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THE DAITO RIDGE GROUP AND THE KYUSHU-PALAU RIDGE—WITH SPECIAL REFERENCE TO THE TECTONICS OF THE PHILIPPINE SEA—

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Remarkable progress has been made on the geological and geophysical investigation of the Northwestern Philippine Sea, since the Geodynamics Project started in 1972. Collection of acidic intrusive rocks, schists and other basement rocks, and Eocene *Nummulites* is one of the most remarkable results of the recent research cruises in the sea.

Based on this information some island arc activities of the Kyushu Palau Ridge in the Paleogene ages and that of the Daito Ridge Group in the Pre-Cenozoic ages were ascertained. Considering the geologic history and the petrochemical character, such as ($^{87}Sr/^{86}Sr$), K/Na, K/Rb of the rocks, these ridges were judged as island arcs which died in their immature stages. The petrochemical characters show also that the paleo-islands of the arcs can not be identified with the Kuroshio Paleoland which had existed possibly on the south off the southwestern part of the Japanese Islands.

It may be an interesting subject to concider the maturity of the island arcs in the Pacific Ocean. This consideration might become a way to find a clue to investigate a new project for the study of the "crustal evolution" of the earth.

1. *Introduction*

Study and remarkable progress has been made in the field of geological and geophysical study of the development of the Philippine Sea, since the Geodynamics Project (GDP) started in 1972.

As is well known, the Philippine Sea has a particular and noteworthy feature. That is, the sea is bordered by an arc-trench system, not only in its eastern margin, but also in its western margin. It is to be noted moreover, that a ridge (Kyushu-Palau Ridge) streches from north to south dividing the sea into two parts. A ridge group, Daito Ridge Group (the Amami Plateau, the Daito Ridge, the Okidaito Ridge (Fig. 1) occupies the northern half of the western part of the sea, and is bordered by the Kyushu-Palau Ridge on its eastern side. In carrying out our expedition under the Japanese Geodynamics Project, these features of the sea were especially noted. Therefore, most of our geological research cruises have been concentrated on this northwestern region of the Philippine Sea.

2. *Geological Results of the Cruises*

The localities of collected rock samples and that of Eocene *Nummulites* and the other

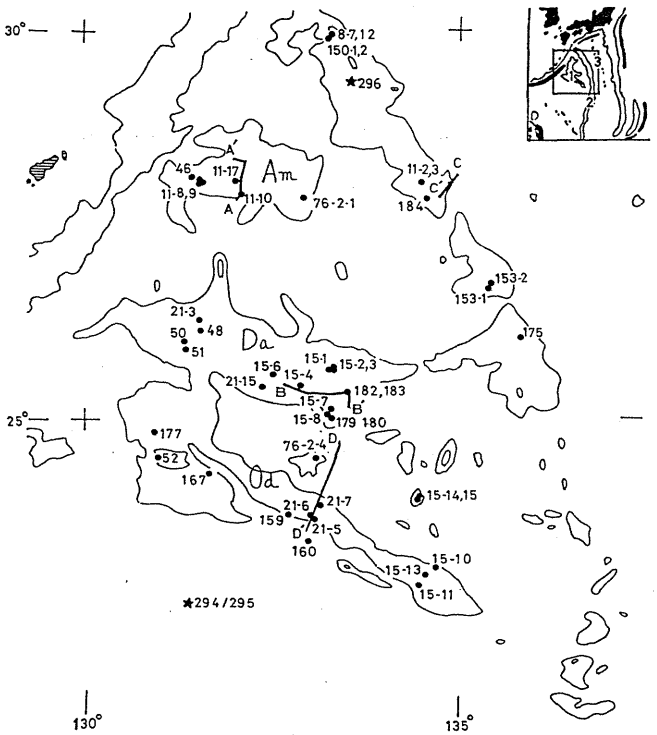

Fig. 1. Sites of rock sampling by Japanese research cruises in the Northern Philippine Sea (Star: DSDP sites). Thick lines: Location of reflection profiles of Fig. 2. Contour: 2,000 m, 4,000 m. Am: Amami Plateau, Da: Daito Ridge, Od: Okidaito Ridge. Index map 1: Daito Ridge Group, 2: Kyushu-Palau Ridge, 3: Kinan Seamount Chain.

larger foraminifers are shown in Fig. 1. Figure 2a–d shows profiler records of the reflection survey corresponding to the lines of shown in the Fig. 1.

