

VIII. ROCKS AND SEDIMENTS

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Samples were obtained by the following methods; rock-coring (4 sites), piston-coring (7 sites) and dredging (39 sites) (see Table I-4). In this chapter a descriptive outline of the sediments and rocks sampled by dredging and rock-coring are described.

1. Sediments

In Table VIII-1, the grain size and the depth of sampled sediment below sea bed are shown. The sediments, with only one exception (rock core, RC22) were taken over an interval, from the seabed to about 15 cms. below, by a cylinder type dredge.

Since the age of sediments is not given on Table VIII-1, it cannot necessarily be inferred that the samples recovered from a particular locality represent the type of sediment currently being deposited at that site. Nor can it be assumed that sediments of a similar lithological content are of direct age equivalence. For example except in one case (rock core, RC22) shell sands in Table VIII-1 were recovered from sites with a water depth shallower than 200 m. For the case of RC22 the upper part is a medium sand but the lower part is a shell sand. However, despite the lithological similarities, the shell sand of RC22 is not the same age as those in the shallower sites.

2. Rocks

1) *North off Oki Islands*

a) *Oki Bank*

Volcaniclastic sandstones were taken from St. 1077 on the slope of the Tsushima Basin. The rocks recovered were angular and the largest one measures 20 cm × 18 cm × 5 cm in size. Grains contained in the rock are reddish-brown olivine, plagioclase, pyroxene, quartz-potassium feldspar aggregates, volcanic glass fragments and basaltic rock fragments. All of them are slightly rounded.

b) *Kita-Oki Bank*

The Bank is located between Oki Bank and Yamato Ridge, and to the northeast of Oki-Dogo Island. Samples were obtained at two sites on the Bank.

In situ granitic rocks were sampled from the slope of a high on the top of the Bank (St. 1080, D266). The rocks are angular boulders and the largest one is 27 cm × 25 cm × 12 cm in size. Modal composition of the rock is shown in Table VIII-2.

Rock-coring was used at one more site on the Bank (St. 1083, RC22). A 120 cm-core was obtained. The upper part (0~110 cm) consists of medium sand containing foraminifera and lower part (110~120 cm) is shell sand containing large shell fragments. No rock was found.

c) *Yamato Ridge*

Sampling works were carried out at 11 sites, 3 on Kita-Yamato Bank, 7 on Yamato Bank, 1 on Nishi-Takuyo Bank.

The dredge site locations on Kita-Yamato Bank are St. 1094, 1104, and 1105 (D276,

Table VIII-1 Grain size and depth of site.

Numbers of shell sand are meaning that of sediment containing shell sand in the left side columns of double lines.

	clay	silt	sandy silt	fine sand	f.~m. sand	medium sand	m.~c. sand	shell sand
0 ~200m				2	5	2	2	(8)
200 ~500		1	2	1	1			
500 ~1000		1	6	4			1*	(1)*
1000~2000	1	6	2					
2000~3000	2	4						
3000~	4							

*RC22.

Table VIII-2 Modal compositions of granitic rocks.

Rock names are based on the nomenclature of the IUGS subcommission on the systematics of igneous rocks (Geo-Times, Oct. 1973).

Station No.	1080	1100	1110
Sample No.	D266-1	D280-1	D289-1
Rock name	tonalite	q-diorite	aplite
quartz	17.2(20.6)	12.6(16.5)	44.6(45.0)
K-feldspar	2.9(3.4)	5.6(7.4)	43.9(44.4)
plagioclase	63.2(76.0)	58.0(76.1)	10.5(10.6)
hornblende	4.1	9.8	0.0
biotite	10.1	7.4	0.8
clinopyroxene	0.0	4.2	0.0
epidote	1.0	0.0	0.1
sphene	1.1	0.0	0.0
opaque mineral	0.1*	2.0**	0.2
others	0.3***	0.3***	0.0

* titanomagnetite and ilmenite.

** titanomagnetite, magnetite and ilmanite.

***allanite and clay mineral.

Table VIII-3 Rocks from Kita-Yamato Bank.

Sample No.	Rock name	Size (cm)	Roundness	Remarks
D276-1	volcanic breccia (doleritic basalt)	6 × 4 × 4	A	
D284-1	volcanic breccia (hld-mica andesite)	9 × 4.5 × 2.5	A	Glassy and porous.
D285-1	mylonite	7 × 4.5 × 2.5	R	ep, ab, chl, qz.
2	hld-act-ab-qz schist	4 × 3.5 × 1.5	R	
3	fine sandstone	6.5 × 3 × 1	A	

284 and 285). No in situ rock was recovered at these sites. Principal samples obtained are shown in Table VIII-3.

