Hydrothermal ore-forming processes of the new discovered giant Furong tin deposit associated with the Qitianling Granitoid in Hunan province, South China

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Recently a giant tin deposit, the Furong deposit, has been found in the Qitianling granitoid, Hunan, South China. The tin mineralization of cassiterite occurs as vein or dissemination in narrow envelopes of chlorite alteration within the granite. The biotite from host granite is Fe-rich annite with high contents of Ti, Sn and Cl. The oxygen fugacity of granite estimated by biotite compositions is near the Fe_2O_3-Fe_3O_4 (MH), which is above common tin granites that are generally lower than Ni-NiO(NNO). The amphibole in granite is farropargasite or ferro-edenite hornblende, which also show high Sn content and high Fe^{3+}/Fe^{2+} ratio. The Al-in-hornblende barometer gives a pressure of 4.6±1.0 kbar. A biotite – calcic-hornblende and a semiquantitative hornblende thermometer yield a forming temperature of 700~800°C. The chlorite from the orebody has negligible K_2O, Ti_2O, F, and Cl, but shows similar Fe/(Fe+Mg) ratios with amphibole and biotite. Cassiterite is observed closely associated with rutile as dissemination in chlorite alteration veins and envelopes. The ore-forming temperature is estimated to be 300~400°C from chlorite geothermometer and initial fluid inclusion study.

The Qitianling granite contains Sn-rich hornblende and biotite, and shows a high oxygen fugacity of the magma, which is slightly different from the common S-type stanniferous granites worldwide. Fractional crystallization of the magma and tin deposition directly from exsolved magmatic-hydrothermal fluids may not be the major mechanism for the tin mineralization in this deposit. In stead, we suggest that post-magmatic hydrothermal alteration of the granite may have released tin and other metals (e.g., Ti) from the Sn-bearing biotite and hornblende in the granite. Then cassiterite and rutile precipitated together with chlorite when the physical and chemical condition of the Sn- and Ti-rich fluids changes.

Genesis of Mesozoic mafic-ultramafic intrusions in the Dabie orogen: Zircon U-Pb age, element and isotope geochemistry

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The Dabie-Sulu orogen in east-central China is characterized by the occurrence of not only Triassic ultrahigh pressure metamorphic rocks but also post-collisional igneous rocks. The latter is composed of voluminously coeval granitoids and minor mafic-ultramafics in Early Cretaceous. The post-collisional igneous rocks provide a potential window to study geodynamic recycling of subducted crust in the collisional orogen. Zircon U-Pb dating, major and trace elements, oxygen isotope composition of mineral separates, and carbon concentration and isotope composition were determined for Mesozoic gabbro and pyroxenite at Shacun and Jiaoziyan in the Dabie orogen.

The results show that these mafic-ultramafic rocks are characterized by strong LREE enrichment, negative HFSE anomalies (Nb, Zr, Ti and P), and positive anomalies of Pb and Ba. Zircon U-Pb dating yields ages of 122 to 128Ma for magma crystallization but younger ages of 105 to 116Ma for post-magmatic hydrothertmal overgrowth. There is a large variation in oxygen isotope ratios of minerals and their host rocks (whole rock: 1.1‰ ~ 6.6‰, linopyroxenite: 3.85‰ ~ 5.7‰, lagioclase: 2.8‰ ~ 7.3‰, zircon: 3.85‰ ~ 6.04‰). Most of zircons have $\delta^{18}O$ values different from normal mantle zircon (5.3±0.3‰). Equilibrium fractionations of oxygen isotopes among minerals have been preserved for some of samples, but the others show obvious disequilibria of oxygen isotopes, indicating alteration by post-magmatic subsolidus water-rock interactions. Carbon concentrations and isotope compositions of apatite and whole-rock vary widely from 0.03% to 0.18% and from -27.0‰ to -5.8‰, respectively. Most of the samples have $\delta^{13}C$ values lower than normal mantle (-5±2‰).

A comparison of Mesozoic mafic-ultramafic rocks with eclogites in the Dabie orogen shows that they have many element and isotope geochemical features in common, and thus a genetic relationship is considered between them. Protholiths of the ecologites are considered mafic, corresponding to rift magmatism during the middle Neoproterozoic in the northern margin of the Yangtze plate. An enriched lithosphere mantle source is probably responsible for the singular geochemical and isotopic characteristics of these mafic-ultramafic intrusions. Partial melting of the old lithosphere mantle triggered by the Pacific superwells is proposed to produce the Early Cretaceous mafic-ultramafic rocks.