

**Report on DELP 1988 Cruises in the Okinawa Trough  
Part 4. Preliminary Report on the Sediment Samples**

Ryosuke TSUGARU<sup>1)</sup>, Yuichi TAMAKI<sup>1)</sup>, Motonori SAKO<sup>2)</sup>,  
Masaaki KIMURA<sup>1)</sup> and Kiyoshi SHIMAMURA<sup>3)</sup>

<sup>1)</sup> Department of Marine Sciences, University of the Ryukyus

<sup>2)</sup> Department of Geology, Kochi University

<sup>3)</sup> School of Agriculture, Kyusyu Tokai University

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**Abstract**

Surface sediment samplings were made using a piston corer at six sites in the central grabens of the Okinawa Trough during the DELP88 leg. 2 cruises on the Kaiko-Maru No. 5. Three sites (P-1, P-2 and P-3B) were located in the southern Okinawa Trough, and the other three sites (P-5, P-6 and P-7) in the Natsushima 84 Deep which is a basin with a hydrothermal activity in the middle Okinawa Trough. These sediment samples consist mainly of gray (7.5Y4/1) silty clay without characteristic sedimentary structure except for the P-1 sample, which is composed of some turbidite layers showing a graded bedding. The sedimentation rate estimated from the analysis of radioactive isotopes is 100 cm/1000 yr (P-2 and P-5), 130 cm/1000 yr (P-6) and 200 cm/1000 yr (P-7). Age determination given by the planktonic foraminifera indicates that all the sediment samples are Recent in age.

**1. Introduction**

DELP 88 cruises were carried out in the southern and middle Okinawa Trough on the Kaiko-Maru No. 5 (Tokai Salvage Company). The survey areas are shown in Fig. 1.

The surface sediments were obtained by means of a piston corer (Fig. 2). Three sites (P-1, P-2 and P-3B) were operated on a traverse section in the southern Okinawa Trough and the other three sites (P-5, P-6 and P-7) are located in the Natsushima 84 Deep in the middle Okinawa Trough where extremely high heat flow was observed (YAMANO *et al.*, 1988). All sampling sites are shown in Fig. 3 (a) and (b), and listed in Table 1.

Total length of the column of sediments recovered is 16.135 m. The lithological features of the cored sediments are shown in visual core

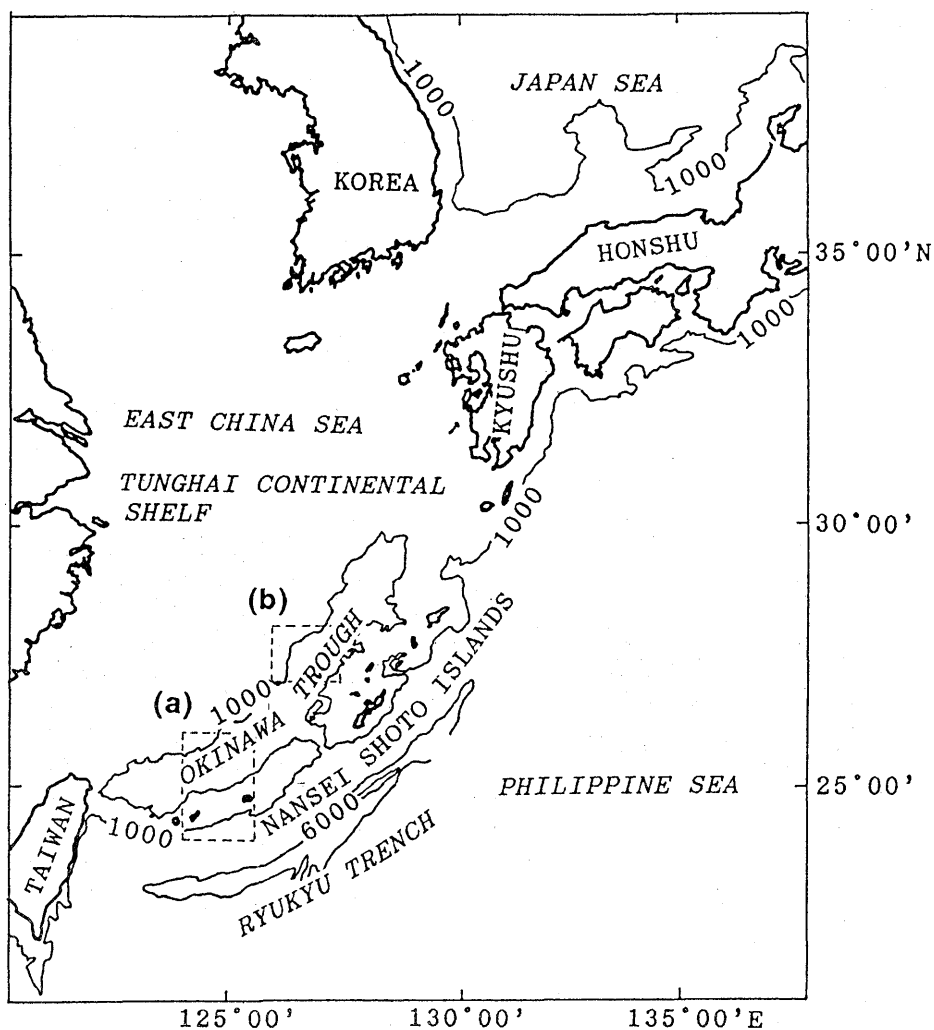


Fig. 1. Index map of the surveyed areas. (a) is the locality of the surveyed area off Miyako Island in the southern Okinawa Trough, and (b) in the middle Okinawa Trough. Depth in meter.

description, photographs, and soft X-ray radiographs (plate 1~5). Analysis of radioisotope (See Table 2 for results.), interstitial water (GAMO *et al.*, private communication), and the measurement of thermal conductivity (YAMANO *et al.*, 1991; part 8 of this issue) were done on the samples. Planktonic foraminiferas were identified in order to determine the sediment age.