Of the five sites on Yamato Bank (St. 1093, 1096, 1100, 1108 and 1109), the samples which seem to be recovered from or near to outcrops were taken at St. 1096, 1100 and 1108. St. 1096 is located on the slope of the central part of Yamato Bank. Volcanic breccia (maximum size, 26 cm × 15 cm × 12 cm), pyroxene-olivine basalt (max., 18 cm × 12 cm × 9 cm) and clinopyroxene-orthopyroxene andesite (max., 16 cm × 10 cm × 10 cm) are considered to be the in situ rocks. In addition thermally metamorphosed rhyolite and siltstone which are rounded and pebble in size were also obtained. D280 was carried out at the slope of the Bank (St. 1100), and many boulders were sampled. As the rocks are largely rounded, they probably do not originate directly from outcrops. However, since quantities of the same kind of rock were obtained, it is considered fairly certain that these represent the rocks which constitute the basement of the Bank. Quartz diorite is particularly common in the dredge samples. The largest sample (Table VIII-2) is 41 cm × 29 cm × 19 cm in size. The rest of the samples are dolerite (max., 27 cm × 23 cm × 13 cm) which may be thermally metamorphosed, rhyolite (max., 20 cm × 13 cm × 12 cm) and sandstone (max., 17 cm × 9 cm × 8 cm).

The rock-coring site is located at the slope of eastern part of the Yamato Bank (St. 1108, RC24). A 211 cm core was recovered. The lithology, and the age of the rock by micropaleontology is given in Chapters IX and XI respectively.

Large amounts of aplitic rock (Table VIII-2) were recovered from St. 1110 on the northern slope of Nishi-Takuyo Bank (D289). The rocks are angular blocks and seem to be recovered from the outcrop. The maximum size of the rock is 34 cm × 16 cm × 14 cm.

2) Oki Islands to off Noto Peninsula

a) Oki Ridge

The dredge sites on Oki Ridge are St. 1078, 1079, 1081, 1086 and 1088.

St. 1078 and 1079 are located in southern part of Oki Ridge. The former is on the slope (D264) and the latter on an uneven surface at the top (D265). The dredge sample of D264 mainly consists of tuffaceous rocks. Of these the tuffbreccia (max., 20 cm × 18 cm × 13 cm) seems to be in situ. The rock has plagioclase and quartz as phenocrysts and contains abundant altered rock fragments of pumice and andesite(?). The matrix of the rock is devitrified glass which forms aggregates of very fine crystalline material. In addition, rhyolitic welded tuff (max., 20 cm × 8 cm × 8 cm), moonstone-bearing, welded tuff (max., 7.5 cm × 7 cm × 3 cm), biotite granite (8 cm × 4.5 cm × 2.5 cm), biotite gneiss (6 cm × 3 cm × 1.5 cm) and muscovite-biotite gneiss (7 cm × 2.5 cm × 2.5 cm) were obtained. Except for the rhyolitic welded tuff, the above rocks are interpreted as clasts of a conglomerate. Since material, which presumably represents the matrix of conglomerate, clings partly to the surface of these samples. The conglomerate may be in situ. Angular andesitic rubble (max., 11 cm × 4 cm × 3.5 cm) containing thoroughly altered pyroxene phenocryst were recovered from St. 1079 (D265).

St. 1081 is located on the southern, break of slope in the central part of Oki Ridge (D267). Samples are all rounded pebbles to granules of volcanic and granitic rocks, chert, sandstone etc. The largest fragment recovered was 5 cm × 4.5 cm × 2 cm.

Two dredge sites are located on the northern part of the Oki Ridge (St.1086 and 1088).

In situ rocks from St.1086 (D269) are shaly siltstone and slightly soft siltstone. The largest rock is 11 cm × 9 cm × 3 cm in size. Minor amounts of rubble of hard shale (max., 7 cm × 5 cm × 4 cm) were also obtained. Fragments of pillow basalt were taken from St.1088 (D270). The rock contains plagioclase and clinopyroxene pseudomorph as phenocrysts and have valiolitic texture. The largest fragment is 19 cm × 16 cm × 11 cm in size. Fragments of dolerite which have quench texture in part were also obtained (max., 18 cm × 12 cm × 9 cm). Both basalt and dolerite may be in situ.

b) West off Noto Peninsula

Sampling works were carried out at four sites, St.1084, 1085, 1089 and 1090.

Top (RC23) and slope (D268) of the Bank called "Oguri" (off Kaga City) were sampled (St.1084 and 1085). No rock was recovered from St.1084, however, from St.1085 conglomerates containing fossils were collected. The rock may be in situ.