2.1 Kyushu-Palau Ridge

Several years ago, Ostapenko and other members of the Sakhalin Complex Scientific Research Institute dredged some granitic rocks at the Komahashi Seamount II (Komahashi-daini Seamount) located near the north end of the Kyushu-Palau Ridge (OSTAPENKO and NARYIENYI, 1976). This was the first collection of the basement rock from the northern part of the Philippine Sea, and encouraged Japanese researchers for later geological exploration and investigation of the sea.

Similar acidic plutonic rocks were obtained during the later Japanese research cruises from the seamounts of the ridge (SHIKI *et al.*, 1974; MIZUNO *et al.*, 1975b). Selected data of petrochemical characters such as ($^{87}Sr/^{86}Sr$) ratios, trace element contents, and radiometric ages of the rocks of the ridges in the northwestern Philippine Sea are shown in Table 1. It is interesting that the analyzed plutonic rock samples from the Kyushu-Palau Ridge are characterised by low K content, very low Rb content, high K/Rb ratio, low Rb/Sr ratio, and a relatively low initial ($^{87}Sr/^{86}Sr$) ratio (ISHIZAKA, 1975; ISHIZAKA and YANAGI, 1975). High Na content of the rocks is also noteworthy.

Table 1. Selected data of petrochemical character of igneous rocks.

Locality	Sample		K(ppm)	Rb(ppm)	Sr(ppm)	K/Rb	$^{87}Sr/^{86}Sr$	$^{87}Sr/^{86}Sr$ (initial)	age
Kyushu-Palau Ridge									
Komahashi-daini Seamount	GDP 8–12–1*	biotite-hornblende tonalite							37.4±6.4 (K–Ar age)
〃	GDP 8–12–4†	quartz diorite							
		whole rock	7161	13.2	217.8	543	0.70338± 9	0.70329± 9	
		plagioclase+quartz		4.75	281.8		0.70336±10	0.70333±10	
〃	GDP 8–12–21†	quartz diorite							
		whole rock	3532	3.16	260.7	1118	0.70336±21	0.70334±21	
		plagioclase+quartz		1.91	294.8		0.70338± 9	0.70337± 9	
〃	GDP 8–12–9**	quartz diorite							51 ±1 (fission track age)
〃	GH74–7–150–1–11††	biotite-hornblende tonalite							37.5±1.9 (K–Ar age)
Minamikoho Seamount	GH74–7–175–1***	granodiorite (biotite)							48.5±1.4 (K–Ar age)
	DSDP 296 63–4†††	lapilli tuff							47.5±4.0 ($^{40}Ar/^{39}Ar$ age)
Amami Plateau	GDP 11–9–3****	augite-olivine (ps) basalt	18700	32.1	495	583	0.7038 ± 4		85.1±2.1 (K–Ar age)
〃	GDP 11–9–33****	augite-olivine(ps) basalt	10600	24.1	1255	434	0.7030 ± 2		82.4±2.2 (K–Ar age)
〃	GDP 11–17–1****	biotite-hornblende tonalite							
		whole rock	5440	4.9	782	1110	0.7032 ± 4		69.5±2.0 (K–Ar age)
		hornblende	4430	33.7	128	131	0.7034 ± 3		75.1±2.4 (K–Ar age)
		quartz+plagioclase		5.3	957		0.7030 ± 2		

* Shibata and Okuda, 1975; † Ishizaka and Yanagi, 1975; ** Nishimura, 1975; †† Shibata *et al.*, 1977; *** Mizuno *et al.*, 1977; ††† Ozima *et al.*, 1977; **** Matsuda *et al.*, 1975.