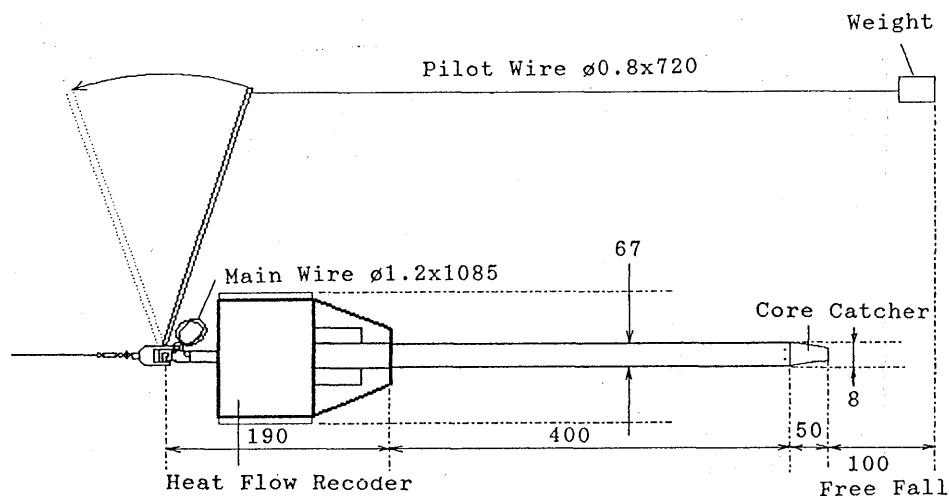


Fig. 2. Piston corer used during the DELP88 leg. 2 Cruise. Scale in cm.

## 2. Sample Description

Grain size of the sediments varies from clay to fine or medium sand showing some turbidite layers of decimeters in thickness, and color variation is prominent in the sample P-1 (0 to 150 cm in core depth).

Sediment of P-2 is composed of gray clay except for a part (235 to 250 cm) which showed graded bedding from fine to coarse grain sand by soft X-ray radiography.

The sample P-5 recovered from the Natsushima 84 Deep shows a normal grading from silty clay to very fine sand (200 cm to core bottom). The cause of two cracks are unknown.

The sample P-6 consists of gray clay and silty clay without conspicuous sedimentary structure.

The sample P-7 is composed of olive black silty clay and gray clay. Some cracks, a few cm in length, are seen around 75 cm.

All the planktonic foraminiferas in the samples P-1, P-2, P-3B and P-7 are Recent in age. The index fossil is *Globorotalia truncatulinoides*.

## 3. Discussion

There are four possible patterns of sediment supply in the surveyed areas as follows; 1) Psamitic sediments mainly by turbidity current from the Tunghai Continental Shelf. Sediments on the southeastern Tunghai Continental Shelf were reported to be sandy (WAGEMAN *et al.*, 1970). 2) Volcanic fragments from submarine or neighboring volcanoes. Volcanic

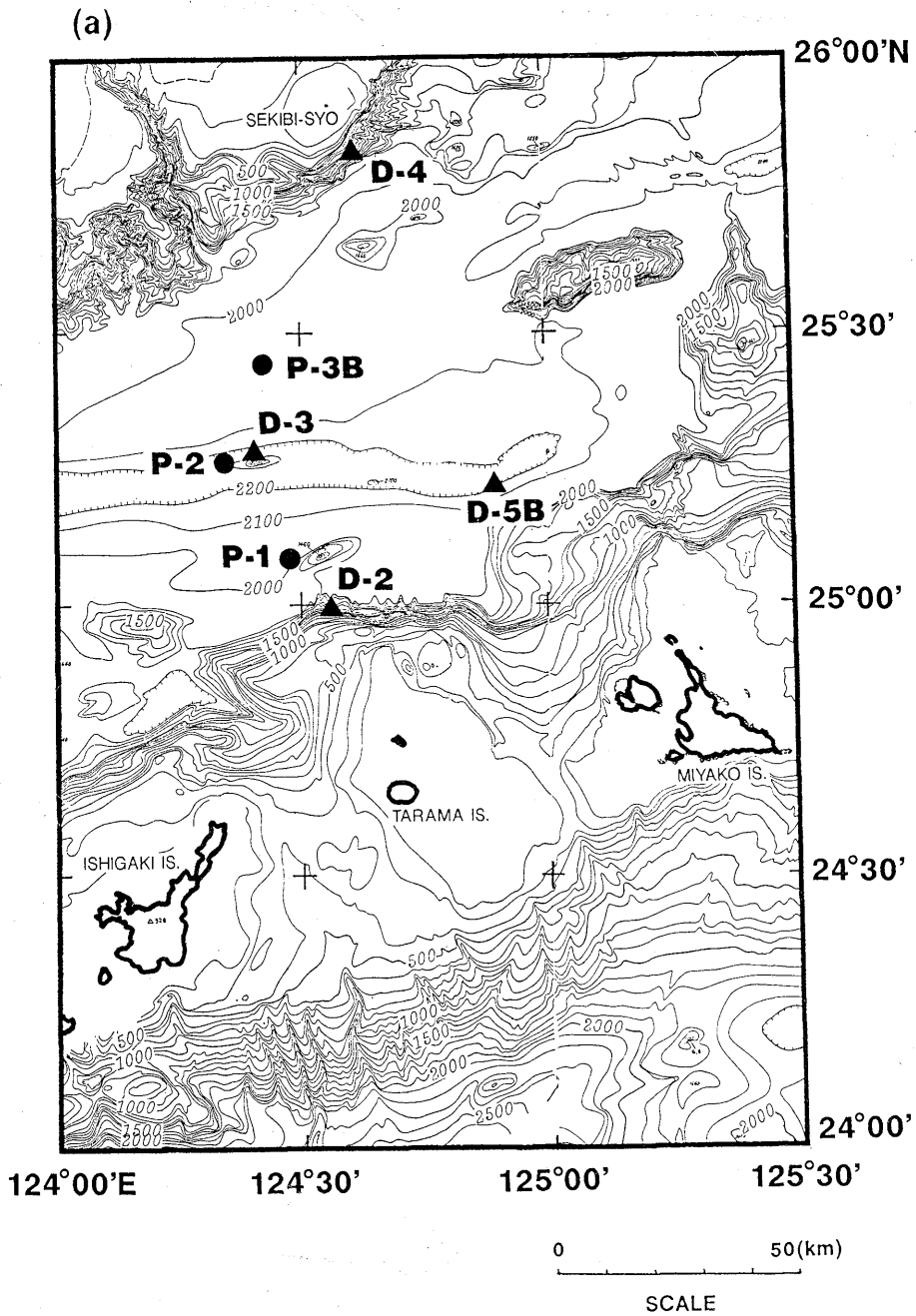


Fig. 3. (a)