St.1089 is located on the slope leading down to the Oki Trough, west off Noto Peninsula (D271). Minor amounts of clinopyroxene andesite containing anhedral quartz in the groundmass and hard siltstone were dredged. It is not known whether the rocks are in situ or not. Pebbles of acid welded tuff and pumice were also obtained. Large amounts of angular fragments, 1~3 cm across, were dredged from the shelf west, off Noto Peninsula (St.1090, D272). The rocks are hornblende-pyroxene andesites containing biotite recrystallised by thermal metamorphism. Pebbles of granitic rock and acid volcanic rock were also obtained.

c) North off Noto Peninsula

Sampling works were carried out on the shelf (St.1091 and 1092) and slope down to the Yamato Basin (St.1098 and 1099). The following samples were obtained;

St.1091 (D273)

Titaniferous augite bearing olivine dolerite (max., 13 cm × 7.5 cm × 5.5 cm, slightly rounded).

Calcareous aggregate (6.5 cm × 5.5 cm × 3 cm).

Pebbles of pumice and acid volcanic rock.

St.1092 (D274)

Many boulders and cobbles of fossil bearing sandstone (max., 27 cm × 26 cm × 15 cm) and limestone (max., 23 cm × 16 cm × 14 cm).

St.1098 (D278)

Olivine dolerite which seems to be a part of a boulder (12 cm × 10 cm × 2 cm).

Pumice (15 cm × 9 cm × 4 cm).

St.1099 (D279)

Orthopyroxene andesite (max., 22 cm × 19 cm × 16 cm, subrounded, glassy).

Clinopyroxene-orthopyroxene dolerite (max., 19 cm × 17 cm × 5 cm, angular).

Hornblende-pyroxene andesite (max., 11 cm × 5.5 cm × 3 cm, angular).

It is not clear whether the rocks listed above are in situ or not.

3) Area between Sado Islands and off Oga Peninsula

a) North off Sado Island

Of the four sampling sites (St.1102, 1103, 1106 and 1107), only St.1102 is situated on the shelf of Sado Island. Large amounts of calcareous siltstone and sandstone were dredged. The rocks are angular and the largest measures 28 cm × 16 cm × 8 cm. They seem to be

in situ. Blocks of pyrite aggregate (max., 13.5 cm × 11 cm × 2 cm) were also obtained.

Pumiceous tuff (7 cm × 6 cm × 3 cm) and pyroxene andesite (4 cm × 3 cm × 2.5 cm) were dredged together with shell sand from the slope near the top of the Bank called "Hyotanguri" (St.1103, D283).

St.1106 and 1107 are located at the slope and flat top of "Mukaise (bank)" (D286 and 287). Angular fragments of vitric tuff and tuff breccia (max., 10 cm × 8 cm × 5.5 cm) were dredged from the slope and rounded, boulder (max., 23 cm × 19 cm × 13 cm) to pebble size fragments sampled at the top. The kinds of rocks sampled at the top are hornblende andesite, hornblende-biotite granite, clinopyroxene-orthopyroxene andesitic welded tuff and others.

b) Off around Oga Peninsula

Sampling works were carried out at four sites (St.1112, 1114, 1115 and 1118).

Angular blocks of siltstone, considered to be in situ, were dredged from the shelf off Tobishima Island (St.1112, D290). Other samples at this site are tuffaceous siltstone (angular), pebbles of pumice, andesite and siliceous siltstone, and a barite nodule.

From the small bank south of "Shinguri (bank)" off Akita tuffaceous conglomerate (max., 10 cm × 7.5 cm × 4.5 cm, angular) and siltstone (max., 4.5 cm × 3.5 cm × 2.5 cm, angular) were sampled (St.1114, D291). The rocks may be in situ.

It is not clear whether the samples from St.1115 and 1118 are in situ or not. They are as follows:

St.1115 (D292): upper slope of "Oga Mukose (bank)"

Orthopyroxene-clinopyroxene dacite (max., 26 cm × 23 cm × 14.5 cm, angular).

Sandstone (max., 8 cm × 7 cm × 5.5 cm, angular).

Siltstone (max., 6.5 cm × 5 cm × 2 cm, angular).

St.1118 (D294): slope off the high situated at margin of Japan Basin west-by-northwest off Oga Peninsula

Small fragments of siltstone and orthopyroxene andesite (max., 10 cm × 7 cm × 4.5 cm, subangular).

