Tracking deep ancient crustal compositions by statistical analysis on information of xenocrystic/ inherited zircons within igneous rocks from the Altai-East Junggar regions: constraints on the continental architectures

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The Chinese Altai and East Junggar as well as adjacent regions, located in the western part of Central Asian Orogenic Belt, has long been studied; however, the existence and distribution of ancient/ reworked deep crust components remains controversial. We present an integrated study of geochronological and Hf-in-zircon isotopic data for xenocrystic zircons from the Paleozoic granitoid rocks and associated felsic volcanic rocks of the Chinese Altai, East Junggar and nearby regions, aiming at presenting a new perspective on tracing crustal compositions of variable tectonic units in the Chinese Altai-East Junggar region and adjacent areas. Information only based on crystallized zircon grains from the cooling magma does not always reflect the complete information on magma source components. It is therefore crucial to obtain all available information on zircon grains from magmatic rocks. Based on this compiled dataset, considering (1) the pre-magmatic age and spatial distribution and available Hf isotopic signatures of xenocrystic zircon grains and (2) the tectonic units in which they occur, we divide the Altai-East Junggar terrane and adjacent regions into three inherited zircon provinces: Province I, mainly situated in the eastern part of the central Chinese Altai, is characterized by the abundant inherited zircons with Meso-proterozoic and Paleo-proterozoic ages (1000-1600 and 1600-2500 Ma), and variable Hf (t) values ranging from -15 to +7 with ancient Hf crustal model ages (TDMC) ranging from 1.5 to 2.9 Ga. A few scattered parts of province I are scattered situated in the East Junggar. Province II, situated mostly in the central Chinese Altai, is characterized by abundant xenocrystic zircons with Neo-Proterozoic ages (542-1000 Ma), Hf(t) values ranging from -6.8 to +8.1 and correspond Hf crustal model ages of ~1.0 to 1.3 Ga. Province III contains abundant Phanerozoic (<541 Ma) xenocrystic zircons that show highly positive Hf(t) values ranging from +5 to +16 and the youngest Hf crustal model ages (0.4-0.95 Ga). The main part of Province III occupies in most areas of the East Junggar and the southernmost and northern parts of the Chinese Altai. These provinces reveal the architecture and distribution of deep continental components and provide additional constraints on the tectonic subdivision of the region. Ancient compositions (1-1.6 Ga and 1.6-2.5 Ga) exist in the eastern segment of central Chinese Altai. Similar -ancient components were also identified in some local areas in the East Junggar. Identification of the ancient (pre-Neoproterozoic) Hf crustal model ages in the eastern part of the central Chinese Altai (Province I) supports the suggestions that ancient concealed crustal components exist in the Chinese Altai. These ancient compositions may be interpreted as reflecting Precambrian basement or fragments of continental micro-blocks. In contrast, Province III in the East Junggar indicates that most parts of the East Junggar terrane are juvenile.