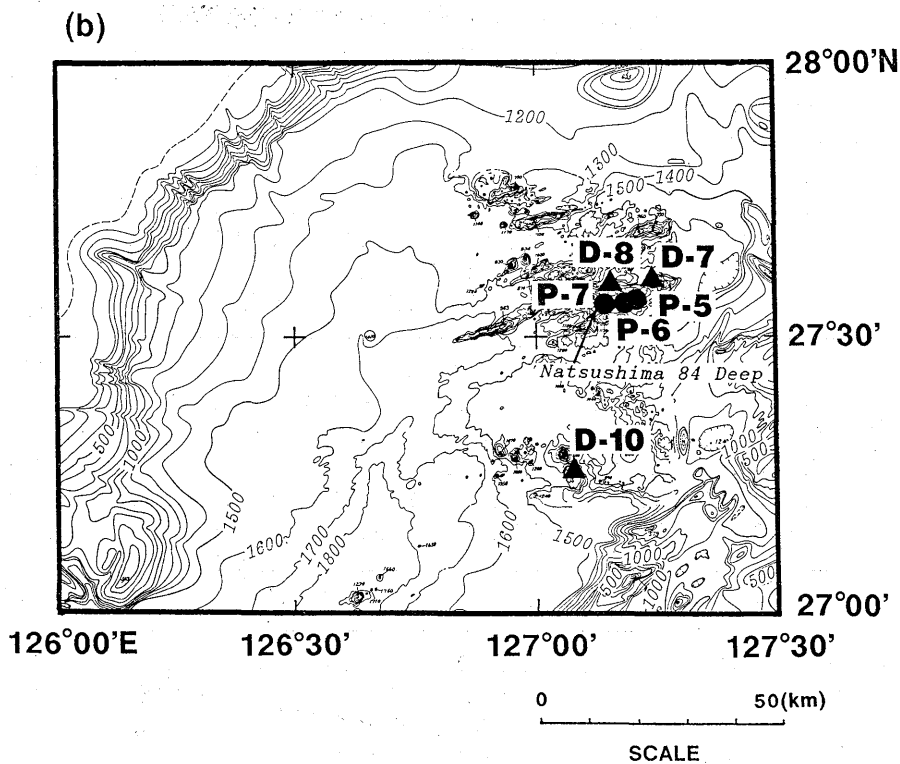


Fig. 3. (b)

Fig. 3. Locality of the surveyed area off Miyako Island in the southern Okinawa Trough (a) and in the middle Okinawa Trough (b). Depth in meter. Closed circles are piston coring sites, and closed triangles are dredging sites. P-1 to P-7 are listed and explained in Table 1. The bathymetric charts are modified from Oshima et al., 1988. Depth in meter.

Table 1. Location and depth of piston coring sites during the DELP88, Leg 2 Cruise

Station No.	Position Lat.	Position Lon.	Depth (m)	Core length	Remarks
P-1 (OKPCHF-1)	25°05.17'N	124°28.66' E	2030	325cm	southern Okinawa Trough
P-2 (OKPCHF-2)	25°15.08'N	124°20.98' E	2290	310cm	southern Okinawa Trough
P-3B (OKPCHF-3B)	25°26.41'N	124°25.30' E	2120	20cm	southern Okinawa Trough
P-5 (OKPCHF-5)	27°34.61'N	127°12.76' E	1780	325.5cm	Natsushima-84 Deep
P-6 (OKPCHF-6)	27°34.47'N	127°11.79' E	1750	275cm	Natsushima-84 Deep
P-7 (OKPCHF-7)	27°34.18'N	127°08.09' E	1760	358cm	Natsushima-84 Deep

activities in the surveyed areas were reported by KATO (1982), KIMURA *et al.* (1986) and MATSUMOTO (1983). 3) Terrigenous sediments from the Nansei Shoto Islands. 4) Pelitic sediments.

Table 2. Results of the analysis of radioactive isotopes by Y. Tamaki.

