南インド、Chitradurga 片岩帯のIngaldhal地域 における始生代の緑色岩類の地球化学的研究
Geochemical study of Archean greenstones of Ingaldhal Formation in the Chitradurga schist belt, Southern India

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Archean greenstone and TTG gneiss are widely distributed over the western Dharwar craton in southern India. Especially, the komatiite occurrences in the Paleoarchean greenstone belts have been geochemically studied well and the influence of Archean volcanic activity and mantle geodynamics are often discussed from their magma genesis.
In this study, we focused on the greenstones in the Chitradurga schist belt, western Dharwar craton, in southern India. There are many occurrences of volcanic rocks in this belt, all of which were altered by low- to medium-grade metamorphism. After carrying out a detailed thin section petrography, we performed various geochemical analyses on whole rock samples. Based on the results of petrography and geochemical analyses, the greenstones were divided into 4 units. The oldest unit A is affected by amphibolite facies metamorphism, whereas the units B and C are greenschist facies metabasalts and they usually have dendritic texture made of amphibole or pyroxene similar to the texture shown by komatiites. Rarely, pillow lava structures were observed and it indicate that the volcanic activity has occurred under subaqueous (marine?) conditions. The unit D is the youngest unit and most altered one among the 4 units studied. These rocks have high calcite content and the LOI was very high (>12wt.%). Because of this reason, we decided to select the samples that contain LOI less than 5 wt.% in order to restrict the effect of alteration in the geochemical data.
The major and trace element compositions of the samples from three units can be grouped into 2 types. The first type of rocks occurring in the unit A and unit C are characterized by flat REE pattern and spider diagram. The second group of rocks, occurring in the unit B, have enriched compositions of LIL, LREE and slightly depleted HREE than the first type. In addition, Nd isotope ratio was different for these 2 types, the first group have near zero to positive Nd values compared to negative values for the second group.
Three possibilities were considered based on the geochemical differences observed: the difference in the degree of partial melting, the effect of crustal contamination and the changes in tectonics setting. The Nd isotopic data and various discrimination diagrams indicate that the source mantle was different. So it is difficult that this difference occurred by the partial melting. Secondly regarding the crustal contamination, we calculated AFC model, but in this model the trace elements didn't follow the AFC curves. In addition, it was recognized that if the difference had been generated by contamination it is necessary to link it with a felsic contaminant such as continental crust. However, the volcanic activity at this time has occurred in a marine environment where a corresponding contaminant is lacking. Considering these points, it was concluded that the compositional variations observed between the two types of volcanic rocks were cause by the difference in source magma genesis due to a difference in tectonic settings. The units A and C have likely oceanic ridge type characteristics as evidenced by the REE patterns and Nd isotopic ratio

related to a possible upwelling mantle plume. On the other hand, the unit B volcanism can be related to an arc setting possibly caused by subduction. However, some features of geochemical discrimination diagrams suggested that units A, B and C have formed under different settings, which needs further evaluation. The difference in tectonics setting is also complemented by negative epsilon Nd values suggestive of possible sediment input by subduction. In summary, the geochemical characteristics shown by the Ingaldhal volcanic rocks represent a drastic change in the tectonic setting related to plate tectonics as early as MesoArchaean.

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