

Crustal Development in the Northeast Asian Orogenic Belt and its comparison with the Central Asian Orogenic Belt

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The Northeast Asian Orogenic Belt is a Mesozoic-Cenozoic accretionary orogenic collage, and it constitutes the northern and principal part of the “Nipponides” (Sengor and Natal’in, 1996). The tectonic framework was formed in Mesozoic and Cenozoic, and it continues to evolve along the modern Pacific arc-trench systems. Generally, a oceanward younging of tectonic units may be discerned, but such a simple pattern is disrupted in many places by extensive strike-slip faulting, most of which is left-lateral. In this talk, the issue of crustal development in the sector of Sikhote-Alin and Japanese Islands will be discussed based on the geochemical and isotopic analyses of granitoids that intruded in various tectonostratigraphic terrains.

The majority of granitoids in the NE Asian Orogenic Belt formed from Jurassic to late Cenozoic, with Cretaceous as the dominant period of granitic magmatism and tectonothermal events. A few Early Paleozoic granitic rocks (500 to 450 Ma) have been identified in SW Japan (Kurosegawa Belt) as well as in NE Japan (Kitakami Belt), among them the ca. 500 Ma diorites and tonalites of southern Kitakami are the oldest rocks in Japan and interpreted as the first TTG crust of proto-Japan (Isozaki et al., 2015). Cretaceous granitoids are widespread in Sikhote-Alin and in NE and SW Japan. However, granitoids were emplaced only in the Cenozoic in Sakhalin (ca. 44 - 42 Ma) and Hokkaido (45, 37 and 18 Ma).

Most granitoids from Sikhote-Alin are of I-type and have $ISr = 0.7040$ to 0.7083 , and $\epsilon Nd(T) = +3.0$ to -6.0 (mostly 0 to -5). The Sr-Nd isotopic data fall within the range of granitoids from SW Japan (0.704 to 0.712 ; $+5.0$ to -13.0), and the data of Cretaceous granitoids from Sikhote-Alin and SW Japan overlap almost completely. The Cenozoic granitoids of Hokkaido are characterized by $ISr = 0.7044 - 0.7061$, $\epsilon Nd(T) = +1.0$ to $+4.7$, and Sm-Nd model-1 ages = 400-1000 Ma. This is remarkably similar to the Sakhalin granitoids with $ISr = 0.7047 - 0.7050$, $\epsilon Nd(T) = +2.8$ to $+3.7$, and model-1 ages of 700-1100 Ma. The isotopic data suggest that the granitoids were generated by partial melting of sources with mixed lithologies, including subducted accretionary complexes and probably some hidden Paleozoic to Proterozoic basement rocks. The Nd isotopic data also suggest a proportion of 30-77% of juvenile component in the generation of Sikhote-Alin granitoids, whereas the proportion is much higher for the Cenozoic granitoids of Hokkaido and Sakhalin (about 65-95%). In any case, a significant amount of juvenile crust has been added to the NE Asian Orogenic Belt.

Geological correlation between Sikhote-Alin and Japan, and between Sakhalin and Hokkaido, has been proposed by many workers based various criteria. The present work may support the general scenario. However, the significant difference between SW Japan and NE Japan in their crustal composition and building mechanism has to be reckoned. The two geologic entities might have evolved in very different ways.

A brief comparison of crustal evolution in the NE Asian Orogenic Belt and the CAOB will be presented. (Supported by MOST 104-2913-M-002-005, Taiwan)