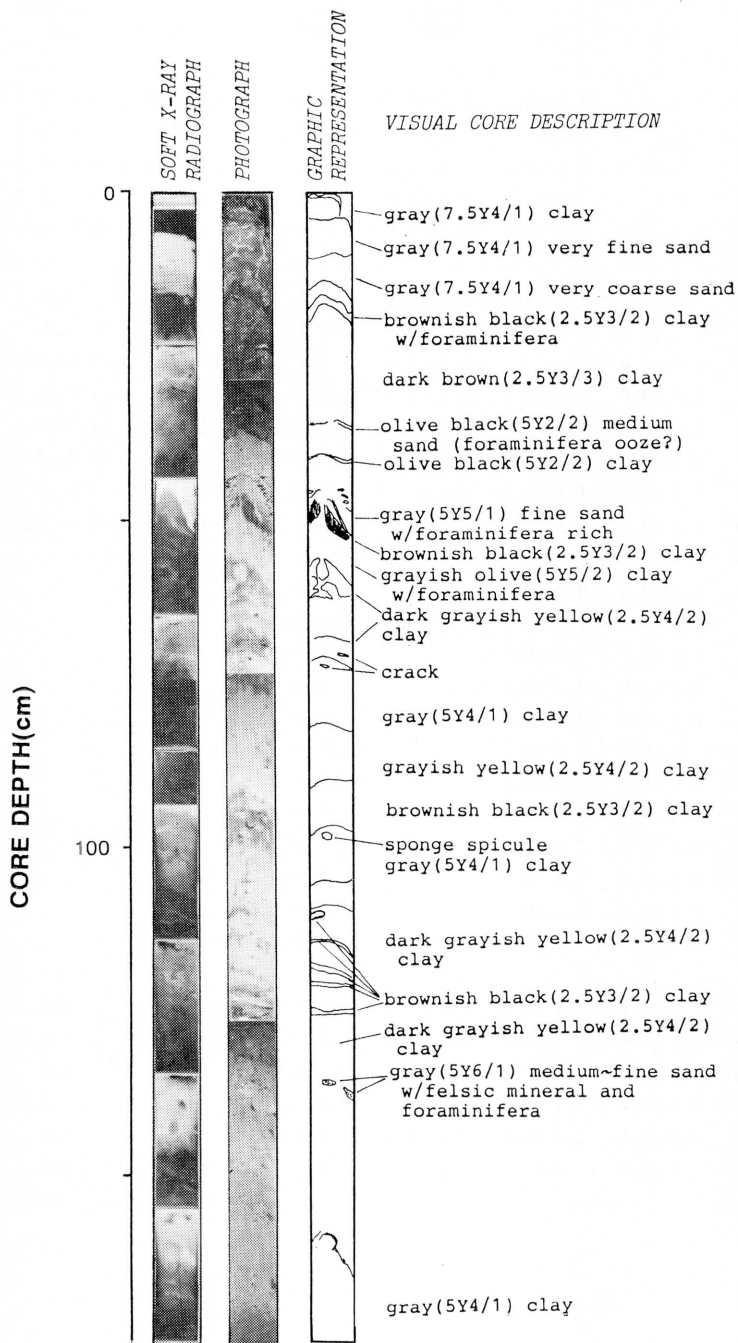
Sample name	$E_{\gamma}$ (KeV) depth	Pb-210 46.5	U-234 53	Th-234 63	92.8	Th-228 84	Ra-226 186	Pb-212 239
P-2	(cm) 2.5	5.7±1.4	18.8±3.5	4.6±2.3	n.d.	n.d.	n.d.	1.6±0.2
	7.5	8.9±1.5	n.d.	5.1±2.4	n.d.	12.6±1.3	1.4±2.9	2.2±0.2
	12.5	3.2±1.4	6.7±3.1	6.7±2.4	n.d.	6.9±0.9	n.d.	2.0±0.2
	17.5	3.5±1.4	23.0±3.7	4.7±2.4	n.d.	n.d.	0.1±2.4	1.7±0.2
	22.5	3.7±1.4	n.d.	4.3±2.4	4.5±1.7	n.d.	n.d.	1.9±0.2
P-5	2.5	8.2±1.5	3.6±2.9	1.2± 2.3	1.6±1.7	n.d.	8.6±3.1	1.5±0.2
	7.5	7.1±1.4	n.d.	0.7±21.3	1.3±1.7	15.7±1.4	2.3±2.9	1.7±0.2
	12.5	1.9±1.3	0.2±0.04	n.d.	n.d.	n.d.	n.d.	0.8±0.2
	22.5	5.2±1.4	0.3±0.04	3.1± 2.4	n.d.	n.d.	n.d.	1.4±0.2
	27.5	2.6±1.3	6.3±3.1	0.6± 2.3	1.8±0.2	n.d.	n.d.	1.5±0.2
	35	12.2±1.5	n.d.	4.9± 2.4	n.d.	11.5±1.2	0.7±2.9	1.1±0.2
	42.5	3.4±1.4	0.7±0.04	2.7± 2.4	n.d.	9.9±0.9	n.d.	1.0±0.2
	47.5	6.2±1.4	1.0±0.3	n.d.	3.1±1.6	19.4±1.6	n.d.	0.6±0.2
P-6	1	71.3±1.8		1.8±2.0	2.2±5.1		3.1± 2.1	2.6±0.2
	3	74.9±2.0		n.d.	3.7±2.2		2.0± 0.6	2.6±0.2
	5	41.8±1.5		3.3±0.7	2.1±0.4		8.9± 4.3	2.8±0.2
	7	34.6±1.3		1.3±0.3	3.6±0.8		7.5±30	4.0±0.2
	9	13.1±0.9		0.8±0.1	0.9±0.2		5.5± 1.5	2.0±0.2
	11	11.0±1.3		0.5±0.1	4.0±4.1		4.2± 3.0	2.3±0.1
	13	6.9±0.5		1.3±0.3	5.4±1.3		4.7± 1.9	2.2±0.2
	15	4.3±1.1		1.5±0.7	1.4±0.6		6.1± 9.4	2.8±0.2
	17	6.1±1.2		0.2±0.04	0.4±0.1		6.6±13.0	3.2±0.2
	19	3.0±0.6		4.0±0.7	n.d.		8.1± 7.3	2.1±0.1
	21	9.9±0.8		1.0±0.2	2.2±0.9		6.5± 2.1	2.6±0.2
	23	4.2±0.7		3.3±0.7	3.9±1.3		2.6± 1.3	2.4±0.2
	P-7	2.5	4.0±1.4	n.d.	n.d.	1.2±1.7	23.8±2.0	n.d.
7.5		8.4±1.5	n.d.	0.4±2.1	n.d.	22.4±2.0	1.2±2.9	1.9±0.2
15		5.2±1.4	n.d.	4.9±2.4	4.8±1.7	12.2±1.5	n.d.	1.5±0.2
27.5		4.5±1.4	26.3±3.3	n.d.	n.d.	25.2±2.1	3.5±2.9	1.1±0.2
47.5		6.9±1.4	63.8±26.0	2.6±2.4	2.3±1.7	n.d.	3.0±2.9	0.8±0.2
52.5		3.2±1.4	n.d.	n.d.	n.d.	15.8±1.7	2.5±2.9	1.3±0.2

Unit of radioactivity is dpm/g. Sample depth in cm.



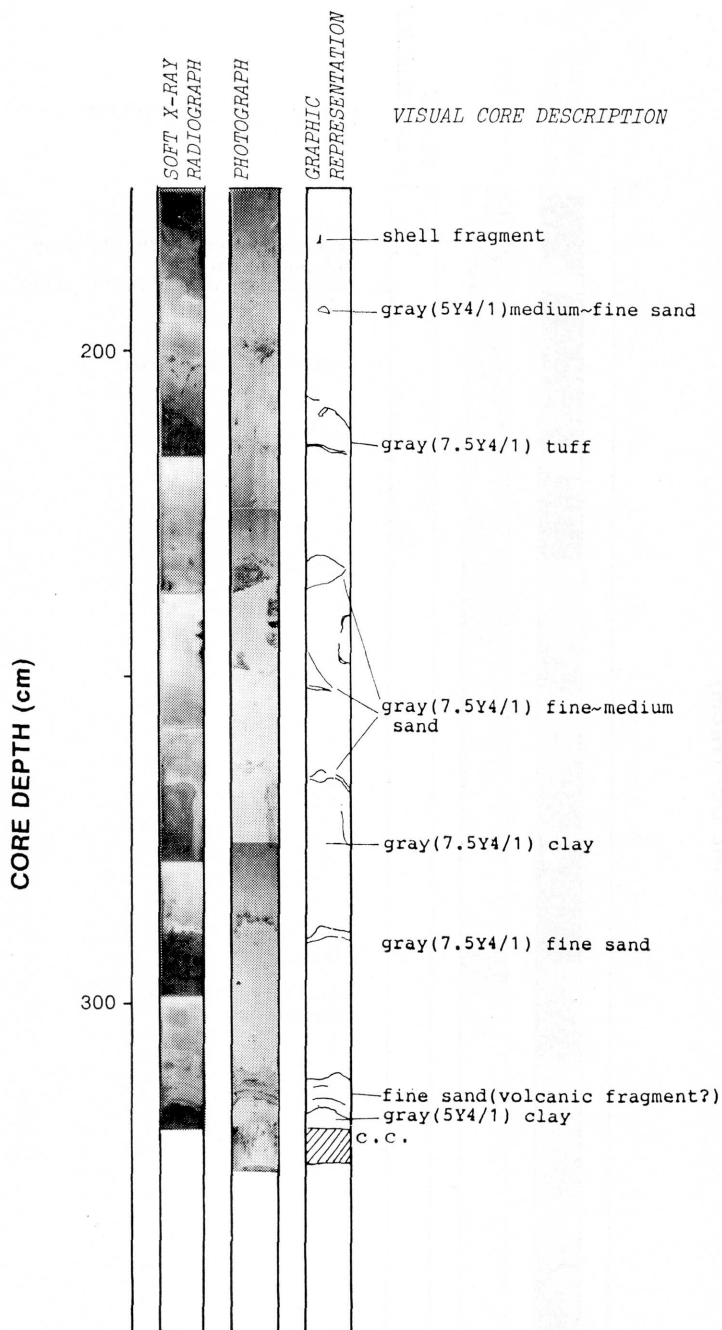
## OKPCHF-1(a)

