

Research Advances

New Ar-Ar Isotopic Ages of the Southern Tianshan Mountains, Kyrgyzstan and their Geological Implications

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Objective

The Late Paleozoic Southern Tianshan Ocean is usually considered to be the last-closed ocean in the Tianshan Orogeny. However, there is still no consensus if this is indeed the case. Blueschist, eclogite and ophiolite are present in the Atbashi Range, Kyrgyzstan, which are believed to be the relics of the Southern Tianshan Ocean. New data obtained through Ar-Ar isotopic analysis in this research provide reliable chronological restrictions for this problem.

Methods

Two schist samples were collected from the collision zone in the Atbashi Range. The samples No. KG1306 and KG1309 were taken from the northern slope of the Atbashi Range, Kyrgyzstan, at coordinates of N40°50'59", E75° 12'55" and N41° 02'47", E75° 40'27" and an elevation of 3011 m and 2613 m, respectively. Pure white micas were separated from the sample rocks and were then washed through ultrasonic waves before sending them to a nuclear reactor for fast-neutron irradiation. While argon isotopes were detected, step heating was applied to acquire a series of argon isotopic ratios in different temperature.

Results

In both samples, flat age curves were observed, which means the data is reliable. The plateau ages of KG1306 and KG1309 are 322.1 ± 1.9 Ma and 326.8 ± 1.9 Ma, respectively, whereas the MSWD are 1.18 and 0.56, respectively (Fig 1.). The protoliths of the metamorphic schist are Late-Proterozoic volcanic and clastic rocks in which the Early Silurian granodiorite plutons intruded in. Obviously, these old rocks have experienced subsequent metamorphic superposition and the Ar-Ar closing system

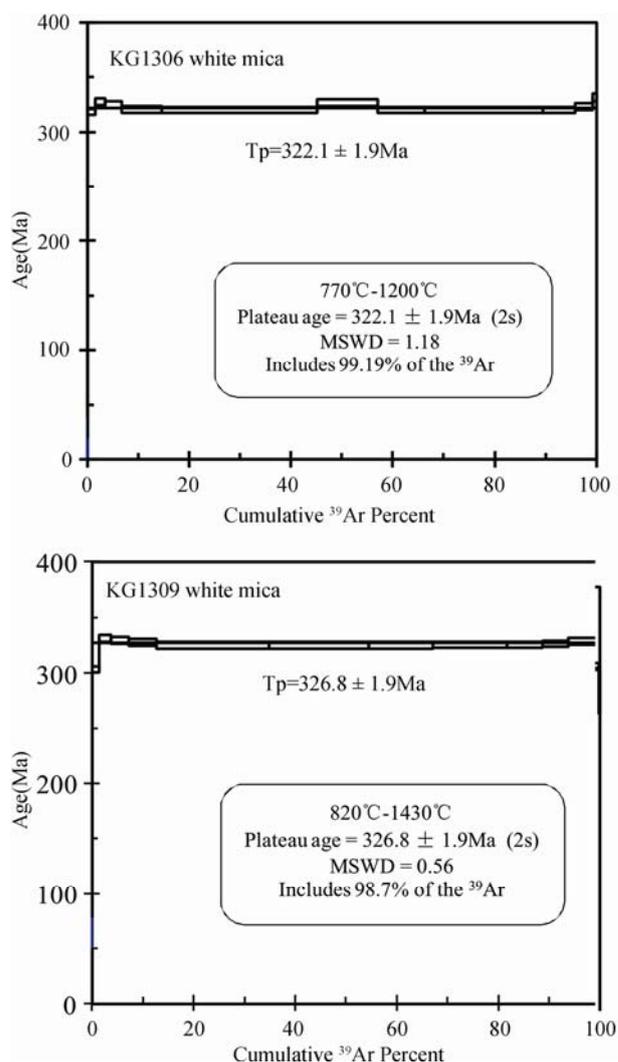


Fig. 1. Ar-Ar age curves of schist samples from the Atbashi Range, Kyrgyzstan.

has been reset in white mica minerals during the Early Carboniferous. The result is consistent with the ages that were published in recent years by other geologists in a similar tectonic setting in Tianshan Orogeny, both in Kyrgyzstan and China, in which blueschist and eclogite are observed as lenticular pudding with the Late Carboniferous isotopic ages (Hegner et al., 2010; Zhang

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Lifei et al., 2013). The schists from the collision zone are usually considered as syn-collisional products and thus recorded the age of the collision event.

This age is coincident with the cessation of the widespread Early Carboniferous Dahalajunshan arc-type volcanism that indicates northward subduction of the Southern Tianshan Ocean (Yu et al., 2016). Moreover, widespread Namurian and Bashkir conglomerates are outcropped in the north adjacent areas of the collision zone which are the syn-collisional sedimentary response, or orogenic molasse. This coincidence may indicate that when the South Tianshan oceanic crust subduction completed, the collision then commenced in which high pressure metamorphic blueschist and eclogite emerged.

Conclusions

Two Ar-Ar isotopic ages are 322.1 ± 1.9 Ma and 326.8 ± 1.9 Ma, respectively, which are within the Serpukhovian stage, Early Carboniferous. They record the metamorphic time of the schists from the Atbashi Range suture zone which may have implications on the high pressure metamorphism and the final closing age of the Late Paleozoic Southern Tianshan Ocean.

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