Paleozoic magmatism in the Alxa Block and its geological implication: constraints from geochronology and geochemistry of the Devonian plutons in the Bayanwulashan area

*Kaiyuan Xu[1,2], Changqing Yin[1,2], Jian Zhang[1,2], Jiahui Qian[1,2], JIngna Liu[1,2]

1. School of Earth Sciences and Engineering, Sun Yat-sen University, Guangzhou 510275, P.R. China, 2. Southern Marine Science and Engineering Guangdong Laboratory (Zhuhai), Zhuhai 519082, P.R. China

The Alxa Block which surrounded by Tarim Craton (TC), Central Asian Orogenic Belt (CAOB), Qilianshan orogenic belt and Langshan-Bayanwulashan fault zone was long considered as a part of the North China Craton (NCC). However, in the past few years, some scientists considered the Alxa Block as an independent Archean block that did not aggregate into the NCC until Paleozoic. Clarifying multiple Paleozoic magmatic events during the development of the Paleo-Asian Ocean (PAO) in the Alxa Block will be a crucial scientific question in understanding the evolutionary history of the Alxa Block, which will also help to evaluate the relevance among the contemporaneous events in the NCC and Alxa Block. Bayanwulashan area, where both have Paleozoic plutons and Proterozoic basement rocks, locates in the most eastern of the Alxa Block. In our study, results of LA-ICPMS zircon U-Pb dating and whole-rock analysis have revealed an episode of Paleozoic magmatism (ca. 375 Ma) which is the first discovery of Late Devonian plutons in the Alxa Block. Basic plutons with low SiO_2 content (44.19–50.54 wt.%) have a low-temperature crystallization condition (715–796 ℃) and intermediate plutons with higher SiO_2 content (53.90–59.15 wt.%) indicate a higher-temperature crystallization condition (792–849 ℃). All ca. 375 Ma basic-intermediate plutons show arc affinities, indicating a southward subduction system along the northern margin of the Alxa Block. In-situ zircon Hf isotope analysis (ε Hf(t) ranges from -10.3 to -2.9) which was conducted by LA-MC-ICPMS shows that these plutons might share the same source of PAO-related magmatism during Paleozoic. The whole-rock Sr isotope (initial $^{87}Sr/^{86}Sr$ is 0.706374-0.707637) and Nd isotope (initial $^{143}Nd/^{144}Nd$ is 0.511690-0.511783) suggest a mixing source between the lithospheric mantle and lower continental crust. Combining previously published data and our study, we suggest that a large Phanerozoic magmatic arc bordering the northern margin of NCC was westerly extended to the Alxa Block, which might have been involved in the same southward subduction system along the southern margin of PAO lithosphere since the early Paleozoic. Besides, we also believe that the Alxa Block has had the same Proterozoic-Archean basement with the northern margin of NCC and has undergone similar evolutionary history.

Keywords: North China Craton, Alxa Block, U-Pb zircon dating, in-situ Hf isotope, Sr-Nd isotope, Geochemistry