Plate 1~5. Visual description, soft X-Ray radiograph and photograph of the recovered samples. Closed triangles beside the Soft X-Ray radiographs in plate 3, 4 and 5 show the cracked part while kept in refrigerator.

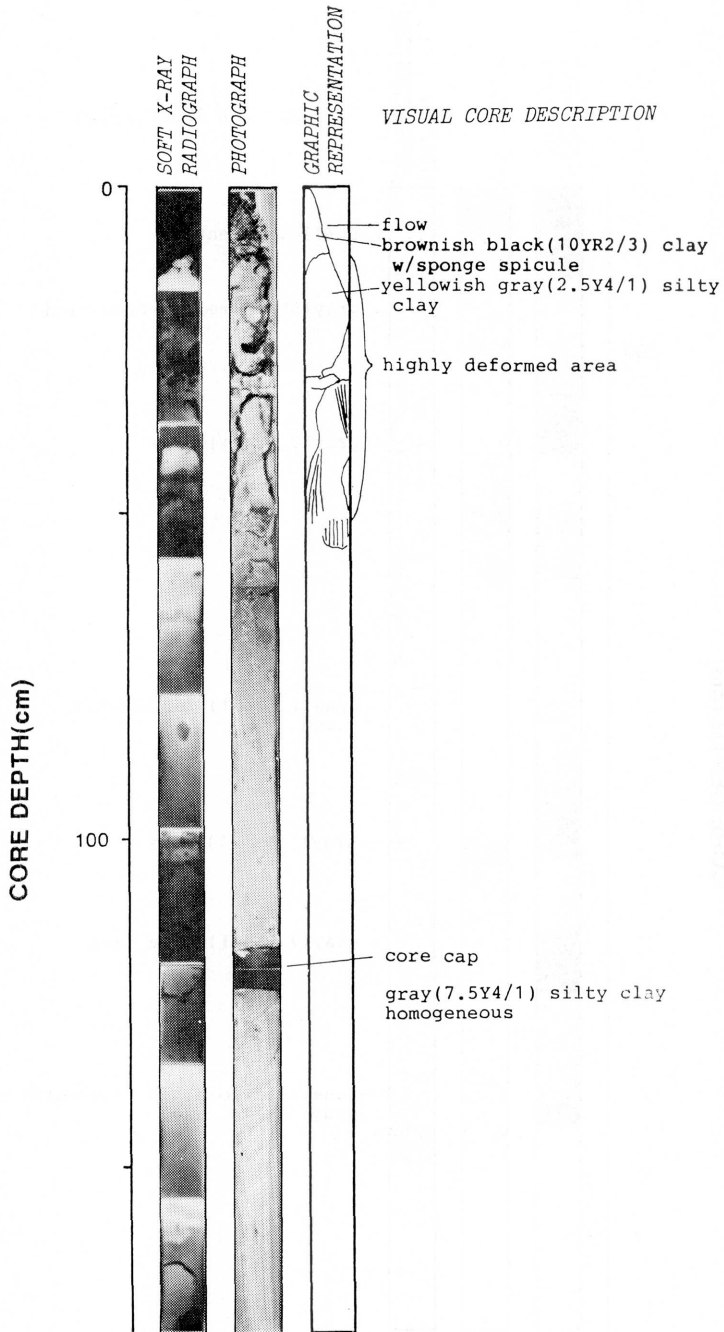




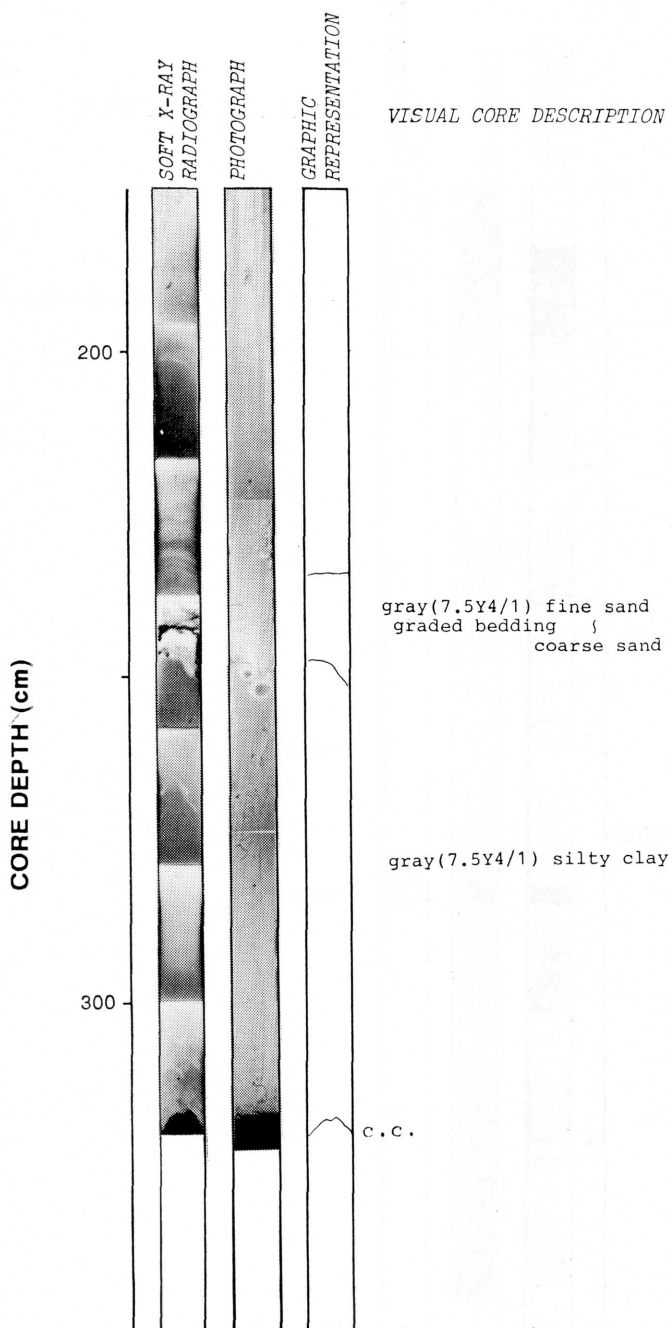
OKPCHF-1(b)



