Geochemical characteristics and LA-ICP-MS age of zircons from the Luohanshi Formation mafic volcanic rocks, North Qinling: Evidence for Paleozoic subduction-accretion Process in the Qinling Orogen

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The Shangdan Ophiolitic Tectonic Mélange zone is an important plate subduction-accretion zone that is located in the southern margin of the North Qinling Belt. Luohanshi Formation as one key elements occurs along the south frank of the Shangdan Ophiolitic Tectonic Mélange zone and comprises fine-grained sandstones with interbeds of volcanic and volcaniclastic rocks and carbonates. Locally, wedge-shaped deposits, which contain conglomerate-bearing sandstones, sand conglomerates and conglomerates, develop. It exhibits the fault contact with the Danfeng Group to the north and Liuling Group to the south. In this study, whole-rock major-trace elements and zircon U-Pb isotope compositions are presented for mafic volcanic rocks from the Luohanshi Formation in the North Qinling Belt. Two selected samples yield zircon U-Pb ages of 389.4Ma (MSWD = 0.31) and 397.7Ma (MSWD = 1.4), implying the Luohanshi Formation form at Devonian. Geochemically, these mafic rocks have SiO2=49.59~50.64, Al2O3 < 15.5, K2O/Na2O= 0.90~1.03, K2O=1.50~3.08, typical of shoshonite series. In addition, they are characterized by continental arc-like patterns of trace element distribution, with enrichment in strong and medium incompatible elements (except for element Sr) but depletion in weak incompatible elements such as Sm, Y and Yb on N-MORB normalized diagrams. Their REEs patterns are also similar to those of continental arc, characterized by low ∑REE varying from118.43ppm to 125.84 ppm, fractionated REE patterns ((La/Yb)n ranging from 8.34 to 9.73), and weak to no Eu anomalies (Eu/Eu* = 0.97 ~ 1.01). Integrated with the regional geological features, we can infer that the Luohanshi Formation volcanic rocks probably are interpreted as an accretion arc. In this case, subduction during late-Palaeozoic would give rise to the volcanic rocks of the Luohanshi Formation. Therefore, the Devonian mafic rocks provide the important petrological record of subduction-accretion processes during the late-Palaeozoic North Qinling Orogen.

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Oscillatory Zoning of Jarosite-Group Minerals in the Xitieshan Pb-Zn Deposit, NW China

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Composition, texture, and origin of jarosite-group minerals in weathering profiles overlying the SEDEX Xitieshan Pb-Zn deposit, NW China, has been studied using a combination of optical microscopy and SEM-EDS, XRD, and EMP analysis. The results reveal that they are characterized by spectacular oscillatory zoning consisting of jarosite, natrojarosite, and Pb-jarosite that variably contain abundant fluid inclusions. Although EMP data of the minerals show a linear trend in the K versus Na diagram, a gap between the K-Na end-member compositions exists. Scorodite and Pb-P-jarosite have also been locally recognized, intergrown with the jarosite-group minerals.

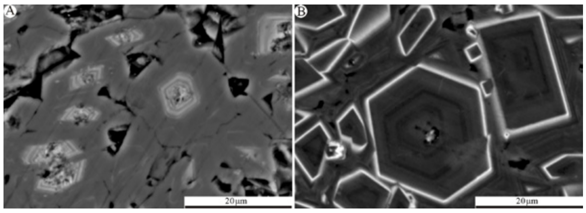

Figure 1: Back-scattered electron images showing oscillatory zoning consisting of jarosite (grey-white and light grey), natrojarosite (dark grey), and Pb-jarosite (white).

The oscillatory zoning could have resulted from alternating growth of jarosite, natrojarosite, and Pb-jarosite due to fluctuation between Na, K, and Pb concentrations in weathering solutions. The alternative precipitation of submicron jarosite, natrojarosite, and Pb-jarosite indicates crystallization of the jarosite-group minerals at low temperatures (<30°C) [1]. Our findings thus provide, for the first time, a natural example for theoretical prediction that a solvus can exist at low temperature to form the end-member jarosite-natrojarosite-plumbjarosite [1-4].

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