# Lajishan Ayishan Formation Rhyolites: Implications for the Closure Time of the Proto-Tethys Ocean



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Abstract: The Qilian orogenic belt, as an important component of the central orogenic system, can be divided into three tectonic units from north to south: the North Qilian tectonic belt, the Central Qilian tectonic belt and the South Qilian tectonic belt. The Lajishan ophiolitic mélange zone is an important part of the South Qilian tectonic belt. The study of the formation age and tectonic attributes of the different rock units in the Lajishan is of great significance for reconstructing the tectonic evolution of the south Qilian tectonics belt and the Proto-Tethys Ocean.The Ayishan formation is an important unit of the Lajishan mélange belt, but its stratigraphic age and formation environment are still not constrained, which limits the reconstruction of the early Palaeozoic tectonic evolution of the South Qilian tectonic belt and the closure time of the Proto-Tethys Ocean. In recent years, a set of rock assemblages consisting of andesite, rhyolite, sandstone and pebbly sandstone have been identified in the Ayishan formation exposed in the Lajishan through detailed geological mapping in the field. They are in fault contact with the underlying ophiolite mélange.

Regionally, a volcano-sedimentary succession consisting of andesite, rhyolite, volcanic breccia, and volcaniclastic sandstone nonconformably overlies the Cambrian arc-accretionarycomplex system in the Ayishan area. These rocks were originally assigned to the Avishan formation and attributed an Early Ordovician age (BGMRQP, 1964, 1991). Our rhyolite samples from the Ayishan formation yielded a weighted mean <sup>206</sup>Pb/<sup>238</sup>U age of 447 Ma using zircon U-Pb dating, which can be interpreted as the eruption age of the volcanic rocks. These volcanic rock assemblages are distributed in sandstone, pebbled sandstone and conglomerate in the form of interlayers. Therefore, the zircon U-Pb age of the volcanic rocks can constrain the age of Ayishan formation that it should belong to the late Ordovician rather than early Ordovician. Additionally, we propose that the Ayishan rhyolites were formed in collision-related tectonic setting based on the geochemistry of the rhyolites, which means the initial continental collision between the Central Oilian block and the Qaidam block occurred at least in the Late Ordovician.

Ayishan formation are in fault contact with the Cambrian Donggoumeikuang complex in the south. The Donggoumeikuang complex represents a Cambrian introceanic subduction system that formed in response to subduction of the Proto-Tethyan Ocean (Yan et al., 2015; Fu et al., 2018). At 450 to 420 Ma, the Proto-Tethyan Ocean closed and the Qaidam block collided against the central Qilian tectonics belt. Voluminous 450–440 Ma I-type and S-type granites (Yan et al.,

2015; Tung et al., 2016) that straddle the Central and South Qilian belts formed a broad Andean-type continental margin (Yan et al., 2019), which indicates that the transition from oceanic subduction to continental subduction occurred in 450–440Ma. At 440–420 Ma, the syncollisional and postcollisional granitoids extensively developed, accompanied by high-pressure granulite-facies metamorphism and anatexis in the South Qilian belt and the Qaidam block (Yu et al., 2014; Yan et al., 2015; Fu et al., 2018).

Key words: Lajishan, rhyolite, Proto-Tethys Ocean, South Qilian

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