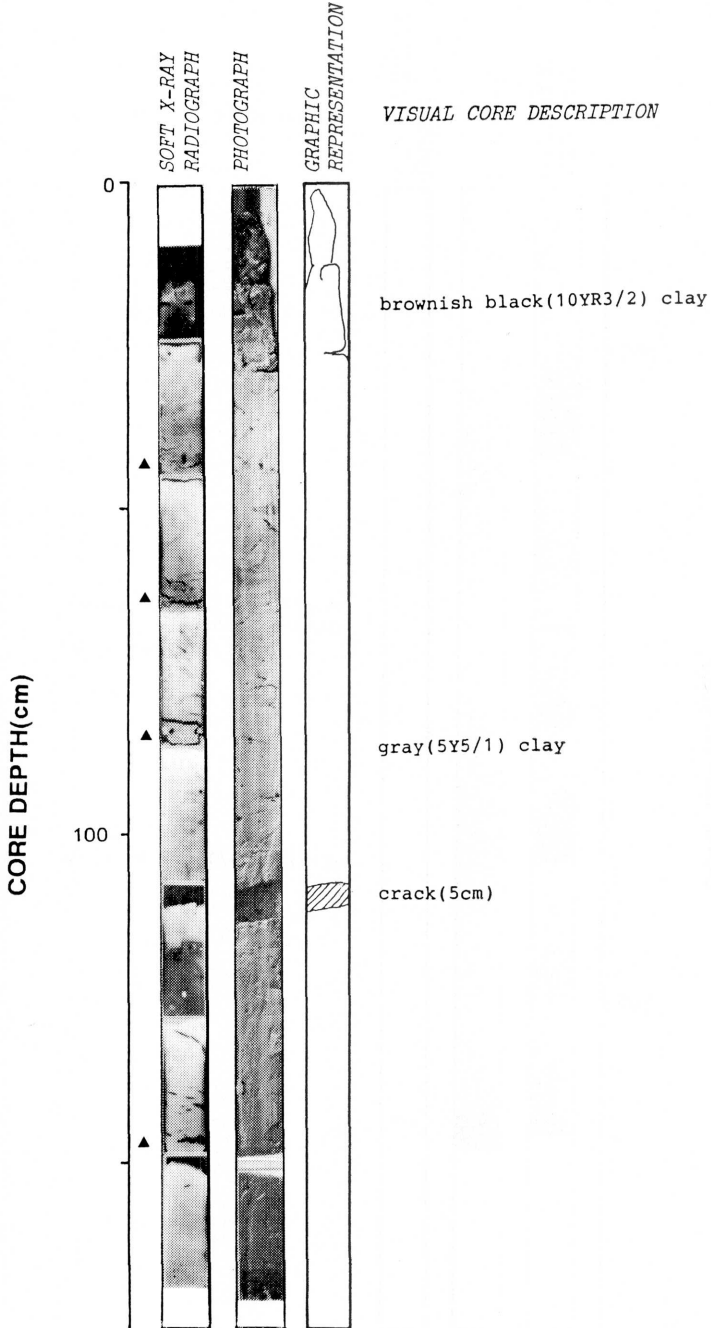
OKPCHF-2(a)



