$^{40}Ar–^{39}Ar$ mineralization ages of the Dongchuan-type layered copper deposits, Yunnan, China

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The Chinese well-known Dongchuan Cu deposits occur in the Proterozoic Kunyang Group. Some messages about the formations in the middle sub-group are shown below.

Formations	Main rocks	Ages (Ma)	Ore types
Qinglongshan	Shale	–	–
Heishan	Shale	Pb–Pb: 1607 ± 128	Taoyuan-type Cu
Luoxue	Dolomitite	Pb–Pb: 1716 ± 56	Dongchuan-type Cu
Yinmin	Dolomitite and shale	Sm–Nd: 1931 ~ 2098	Xikuangshan-type Fe-Cu

The typical Dongchuan-type Cu deposits are layered, which is the most important evidence for the ore genesis opinion that the Cu-ore deposits were sedimentary. The other two types of copper deposits are vein ores, and vein ores also ocurr within the Luoxue formation.

Because it is difficult to collect suitable minerals for traditional isotopic dating methods, few convincible and reliable mineralization ages were obtained before. In a feasibility study to date the fluid inclusions using $^{40}Ar–^{39}Ar$ method by crushing, several quartz samples from the vein ores were analysed by crushing and heating, suggesting that the vein copper mineralizations occurred in 800 to 700 Ma ago (Qiu *et al.*, 2002).

We found fine quartz within the layered ores by chance after the dolomitites were removed using the acetic acid. The quartz provided us the possibility to access the mineralization age of the Dongchuan-type layered copper deposits by $^{40}Ar–^{39}Ar$ crushing-heating method. The approach used is to first crush quartz samples (extracting the fluid inclusions) and then apply stepped heating to the residual powders. Three isochron ages of 807 Ma, 782 Ma and 776 Ma obtained respectively from 98-4fQ by crushing and heating and 98-4aQ by heating, are concordant with the $^{40}Ar–^{39}Ar$ ages of the quartz samples from the vein-ore deposits, and much younger than the Pb–Pb isochron age of the Luoxue formation, which we interpret as meaning that the layered- and vein-copper-ore deposits were all formed by the hydrothermal fluids. Forthermore, the zircon U–Pb age of the syenite near Dongchuan city is 773 Ma.

The above agreeable pluton and mineralization ages may indicate that the copper mineralizations in Dongchuan were associated with large scale tectonic processes related to the breakup of Rodinia.

References

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Geochemistry of K-rich volcanic rocks along the middle-south parts of Tancheng-Lujiang deep fault zone, eastern China: Constraints on mantle source and petrogenesis

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A series of K-rich volcanic rocks occurs along the middle-south parts of Tancheng-Lujiang deep fault zone in eastern China. These rocks are spatially distributed on both the north and south sides of the Dabie-Sulu Convergent Belt (DSCB) with a variety of rock types including trachybasalt, basaltic trachyandesite, trachyandesite, latite and trachyte. Our ^{40}Ar-^{39}Ar dating reveals that these rocks erupted during early Cretaceous from 103.4Ma to 140.2Ma, and the data indicate a younger tendency eastwards for the eruption. These rocks have generally high and variable Al_2O_3 (14.59~19.06%), low TiO_2(<1.30%), high K_2O+Na_2O (5.5~9.7%), and high K_2O/Na_2O and Fe_2O_3/FeO ratios. They are also enriched in LILE (e.g., Rb, Ba, Th, Pb) and LREE and depleted in HFSE. The negative Nb and Ti anomalies and positive K and Pb anomalies imply these rocks have a distinct subduction slab signature.

The K-rich volcanic rocks have highly radiogenic $^{87}Sr/^{86}Sr$ (0.7050~0.7124) and unradiogenic $^{143}Nd/^{144}Nd$ ratios ($\varepsilon_{Nd}(t)$= -1.8 ~ -18.5); and the data display a spatial variation with higher I_{Sr} and lower $\varepsilon_{Nd}(t)$ in the north side than those in the south side of DSCB. No correlations exist between the Sr-Nd isotopic compositions and their chemistry (e.g., SiO_2, Sr and Nd contents), which suggests that these rocks had not been suffered significant crustal contamination during magma ascent. Therefore, the initial Sr and Nd isotopic ratio differences may represent isotopic heterogeneity of the mantle. According to their geological setting and tectonic evolution, and taking together all available geochemical and isotopic data, we suggest that all these K-rich volcanic rocks may have originated from a mantle source which suffered intense metasomatism by hydrous fluids released from westerly-dipping subducted Izanagi oceanic lithosphere. In addition, those rocks in the north side of DSCB may have also been superimposed source mixing of continental crust materials during or shortly after the Triassic continental collision between the Yangzte and North China Block, and the latter event may have played a major role in petrogenesis of these K-rich volcanic rocks.