0 Ma (95% confidence, $n = 23$, MSWD = 0.97, 105#). The cassiterite U-Pb dating results are much younger than the ore-hosting Mid-Devonian reef limestone. Furthermore, cassiterites from the Gaofeng tin deposit have elevated Fe and W contents showing a granite-related magmatic-hydrothermal origin, which is distinctly different from those of SEDEX type tin deposit such as Sullivan. Based on Cretaceous mineralization ages and elevated Fe and W contents, we conclude that the Gaofeng stratiform-like massive tin deposit is related to the hidden granitic pluton and preclude its SEDEX origin.