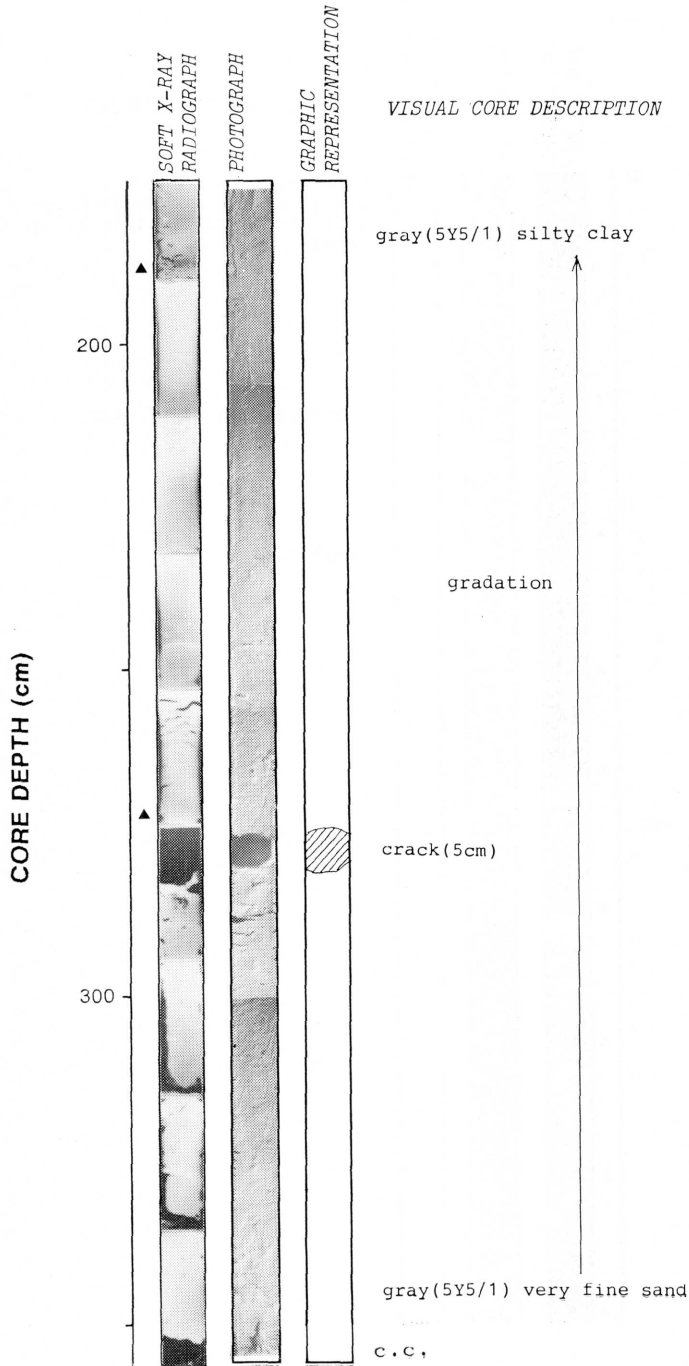
**OKPCHF-2(b)**



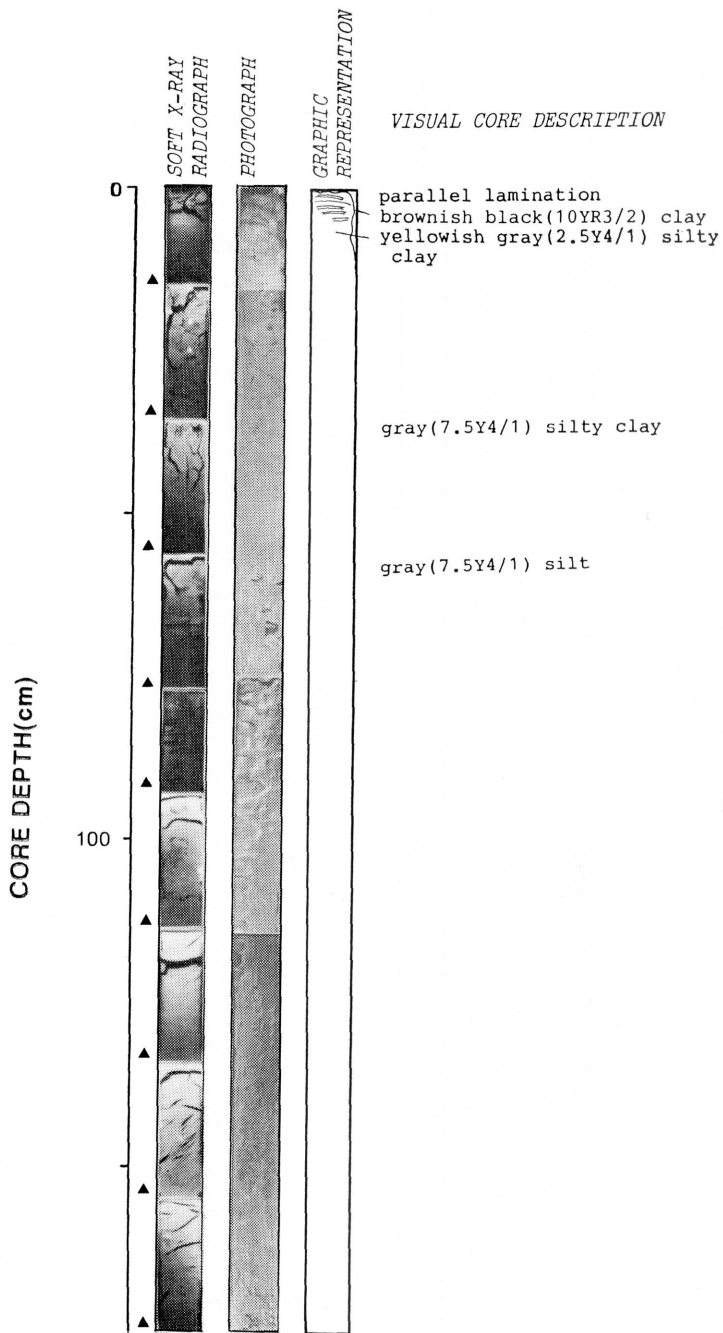
OKPCHF-5(a)



