

The Characteristics of Volcanic Rocks from Late Permian to Early Triassic in Ailaoshan Tectono-magmatic Belt and Implications for Tectonic Settings

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This paper studies the volcanic rocks of Yaxuanqiao, Maoheshan and Lvchun in Ailaoshan tectono-magmatic belt, Yunnan Province, SW China. Yaxuanqiao volcanic rocks mainly composed of Mugearite-basalts with minor andesites formed in late Permian. In TAS diagram, they are plotted in both Alkaline and sub-alkaline areas. These rocks are low-in K_2O (<1.19 wt%) and belong to LKCA-MKCA (low-potassic to middle-potassic calc-alkaline) series in SiO_2 - K_2O diagram. They are mainly calc-alkaline in terms of Peacock's index (diagram of SiO_2 - (K_2O+Na_2O-CaO)). Their spider diagrams of trace elements show enrichment in Pb and depletion in Nb and Ta. The trace element spider diagrams from Zr to V are flat and overall lower compared with those of MORB. The REE patterns are similar to those of MORB, but slightly enriched in LREE and depleted in HREE. These rocks are all plotted in arc settings in tectonic discrimination diagrams. The volcanic rocks in Talanghebian of Yaxuanqiao area are sub-alkaline dacites and belong to MKCA (middle-potassic calc-alkaline) series (cf. diagrams SiO_2 - K_2O). Besides, it is mainly calcic in terms of Peacock's index (SiO_2 -(K_2O+Na_2O-CaO) diagram). The features of spider diagrams of trace elements, REE distribution pattern and tectonic discrimination diagrams indicate that they formed in an arc tectonic setting. Thus it is suggested that Yaxuanqiao igneous rocks belong to arc-type igneous rocks in late Permian. Zircon SHRIMP U-Pb dating of Maoheshan basalt gave an age of 249 ± 1.6 Ma, i.e., early Triassic. These rocks are sub-alkaline albite basalts, belonging to LKCA (low-potassic calc-alkaline) series in the SiO_2 - K_2O diagram. It is mainly calcic in terms of Peacock's index in SiO_2 -(K_2O+Na_2O-CaO) diagram. Compared with MORB, the trace element spider diagrams and REE patterns show slightly enriched in LREE. In the diagrams for discrimination of tectonic settings, they are plotted in the transition area from E-MORB to island-arc. Zircon SHRIMP U-Pb dating of Lvchun rhyolite yielded an age of 247.3 ± 1.8 Ma, i.e., early Triassic. Rhyolites are sub-alkaline (in diagram TAS), shoshonite series (in diagram SiO_2 - K_2O). It is alkaline-calcic in terms of Peacock's index (in SiO_2 -(K_2O+Na_2O-CaO) diagram). Trace elements spider diagrams, REE patterns and plots of tectonic setting discrimination all indicate the Lvchun rhyolites occur in a transition setting from matured arc to continent-continent collision. Combined with previous studies, the paper suggests that Ailaoshan Ocean had opened since late Devonian and probably been spreading between Carboniferous and early Permian(?). But in late Permian the Ailaoshan Ocean had begun to subduct to form initial arc of Yaxuanqiao to the west of the Ailaoshan. In early Triassic (249 ± 1.6 Ma), Maoheshan basalts, characterized by both arc and MORB, formed as a part of Ailaoshan Ophiolites. It may suggest that the Ailaoshan Ocean basin had been shrunk, or converted to intra-arc or back-arc basins of supra-subduction zones. Thus the evolution of the Ailaoshan Ocean went into the late stage, and in some area, such as Lvchun area, it became a transitional setting from matured arc to continent-continent collision (247.3 ± 1.8 Ma). All those mentioned above support the conclusion that the Ailaoshan Ocean had closed in late Triassic, which also coincides with the fact that Yiwanshui Group of late Triassic unconformably overlies the Ailaoshan Shuanggou ophiolites.

This paper was financed by NSFC(40802020), CGS (1212010661311, 1212011121075, 1212010911028), 973(2009CB421002, 2009CB421008) and China Scholarship Council.

This paper has been published on *Acta Petrologica Sinica* (2011,27(12):3590-3602) in Chinese with English abstract.

Key words: Volcanic rocks of Yaxuanqiao, Maoheshan and Lvchun; SHRIMP U-Pb dating of Zircon; Late Permian -Early Triassic; Tectonic Setting