Volcanic rocks from the Kyushu-Palau Ridge during the rifting activity with spreading of the Shikoku Basin

Satoru Haraguchi[1]; Teruaki Ishii[2]; Jun-Ichi Kimura[3]

[1] Ocean Floor Sci., Ocean Res. Inst., Univ. Tokyo; [2] Ocean Floor Geotec., Ocean Res. Inst., Univ. Tokyo; [3] Dept. Geosci., Shimane Univ.

The Kyushu-Palau Ridge (KPR) was investigated by the Japanese Geodynamics Project (GDP) in the 1970's, Hydrographic Department of Japan (JHD) until 1980's, the R/V Tansei-maru (Ocean Research Institute, University of Tokyo) in the 1990's (KT94-10, 1994 and KT98-19, 1998). At the Komahashi-Daini Seamount in the northern KPR, tonalites were recovered until GDP cruise, and considered to indicate felsic plutonic activity during early arc volcanism stage. Haraguchi et al. (2003) studied to the plutonism by the dredged rocks mainly during the KT94-10 and KT98-19 cruises, and considered that this tonalite was produced by fractional crystallization of the basaltic magma during the arc volcanism. During these cruises, basaltic to andesitic volcanic rocks were dredged from other seamounts. In this study, we present igneous activity in the northern to central KPR by petorlogical and geochemical studies of these rocks.

The colored mineral assemblage of any volcanic rocks dredged during the KT94-10 and KT98-19 cruses show the clinopyroxene only. 2-pyroxene assemblage was observed main phase of the Miyazaki Seamount (KT94-10, D02) at the northern end of the KPR, and rare from other seamounts. The crystallization temperature by 2-pyroxene geothermometer shows relatively high.

Bulk composition of many volcanic rocks shows basaltic to andesitic (SiO2 = 47-57%). The Miyazaki Seamount rocks are classified into low-K tholeiite, and the Nichinan Seamount (KT94-10, D03) shows alkali series. Compositions of the other seamount rocks show between these two seamount rock series. The most remarkable characteristic of these rocks is high incompatible (LILE, HFSE) content. These compositions show two or more times higher than those of early arc volcanism in the Izu-Ogasawara-Mariana (IBM) forearc region (ODP Leg 125 Site 786, Ogasawara, Mariana) and following arc volcanism (Izu: ODP Leg 126, Site 792, 793), and higher than recent IBM arc too. Zr content of the Izu forearc shows 20-55 ppm, that of the recent Izu arc shows 20~90 ppm. Volcanic rocks from the northern KPR have 40~210 ppm of Zr, and shows different trend to other region. In the KPR, volcanic rocks from the DSDP Leg 59 Site 448 in the central KPR show similar high content of incompatible elements. On the other hand, tonalite in the Komahashi-Daini Seamount show low incompatible element content similar to recent IBM arc. REE pattern of the KPR volcanic rocks show LREE-enriched patterns in the many seamounts, different from the flat pattern of the Komahashi-Daini Seamount tonalite and the LREE-depleted puttern of the recent Izu arc. These characteristics show the parent mantle of the KPR volcanic rocks had more enriched composition than that of the Komahashi-Daini Seamount tonalite and IBM forearc volcanic rocks.

The radiometric ages of the volcanic rocks from the northern KPR of this study show about 25 Ma (Ishizuka, pers. comm.), and the Site 448 rocks similar characteristics to the northern KPR volcanic rocks shows 30 to 35 Ma. This ages indicate rifting activity associated with the Shikoku and Parece Vela back-arc basin, after normal arc volcanism in the proto-IBM arc. Compared this data to incompatible element composition, the proto-IBM arc volcanism began depleted early arc volcanism (-40 Ma) to normal arc volcanism (40-29Ma), and change enriched volcanism at 30 Ma. At this time, it is considered to change magmatic condition so that beginning of the back-arc basin activity in the proto-IBM arc. Based on comparison incompatible element compositions and REE patterns, this change of condition was caused by the changing of the parent mantle into enriched composition, and assumed that this event was associated with back-arc spreading activity.