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Multiple subduction and collision system in Mongolia

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The collage tectonics of micro-continents formed the Central Asia during Proterozoic to Mesozoic time in terms of the multiple accretion and collision. Mongolia is made up of the four micro-continents; i.e, Baltica, Siberia, North China and Tarim. There are four geological division; continental blocks, subduction complexes, sedimentary basins and Cenozoic cover sequences. The petrological study including geochronology and isotopic geochemistry of various types of igneous rocks provides us some information for tectonic processes during the assembly of microcontinents. Here, we address geochemistry and geochronology of igneous rocks, mainly granitic rocks and discuss magmatic history of the western part of Mongolia.

The study area, western part of Mongolia, is underlain by low- to high-grade metamorphic rocks accompanied by sedimentary rocks and intrusive rocks. The granitic rocks mainly intrude metamorphic rocks with various metamorphic grades. The metamorphic rocks are composed mainly of pelitic gneisses and amphibolites in the northern part of Bulgan, western Mongolia, the Mongolian Altai Mountains. The pelitic gneiss locally contains Grt, St and Ky as porphyroblasts, suggesting medium-pressure type amphibolite-facies conditions (Nakano et al., 2010). Grt-Ms granite intrudes Grt-St-Ky gneiss as post-kinematic dikes or stocks. Grt-Ms granite is free from any deformations. The chemical compositions of Grt-Ms granite show 71-75 wt% in SiO2 and peraluminous (alumino-saturation index: A/CNK=1.02-1.29). Other geochemical characters indicate enrichment of K2O, Rb and depression of Nb, Y. On the other hand, syn-kinematic deformed granitic rocks containing garnet grains are exposed on the Hanhohiyn Mountains, north-west Mongolia. Bt-Ms granite and Hbl-Bt diorite occur as stocks around Tsagaanhayrhan. The granitic rocks show granoblastic texture with or without foliation, and tonalite to granodiorite in compositions. SiO2 contents range from 63 to 66 wt% and alunimo-saturation index is more than 1.1. These granitic rocks, high-Sr granite are characterized by high-Ba and -Sr contents similar to some collision related granitic rocks. Hbl-Bt diorite possesses 52 wt% in SiO2 and A/CNK=0.82 and the chemical composition of the diorite is similar to that of within-plate basalt. In addition to these granitic rocks, pink-colored granites occur probably as stocks in the southeastern part of the Hanhohiyn Mountains. These granites contain pink-colored K-feldspar and show no sings of deformation features. Their chemical compositions are consistent with alkali granite having 70-73 wt% in SiO2 and 8-11 wt% in total alkali, and the pink-colored granites possess low-Ba and -Sr contents.

We conducted monazite EMP dating for selected samples from both regions. Grt-Ms granite from the northern part of Bulgan gave an age of 262 Ma, whereas the syn-kinematic granite and the high-Sr granite from the Hanhohiyn Mountains show ages of 506 Ma and 493 Ma, respectively. It is considered that the magma activities of each region occurred at different ages or events.

Various types of intrusive rocks are exposed on the Mongolian orogenic belt. Most of granitic rocks from both regions are plotted within the fields between volcanic arc granite and syn-collisional granite in some discrimination diagrams. Therefore, the magmatic processes combined with metamorphic evolution in the western part of Mongolia were formed by multiple subduction and collosion events during formation of Central Asian Orogenic Belt.

Keywords: Mongolia, Central Asia Orogenic Belt, Continental collision zone, Subduction zone, EMP monazite ages