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The Geodynamics and Ore-Forming Process of the Makeng-Type Deposits in Southwestern Fujian Depression Belt, South China

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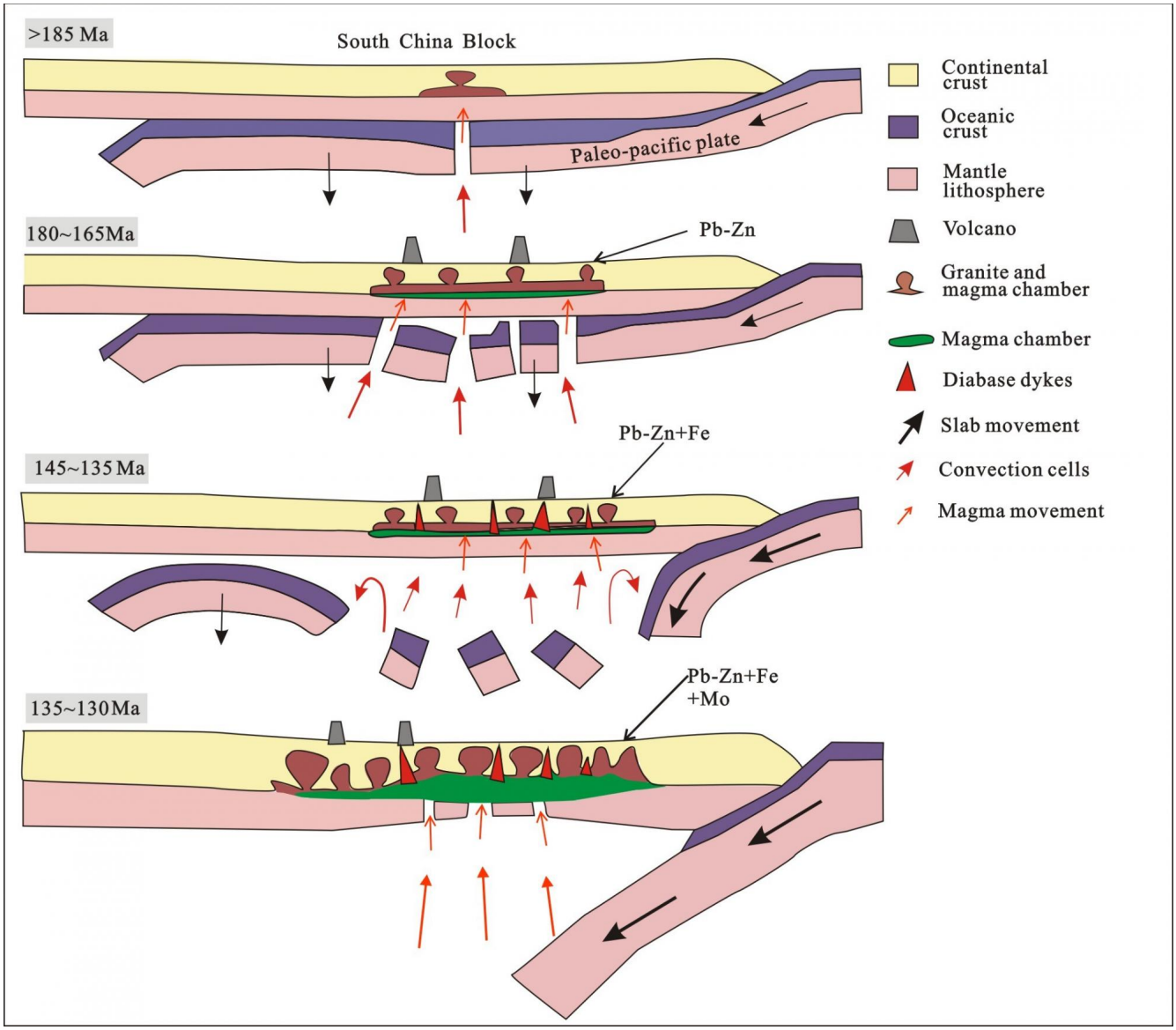
The Southwestern Fujian Depression Belt (SFDB) is located in the southeast margin of South China Block. Approximately 98% of the Fe deposits in Fujian Province are hosted in this belt, such as the Makeng, Dapai, Pantian, Luoyang, Yangshan, Tangquan, and Zhongjia deposits. An association of iron, lead, zinc, copper, and molybdenum, hosted by the Late Paleozoic carbonate and clastic rocks intruded by Mesozoic granites, characterizes the deposits. They are collectively named Makeng-type deposits, after Makeng, the largest Fe polymetallic deposits in the SFDB. There are divergent views among scholars about the genesis and the role of granitoids on mineralization. We combine data from previous scholars on the Makeng type deposits with our Rb-Sr and U-Pb isotope geochronology and S-O-Pb isotopes studies of the Dapai Fe-Pb-Zn-Cu-Mo deposit to understand the geodynamics and ore-forming processes in the SFDB. The Dapai Fe-Pb-Zn-Cu-Mo deposit orebodies are stratabound; it has a visible metal zonation that comprises Pb-Zn ores above Fe ores. Cu ores are present between the Pb-Zn and Fe ores but are often associated with Pb-Zn mineralization. The minor Mo ores are sporadically disseminated throughout the deposit.