4) West off Oshima-Ōshima

a) Matsumae Plateau

Three sites (lower slope (St.1120), middle slope (St.1121) and slope coming off high on the top (St.1127) of the Plateau), were dredged. However no rocks were recovered from any site. Samples consisted of clay and silt from the slope (D295 and 296) and iron sand bearing, sandy silt from the top (D301).

b) Area between Okushiri Island and Shyakotan Peninsula

Four sites were sampled by dredging in the area (St. 1122, 1124, 1125 and 1126), with some recovery in all but St.1125.

From the top of the Okushiri Spur south off Okushiri Island (St.1122), siltstone and andesite, pebble to cobble in size, were obtained (D297).

St.1124 is situated on the wall of the Suttu Canyon on south slope of Iwanai Bank. In situ, angular blocks of siltstone (max., 12 cm × 8.5 cm × 6 cm) containing fossils were dredged (D298).

Shiribeshi Seamount is located northwest off Shyakotan Peninsula. On the basis of its topographic form and magnetic response, the Seamount is thought to have formed by

Table VIII-4 Chemical composition of acid igneous rocks from Japan Sea.

Sample No.	Na ₂ O* (%)	K ₂ O* (%)	CaO* (%)	Rb** (ppm)	Sr** (ppm)	Zr** (ppm)	Th*** (ppm)	U*** (ppm)	Rock name Locality	K/Rb	Rb/Sr	Th/V	Cruise
D225-1	5.33	5.95	2.18	158	4.51	698	18.8	5.6	trachyte	313	0.35	3.4	GH772
D248-1	3.45	2.94	3.84	69	282	131	n.d	n.d	welded tuff	354	0.24	—	GH773
D249-1	2.94	4.81	0.78	182	82	132	16.4	3.1	welded tuff	219	2.22	5.3	"
D249-3	3.05	4.90	0.70	178	74	127	n.d	n.d	welded tuff	228	2.41	—	"
D254	4.13	4.36	0.74	141	73	64	11.9	2.9	hid-dacite	257	1.93	4.1	"
D264-5	2.85	5.57	0.22	150	177	244	12.4	7.9	welded tuff	308	0.85	1.6	GH782
D266-1	4.24	2.45	5.20	75	743	164	8.2	2.5	tonalite	271	0.10	3.3	"
D280-8	4.37	1.80	4.90	48	407	208	5.6	1.6	quartz diorite	311	0.12	3.5	"
D280-6	5.45	2.68	0.70	77	119	376	7.2	2.4	rhyolite	289	0.65	3.0	"
D280-14	3.80	3.77	0.50	96	47	69	5.2	2.2	dacitic tuff	322	2.04	2.4	"
D289-1	3.53	3.98	0.66	96	43	156	11.9	1.6	aplite	344	2.23	7.4	"

* Atomic Absorption Spectrometry (by S. TERASHIMA)

** Energy Dispersive X-ray Fluorescence Spectrometry (by H. KANAYA)

*** γ -ray Spectrometry (by H. KANAYA)

volcanic activity. Small fragments of clinopyroxene-orthopyroxene-olivine andesite (max., 3 cm × 2.5 cm × 1.5 cm) were dredged from the slope of the Seamount (St.1126, D300). It is possible that these rocks form the Seamount.

3. Preliminary results of a geochemical study on acid igneous rocks from the Japan Sea

A great quantity of data and many samples from the cruises in the Japan Sea (GH772, 773, 782 and 783) are now being examined in the laboratories of GSJ. Some comments are briefly described below on preliminary results of a geochemical study on acid igneous rocks recovered during the cruises. On Table VIII-4, 8-element analyses on 11 samples are represented.

1) Welded tuff

Data on the welded tuff from Oki Bank (D264-5, this cruise), Musashi Bank (D248-1, 249-1 and 249-3, GH773 cruise) has been compared with the results of "Nohi Ryolite (welded tuff)" (SHIRAHASE and KANAYA, 1978 and unpublished data). Preliminary results indicate a trend away from that of the "Nohi Ryolite".

2) Granitic rocks

Granitic rocks which form Kita-Oki (D266-1), Yamato (D280-8), and Nishi-Takuyo Banks (D289-1) are compared with granitic rocks from Japan. The rocks which form the Kita-Oki and Yamato Banks resemble granitic rocks from the Kitakami Massif and that of the Hida Mountains. The rock from Nishi-Takuyo Bank is aplitic and is probably, therefore, only of local importance. A regional comparison for this sample then seems to be inappropriate.

Reference

SHIRAHASE, T. and KANAYA, H. (1978) On some trace elements of Nohi Ryolite. *The 85th Annual Meeting of Geological Society of Japan*, abstract, p. 284.