Abstract

To confirm the usefulness of the chemistry of detrital heavy minerals, the provenance of two collisional areas were studied, and the paleogeography before collision and the uplift history of the collisional zone were reconstructed mainly based on the chemistry of detrital heavy minerals. The first is the collision between the Honshu and Izu arcs since Middle Miocene, and the paleogeography before the collision was reconstructed. The second is the collision between the Eurasia Plate and Indian Subcontinent since the earliest Eocene, and the uplift history of the Himalayas was reconstructed.

The latest Oligocene to early Middle Miocene strata in the Mineoka area and the late Eocene to early Middle Miocene strata in the Setogawa area were investigated to reconstruct the paleogeography around the Izu arc collisional zone. The sandstones of the Eocene to Oligocene Mikura Group in the Setogawa area were plotted in the field of "Recycled Orogen" or "Dissected Arc" provenance and they yield the detrital chromian spinels and garnets whose chemistries are similar to those of the spinels in serpentinites of the Kurosegawa Belt and garnets in metamorphic rocks and granite in the Ryoke Belt, respectively. The detritus of the Mineoka, Setogawa and Kurami Group had a similar provenance to that of the Mikura Group except for the origin of detrital chromian spinels. From these strata, detrital chromian spinels whose chemistries are similar to those in the Circum-Izu Massif serpentinites were obtained. Most of the Miocene strata in the Mineoka- Setogawa areas yield detrital chromian spinels whose chemistries are similar to those in the Mineoka type serpentinites, while only the conglomerates in the Mineoka and Setogawa Groups contain detrital chromian spinels whose chemistries are similar to those in the Hayama type serpentinites. It is inferred that the Hayama type serpentinites of the Circum-Izu Massif serpentinites was exposed at first and then the emplacement of the Mineoka type serpentinites occurred. The origin of the Circum-Izu Massif

serpentinites was considered to be backarc peridotites, and the existence of an arc to the east of the Mineoka-Setogawa areas in the Early Miocene was also inferred.

The metamorphic rocks and granites in the Ryoke Belt had supplied detrital garnet to the early Early Miocene to early Middle Miocene strata in the Mineoka and Setogawa area except for the Hota Group. The Hota Group sandstone can be divided into two groups. One group is distributed to the south of the Mineoka Mountains at present, and their detritus had been mostly derived from the volcaniclastic rocks. The chemistry of detrital clinopyroxenes obtained from this group sandstones show the orogenic calcalkaline rock origin. The volcanic activity which supplied detritus to the Hota Group correspond to the northeast Honshu arc or the inferred oceanic island arc. The other group is distributed to the north of the Mineoka Mountains at present. Their sandstones are quartz-feldspathic, and contain a large amount of detrital garnets whose chemistry is similar to those in the continental basement. Thus, there is a possibility that the detritus of the second group was supplied from the continental basement directly.

The modal composition of sandstone and the assemblage of the detrital heavy minerals change between the sandstone from the lower and upper parts of the upper Kushigatayama Subgroup of the early Middle Miocene Koma Group. The chemistries of detrital clinopyroxenes area similar to those in the volcanic rocks in the Izu arc. It is inferred that the change of the provenance observed in the Koma Group was caused by the collision of the Honshu and Izu arc.

The strata from the late Eocene to the present in the Bengal basin were also investigated to reconstruct the uplift history of the Himalayas. From the late Eocene Kopili Formation in Bangladesh, detrital chromian spinels whose chemistries are similar to those of the spinels in the Yarlung-Zangbo ophiolite and intra-plate basalts such as those in the Deccan Traps were obtained. Because the Middle Eocene Sylhet Limestone in Bangladesh contains no detritus, it is inferred that the first supply of detritus from the Himalayas to the Bengal Basin occurred in the late Eocene, and a small amount of the detritus from the Indian Subcontinent had been also supplied in

this period. The Yarlung-Zangbo ophiolite have supplied detritus until the present, however, the detrital chromian spinels whose chemistries are similar to the intra-plate basalts are rarely included in the strata younger than the Kopili Formation.

The detrital garnets were also fond from all the strata in the Bengal basin investigated in this study. The chemistry of detrital garnets had changed two times from the Eocene to the present. The late Eocene Kopili and the Oligocene Barail Formations sandstones contain detrital garnets whose chemistries are similar to those in the Transhimalaya and Higher and Tethys Himalayas. The first change occurred between the Oligocene Barail Formation and the Early Miocene Bhuban Formation. The pyrope-rich almandine was predominant in the detrital garnets from the Barail Formation, while the both the pyrope-rich almandine and spessartine-rich almandine was predominant in the detrital garnets from the Bhuban Formation. This change seems to be caused by active dissection of the Tertiary granitic rocks in the Himalayas. The second change occurred between the Bhuban Formation and the overlying Boka Bil Formation. The Boka Bil Formation sandstones contain a large amount of especially spessartine-rich almandine and grandite. It is probable that this change was caused by the start of dissection of the Lesser Himalayas. These characteristics are also common in the sandstones and sands from late Miocene to the present.

Key words

sandstone, shale, detrital chromian spinel, detrital garnet, detrital clinopyroxene, collisional zone, Mineoka-Setogawa area, Himalayas-Bengal system

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