

## IV. SEDIMENTS AND ROCKS FROM THE CONTINENTAL SLOPES AND NANKAI TROUGH OFF SOUTHWEST JAPAN

*Yasumasa Kinoshita, Yoshihisa Okuda,  
Rodney Grapes,\* and Eiji Inoue*

Rock samples were obtained from three stations at the shoulders of the continental slopes. Soft sediments including gravels and volcanic materials were dredged from ten stations on the slopes and the outer ridges of the terraces. Two samples of calcareous ooze were taken at the top of the Koshu Seamount.

The cores of sediments were taken from seven stations on the terraces, in the trough, and on the abyssal plain. The samples are listed in Table IV-1.

### *Rock sample description*

#### **1. St. 357, sample no. D 109**

The sample was obtained from the southern slope of the Kanesunose Bank near the mouth of Suruga Bay, between the depths of 1100 to 1440 m. The sample contains four kinds of sedimentary rocks.

**Pebble-bearing mudstone:** The mudstone is greenish-grey semi-consolidated silt, includes many pebbles, and is correlated to Pleistocene sediments from its lithofacies. Pebbles are divided into two types in terms of roundness; namely, rounded and subrounded pebbles and angular or subangular gravels. The rounded pebbles are mostly chert, black shale, greywacke, red chert, and granite. These are assumed to have been derived from the Setogawa-Shimanto Belt distributed to the westside of Fossa Magna Zone. The mudstone does not contain recognizable pebbles of the Sanbagawa metamorphic rocks.

**Dark grey mudstone:** The mudstone is semi-consolidated, and appears to be that of the Kakegawa Group of Pliocene age. Such rocks were also obtained from St. 362, St. 373, and St. 376.

**Siltstone:** The siltstone is consolidated, whitish-grey in colour, and is correlated to the Sagara Group of Upper Miocene age. According to Kuroda (Kyushu University, comm. 1975), the fossil pollen assemblage in the siltstone includes *Liquidambar*, *Keteleeria*, and *Carya*, which indicates a Pre-Pliocene age. The siltstone was also dredged from St. 362, St. 373, and St. 376.

**Calcareous conglomerate:** The conglomerate has a white, coarse grained limestone matrix. The pebbles are mostly rounded sandstone, chert, black shale and quartz. Rare pebbles of red chert are also present. These pebbles have been derived from the Setogawa-Shimanto Belt.

---

\*Hokkaido University

**2. St. 361, sample no. D 111**

This sample was obtained from a hill at the southwestern margin of the spur south of the Nankai Trough. The sample includes calcareous ooze with many manganese-coated rock fragments. The rocks are hornblende-orthopyroxene-olivine-augite andesite and augite-olivine basalt. The andesite has the phenocrysts of plagioclase, augite with hour-glass structure, olivine with inclusions of brown spinel, iron ore, orthopyroxene, hornblende, and xenocrysts of quartz. The groundmass is composed of pale brown glass, clear plagioclase prisms, long orthopyroxene prisms, stout clinopyroxene prism, and iron ore.

The basalt contains phenocrysts of clear plagioclase, olivine with brown spinel inclusions, and augite. The groundmass consists of plagioclase, clinopyroxene, iron ore, olivine and a felsic mesostasis.

**3. St. 364, sample no. D 113**

This sample was dredged from the top of the eastern summit of the Kosu Seamount. The sample is a calcareous ooze including small manganese nodules, of which the core rock is olivine basalt. The basalt has phenocrysts of olivine and plagioclase, and the groundmass consists of plagioclase, olivine, and pale brown glass.

Table IV-1 Samples obtained

Station No.	Sample No.	Date	Time	Position		Depth m	Sampler
				Latitude	Longitude		
356	D 108	June 17	13: 36	34°02.6'	138°35.5'	2,570	Cylinder dredge
			~ 15: 06	~ 34°03.4'	~ 138°36.0'	~ 2,580	
357	D 109	17	17: 31	34°17.9'	138°22.2'	1,440	Chain-bag and cylinder dredge
			~ 18: 56	~ 34°17.6'	~ 138°21.0'	~ 1,100	
360	D 110	19	08: 53	33°34.2'	137°27.5'	3,930	Chain-bag and cylinder dredge
			~ 11: 21	~ 33°33.5'	~ 137°28.8'	~ 3,930	
361	D 111	19	15: 51	33°13.4'	137°39.1'	3,400	Chain-bag and cylinder dredge
			~ 18: 03	~ 33°13.5'	~ 137°40.5'	~ 2,950	
362	D 112	20	10: 13	33°57.0'	137°10.7'	1,907	Chain-bag and cylinder dredge
			~ 11: 36	~ 33°56.9'	~ 137°10.1'	~ 1,810	
363	P 57	20	14: 54 ~ 15: 49	34°04.3'	137°09.8'	1,775	Piston corer

during the GH75-4 cruise.

