Late Paleozoic-early Mesozoic magmatism in Delgerkhaan region, Central Mongolia: constraints from the zircon U-Pb age and geochemistry

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Investigating geochemical characteristics and crystallization age of igneous rocks is necessary to understand their petrogenesis and relation of orogenic belts formed in place of former oceans. The Mongol-Okhotsk orogenic belt is the youngest segment of the world’ s largest Central Asian orogenic belt. It formed by the suturing of the Mongol-Okhotsk Ocean and subsequent collision of the Siberian and North China cratons in late Paleozoic to Mesozoic time. The general geology and numerous intrusions of mafic to felsic igneous rocks younging from west to east along the Mongol-Okhotsk suture suggest that the ocean closed in a scissor-like manner, from the late Carboniferous to the Permian in central Mongolia and/or until the Triassic–early Jurassic in southeastern Transbaikalia. However, the robust time of its closure remains debatable. There are numerous large volcano-plutonic fields of late Paleozoic to late Mesozoic ages distributed over a huge territory from Russian Transbaikalia to northern and central Mongolia. The volcano-plutonic belts host abundant granitoid intrusions, both small to medium size plutons and huge batholiths. We studied igneous rock complexes in the Delgerkhaan region of the Khangay-Khentey turbidite basin, Central Mongolia, in order to understand the tectonic evolution of the western Mongol-Okhotsk belt. The study area hosts several granitoid plutons of diorite, granodiorite, monzodiorite, monzogranite and alkaline granite distinguished as Avdrant, Delgerkhaan and Batkhaan granitoid complexes, which intrude Devonian-Carboniferous sediments of the Khangay-Khentey turbidite basin. The zircons separated from seven representative intrusions have euhedral-subhedral shapes, oscillatory magmatic zoning, and Th/U values of 0.38-1.3, indicating their magmatic origin. The zircons of Batkhaan granitoids (2 samples) yielded U-Pb ages of 274±1 Ma and 282±3 Ma (~ Early Permian). The U-Pb ages of zircons of Delgerkhaan and Avdrant granitoids (5 samples) show the time of their emplacement between 240±3 Ma and 220±1 Ma (~Late-Middle Triassic). Chemically, the Early Permian intrusions and coeval rhyolitic lavas show typical geochemical affinities to A-type granites, i.e. high silica, alkalis and high-field strength elements (HFSE), element (REE) spectra. In tectonic discrimination diagrams, their compositions all plot in the fields of A-type granites. On the contrary, the Late-Middle Triassic intrusions are characterized by a wider range of major oxides matching the normal and high-K subalkaline series and indicating their affinity to I-type granites. In addition, they are enriched in light REE and large ion lithophile elements, depleted in heavy REE and HFSE, and show no or minor negative Eu anomalies. The Late-Middle Triassic intrusions are compositionally similar to igneous rocks formed in an active continental margin setting. According to the previous studies, island arc magmatism and double-sided subduction of the oceanic crust of the Mongol-Okhotsk Ocean started in early Carboniferous time followed by the deposition of the turbidite basin. The A-type geochemical features of the Early Permian granites and rhyolites allow us to conclude that they formed by low-degree partial melting of a crustal source in an extensional setting, which was triggered by slab break-off during subduction of the Mongol-Okhotsk oceanic plate.

Keywords: Late Paleozoic–early Mesozoic magmatism, Geochronology, Geochemistry, Mongol-Okhotsk Ocean

