Genesis of tin-dominant deposits in the Dachang district, South China: Insights from cassiterite U–Pb ages and trace elements

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The Dachang tin-dominant polymetallic district in western South China, is one of the largest tin districts worldwide, hosting a total Sn metal reserve of ~1.1 Mt. Economic tin mineralization was hosted by Devonian carbonate-rich sediments, in forms of stratiform/massive cassiterite-sulfide ores and cassiterite-quartz veins. However, due to lack of reliable mineralization ages, the genesis of tin deposits has been debated for decades, with arguments mainly focusing on whether they are Devonian syngenetic deposits related to submarine exhalative volcanism (SEDEX) or Cretaceous granite-related magmatic-hydrothermal mineral deposits. Cassiterite (SnO_2), the main ore mineral in tin deposits, has been proven a target mineral for direct dating tin deposits. We used LA-ICP-MS cassiterite U–Pb dating technique to precisely constrain the timing of tin mineralization event at Dachang. Seven cassiterite samples from the Tongkeng-Changpo, Gaofeng, Dafulou, Huile and Kangma tin deposits within the district yield weighted mean $^{206}Pb/^{238}U$ ages ranging from 90.3 ± 1.8 Ma to 95.4 ± 4.9 Ma, which overlap the emplacement age of 96.6–93.9 Ma for the Longxianggai biotite granite. Furthermore, the elevated Fe–W but low Nb–Ta contents for most cassiterite grains in the Dachang district suggest that cassiterite crystallized in a granite-related hydrothermal environment.