Area and topography	Samples	Remarks
Off Suruga Bay, slope of ridge south of the Nankai Trough.	Green grey fine silt or clay, homogeneous, having an oxidized layer. Foraminifera common. Including pumice, glauconite scoria and shell fragments.	
Off Suruga Bay, slope of the Kinsu-no-se.	<p>Rock fragments and gravel.</p> <p>Fragments:</p> <ul style="list-style-type: none"> <li>① Greenish grey f.v.f. s.s. of upper Miocene or lower Miocene.</li> <li>② Greenish grey semi-consolidated silt or soft siltstone of Pliocene age?</li> </ul> <p>Pebble:</p> <ul style="list-style-type: none"> <li>① Subangular shaped greyish green f.s.s. and silt in abundant.</li> <li>② Dark grey hard s.s. and silt st. of Shimanto group, rounded.</li> <li>③ Grey small pebble cgl.</li> <li>④ Small pebble of granites, chart, quartz etc in few.</li> </ul>	It is postulated that a gravel bed covers Pliocene sediments which lies on the Miocene bed
Kumanonada. Slope north of the trough.	<p>Greenish grey silt, homogeneous, including black and v.f. grains. Oxidized layer.</p> <p>Shell fragments: <i>Portlandia</i> <i>Cuspidaria</i> <i>Dentalium</i> Echinoid</p>	
Kumanonada. Slope and top of sea-mounts south of the trough.	<p>Rock fragments and pebbles.</p> <p>Titanaugite-olivine basalt.</p> <p>Manganese nodules having basalt core.</p> <p>Many pieces of pumice.</p> <p>Pink coloured tuff.</p>	
Kumanonada. Slope of north wall of the trough.	<p>Greyish green silt including 2 cm thick pink coloured tuff. Glauconite in abundant.</p> <p>Semi-consolidated greyish green silt or v.f. sand. Shell fossil few.</p> <p>Foraminifera in abundant.</p> <p>Shell: <i>Limopsis</i> sp. <i>Epitonium</i> sp. <i>Dentalium</i> sp.</p> <p><i>Balanus</i> Echinoid Brachiopod</p>	
Kumanonada. Small depression south of Daiō-saki.	<p>293 cm core of sediments.</p> <p>Light greenish grey silt including 2 cm of tuff. Granule cgl and v.c. sand at bottom of core. Silt including black minerals.</p>	Including pebbles and shell fragments at 213-218 cm from top.

Station No.	Sample No.	Date	Time	Position		Depth m	Sampler
				Latitude	Longitude		
364	D 113	23	08: 03	31°26.0'	136°08.2'	3,560	Chain-bag and cylinder dredge
			~ 10: 33	~ 31°27.2'	~ 136°08.8'	~ 3,440	
365	D 114	23	12: 22	31°30.6'	135°53.8'	2,920	Chain-bag and cylinder dredge
			~ 14: 00	~ 31°30.6'	~ 135°53.6'	~ 2,920	
366	P 58	23	15: 45 ~ 17: 30	31°19.0'	136°05.4'	4,000	Piston corer
367	P 59	28	14: 58 ~ 15: 40	32°43.0'	133°20.5'	1,067	Piston corer
368	P 60	29	09: 45 ~ 12: 15	31°26.9'	133°20.5'	4,890	Piston corer

Area and topography	Samples	Remarks
Koshu Seamount, Kumanonada. Slope of seamount.	Manganese nodules and whitish brown semi-ooze. Manganese nodules: Cores of basalt and pumice, irregular shape. 4 cm of maximum diameter.	
Koshu Seamount, Kumanonada. Slope of seamount.	Whitish brown muddy ooze including pumice pebbles.	
Koshu Seamount, Kumanonada. Top of small hill.	0-25 Oxidized brown clay. 25-57 Transition facies. 57-113 Light grey silt intercalated with tuffaceous thin layers coloured green in part. 113-514 Grey fine silt homogeneous. 514-518 Ditto. (shoe)	Total core length 518 cm. Core length of pilot corer 25 cm of brown clay.
Off Kouchi Top of Tosa Terrace.	0-21 Greenish grey f. silt (pilot). -130 Greenish grey f. silt including Foraminifera. (flow-in) -166 Greenish grey silt. -167 Light grey v.f. sand, tuffaceous. -229 Green grey silt, including tuff irregularly. -257 Alternation of greenish grey silt and light grey tuffaceous silt. -284 Greenish grey silt. -285 Tuffaceous, light grey silt or v.f. sand. -324 Greenish grey silt. -337 Ditto (in shoe).	
Off Kouchi Bottom of Nankai Trough.	0-12 Brown clay. -28 Greenish grey silt including light grey v.f. sand irregularly, tuffaceous. -232 Green grey f. silt or clay, homogeneous. -233 Tuffaceous v.f. sd. -259 Empty. -263 Light grey tuffaceous silt, wedged into grey silt. -364 Greenish grey silt including l.g. silt lamina irregularly. -383 Greenish grey silt. -392 Light grey tuffaceous silt. Foraminifera abundant. -435 Greenish grey f. silt including silt. -450 Greenish grey c. silt, medium sand at base. no sample in shoe.	

