

Research Advances

Petrogenesis of the Paleozoic and Mesozoic Volcanic Rocks in Northwest China

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Recently, we carried out the National Nature Science Foundation of China (No. 41273033) and Special Fund for Basic Scientific Research of Central Colleges (No. 310827153407) and made some advances as follows.

The main research achievements of the Paleozoic volcanic rocks in northwest China include two aspects: one is the establishment and the research on the genesis of the Late Paleozoic large igneous province (LIP) of Xinjiang, and the other is that the new advance in petrogenesis of the late Paleozoic volcanic rocks from Tianshan.

The residual distribution area of the Tarim large igneous province (TLIP) is greater than 250000 km², whose maximum residual thickness is up to 780 m. A huge amount of basalt erupted at the early stage (290Ma), which belongs to the rapid eruption of LIP magmatic events. The late stage (280Ma) includes ultrabasic-basic and felsic rocks, dyke swarm and felsic volcano rocks. Trace element characteristics of the most developed basalt and diabase dyke are similar to those of oceanic island basalts (OIB), the major of which contain high titanium content. Isotopic characteristics can be obviously divided into two categories: one is the Keping basalt derived from enriched mantle with negative $\varepsilon_{\text{Nd}}(t)$ value and relatively higher heavy rare earth element (HREE); the other is north Tarim basalt and diabase derived from depleted mantle with positive $\varepsilon_{\text{Nd}}(t)$ value and relatively low HREE value. However, another view is that the two significantly distinct mafic magmatism result from the lateral flow difference of plume caused by the variations of spatial and temporal distribution and geochemical characteristics of these two groups of magma.

The Carboniferous volcano rocks in East Tianshan are a suite of calc-alkaline basalt - andesite - rhyolite formation. The basalt includes the N-MORB and IAT two types,

indicative of the existence of a inter-arc basin in Carboniferous in East Tianshan. The Carboniferous volcanic rocks in East Tianshan show obvious compositional zoning from north to south, which may result from the oblique subduction of the Paleo-Asian Ocean to the southeast Junggar - Turpan - Hami terrane in the Carboniferous. This provides valuable information for exploring the tectonic evolution between the Junggar and Tianshan.

Two sets of volcanic rocks were developed in the West Tianshan Mountains in the Early and Late Carboniferous, which were suggested to be the product of rift by the previous mainstream view. In recent years, more and more researchers believe that the tectonic setting of West Tianshan was volcanic arc in Early Carboniferous, but converted to intracontinental rift setting in Late Carboniferous. Furthermore, the Songhu, Beizhan, Dongde, Zhibo and other iron deposits were discovered in the Early Carboniferous volcanic rocks in the Awulale area of the eastern part of West Tianshan, all of which were formed in a volcanic arc tectonic setting.

In recent years, adakites, Nb-rich basalts and sanukitoids related to subduction were distinguished from the late Paleozoic magmatic events in Tianshan, Junggar and Aletai north of Xinjiang. It is confirmed that the Junggar ancient ocean basin was the arc tectonic setting from the Devonian to Carboniferous, which enriches the genetic types of volcanic rocks in northwest China. In addition, the new progress was made in reservoir lithology and lithofacies model for the Carboniferous volcanic rocks in the Junggar basin.

The Permian volcanic rocks north of Xinjiang have a bimodal characteristic, which is served as important evidence for that the Junggar ancient ocean and Tianshan Ocean have been completely closed and entered an extensional tectonic regime.

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