Pyrite and sphalerite grains from the Pb-Zn-Cu ore bodies yield a well-constrained ^{87}Rb-^{86}Sr isochron age of 175.5 ± 3.3 Ma. A porphyritic granodiorite in the Dapai ore district yielded U-Pb zircon ages of 131.72 ± 0.41 Ma while granodiorite yielded 146.6 ± 2.3 Ma. Five porphyritic granodiorite zircon grains yielded a ^{206}Pb / ^{238}U model age cluster of about 150 Ma. Furthermore, six granodiorite zircon grains yielded a ^{206}Pb / ^{238}U model age clustering around 180 Ma. The 175.5 ± 3.3 and 180 Ma ages represent a Pb-Zn mineralization period. The 131.72 ± 0.41 and 146.6 ± 2.3 Ma ages are related to the Mo and Fe periods of mineralization, respectively; similar ages were reported in Pantian, Luoyang, Yangshan, and Makeng. The $\delta^{34}S_{CDT}$ values of galena, pyrite, and sphalerite (from -2.6 to 1.5‰) and their $^{206}Pb/^{204}Pb$, $^{207}Pb/^{204}Pb$, and $^{208}Pb/^{204}Pb$ ratios (18.486-18.537, 15.665-15.712, and 38.823-38.979‰, respectively) indicate that the source of sulfur and metals for Pb-Zn-Cu ore is mainly crust-derived magmas slightly mixed with mantle magmas. The $\delta^{18}O$ values of magnetite grains (average value of 3.53‰) and garnet grains (average value of 4.8‰), intimately associated with magnetite, suggest that the Fe metals and fluid are related to magma mixing. The Re contents of the Mo orebody coupled with the geochemical signatures of the ~130 Ma old granite suggest that the significant source of fluids and metals of the Molybdenite body is mainly crustal magmas.

Three periods of mineralization are recognized based on the deposit characteristics, microscope observation, and robust isotopic ages (Pb-Zn-Cu: 180-160, Fe: 150-135, and Mo: 135-125 Ma). We propose a multi-stage hydrothermal metallogenetic model for the Makeng-type deposits. Different metal associations may have been formed by multiple stages of magmatism that were stimulated by compression, transformation, and extension tectonics widely accepted in the area. The system is driven by the subduction and rollback of the paleo-Pacific plate under South China.


>185 Ma
South China Block
Paleo-pacific plate
180~165Ma
Pb-Zn
145~135 Ma
Pb-Zn+Fe
135~130Ma
Pb-Zn+Fe
+Mo
Continental crust
Oceanic crust
Mantle lithosphere
Volcano
Granite and magma chamber
Magma chamber
Diabase dykes
Slab movement
Convection cells
Magma movement