Station No.	Sample No.	Date	Time	Position		Depth m	Sampler
				Latitude	Longitude		
369	D 115	29	15: 44	31°45.7'	133°12.0'	2,650	Chain-bag and cylinder dredge
			~ 17: 38	~ 31°46.0'	~ 133°12.7'	~ 2,500	
370	D 116	30	09: 30	31°49.0'	132°30.8'	2,265	Chain-bag and cylinder dredge
			~ 11: 32	~ 31°50.0'	~ 132°31.0'	~ 2,220	
371	P 61	30	12: 53 ~ 14: 00	32°02.5'	132°31.8'	1,774	Piston corer
372	D 117	July 1	09: 06	31°06.9'	132°43.9'	4,820	Chain-bag and cylinder dredge
			~ 12: 30	~ 31°06.9'	~ 132°44.5'	~ 4,720	
373	D 118	1	14: 43	30°51.2'	132°37.5'	3,030	ditto
			~ 17: 09	~ 30°52.0'	~ 132°39.0'	~ 2,800	
374	D 119	2	10: 21	31°31.8'	132°04.0'	1,580	Chain-bag and cylinder dredge
			~ 11: 33	~ 31°31.5'	~ 132°03.4'	~ 1,600	
375	P 62	5	08: 10 ~ 10: 10	32°53.7'	136°36.6'	4,440	Piston corer
376	D 120	5	11: 00 ~ 13: 29	33°00.9'	136°36.4'	3,550	Chain-bag and cylinder dredge
377	P 63	5	15: 32 ~ 16: 35	33°28.0'	136°40.5'	2,050	Piston corer
378 ≡ 358	D 121	6	08: 04 ~ 10: 38	33°39.0' ~ 33°39.0'	137°50.8' ~ 137°52.2'	3,780 ~ 3,780	Chain-bag and cylinder dredge

Area and topography	Samples	Remarks
Off Tosa. Slope north of Nankai Trough.	Brown clay, semi-consolidated bluish green silt and rock frag. of yellowish grey, bentonitic tuff. A few of manganese nodules.	
South of Ashizurimisaki. Slope.	Greenish grey silt having oxidized layer. Foraminifera abundant. Including manganese nodules.	Temperature of sediments 0.2°C.
South of Ashizurimisaki. Plain of terrace.	Greenish grey silt to fine-medium sand, intercalated with three shell beds which smell H <sub>2</sub> S.	Core length: 324 cm many parts of flow-in.
Hyuganada lower part of slope.	Bluish grey silt and clay having oxidized layer. Foraminifera abundant. Including mudstone breccia.	Temperature of sediments -0.2°C.
Hyuganada No. 1. Komahashi Seamount	Brownish grey clay and bluish grey silt, homogeneous, including manganese coating pumice. Foraminifera abundant.	Temperature of sediments -0.5°C.
Valley wall on slope. Hyuganada.	Green grey sdy silt. Including Pumice, spines, deepsea fish etc.	
Bottom of Nankai Trough. Kumanonada.	Alternation of greenish grey silt and light grey sandy silt, including v.f. sand lamina irregularly.	Length of core 587 cm.
Lower part of slope. Kumanonada.	Bluish grey silt including pebbles of pumice, mudstone and Paleozoic? shale. Having oxidized layer. Foraminifera fossil occurs.	Temperature of mud 0°C.
Bottom of small basin. Kumanonada.	Alternations of greenish grey silt, light grey v.f. sand or sandy silt and white tuff. Sapropel smell. Including a bed of plant micro-fragments.	Length of core 415 cm.
Slope of outer ridge. Enshūnada.	Greenish grey silt including volcanic rock fragments and breccia of siltstone. Shell fragments in a few.	