Crustal accretion and reworking processes of microcontinental massifs within the orogenic belt through time: A case study from the Erguna Massif

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This paper summarizes the geochronological, geochemical and zircon Hf isotopic data of the Paleoproterozoic-Mesozoic granitoids and their spatial-temporal variations, with the aim of constraining the accretion and reworking processes of continental crust within the Erguna Massif of the eastern Central Asian Orogenic Belt, and further providing the new evidence for the continental formation and evolution within the orogenic belt. The geochronological data indicate that the granitoid magmatisms within the Erguna Massif can be subdivided into Paleoproterozoic, Neoproterozoic, Paleozoic, and Mesozoic stages. These different stages of granitoids have similar major- and trace-element compositions. However, they have different zircon Hf isotopic compositions, i.e., εHf (t) values of zircons from these granitoids gradually increase, whereas their T_{DM2} values decrease throughout time. The latter result indicates a change in the source of granitic magmas from the melting of ancient crust to more juvenile crust. The T_{DM2} values of zircons from different stages of granitoids reveal the crustal accretion of the Erguna Massif mainly took place in 0.78-1.40 Ga, as well as minor 2.8 Ga and 2.06 Ga. Additionally, zircon εHf(t) values also exhibit spatial variations, with εHf(t) values decreasing northwards, whereas T_{DM2} ages increase. This pattern suggests that, moving from south to north, there is an increasing component of ancient crustal material within the lower continental crust of the Erguna Massif. Taken together, we conclude that zircon Hf isotopic data reveal lateral and vertical heterogeneities in the lower continental crust of the Erguna Massif, that the crustal accretion of microcontinental massifs within the orogenic belt mainly happened during Mesoproterozoic to Neoproterozoic, and that crustal vertical growth is a main style of continental formation of microcontinental massifs within the orogenic belt.

This ressearch was financially supported by the MOST of China (2016YFC0600403) and the National Natural Science Foundation of China (41330206).