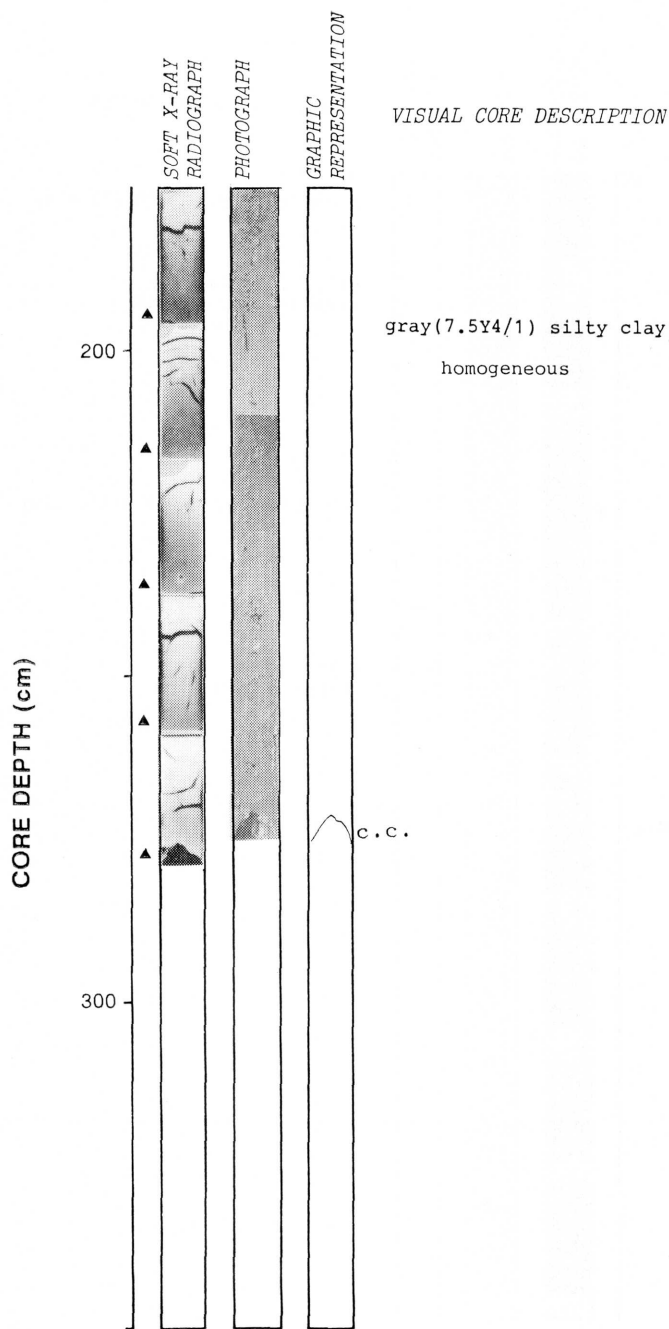
**OKPCHF-5(b)**



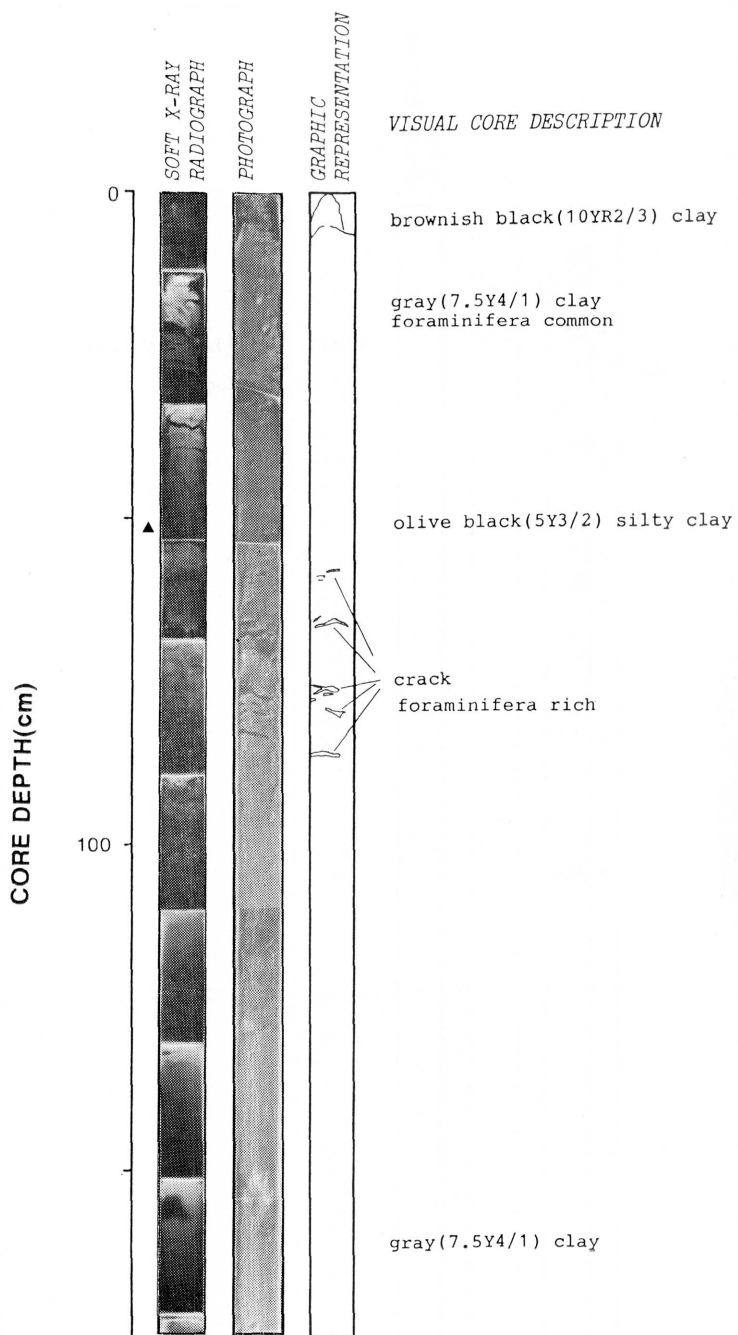
OKPCHF-6(a)



OKPCHF-6(b)

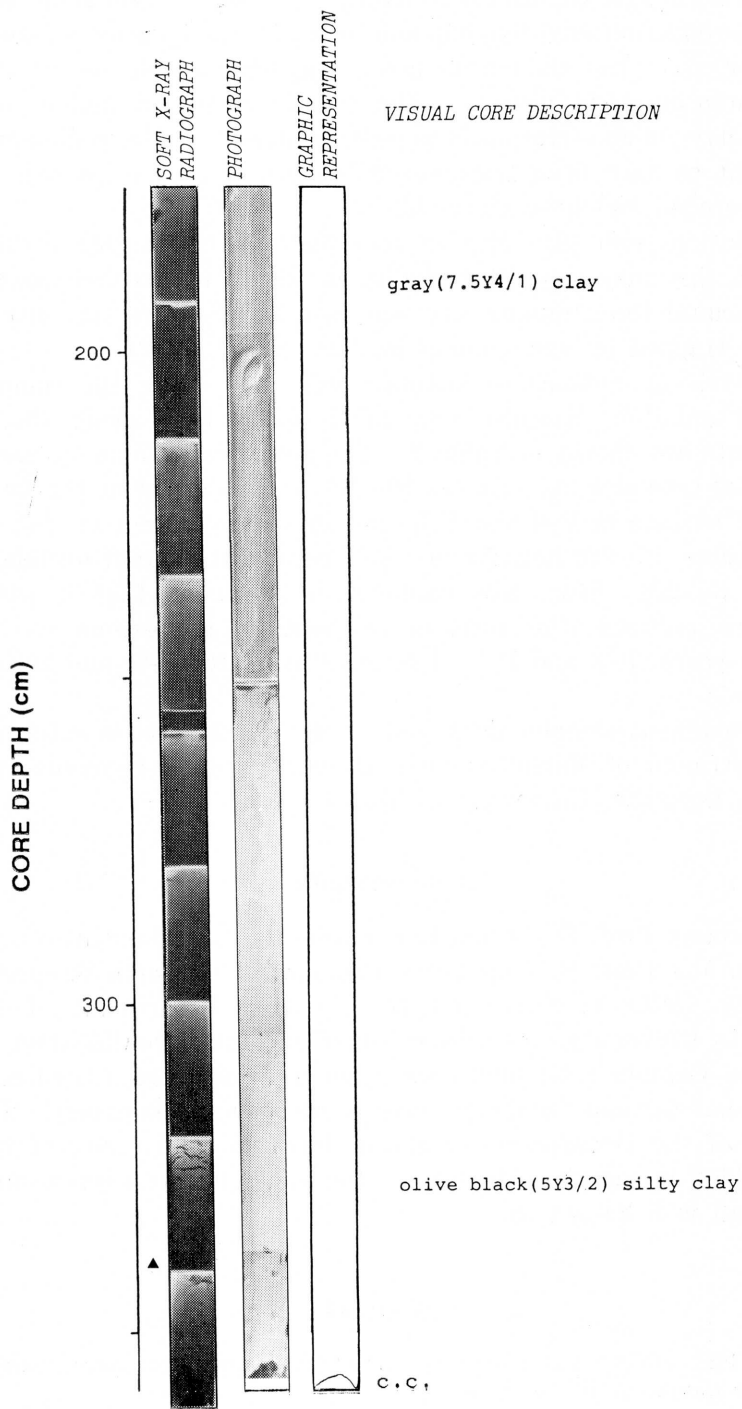


## OKPCHF-7(a)





OKPCHF-7(b)



The samples may reflect these differences in sediment supply. The color variation and the turbidite layers in P-1 may reflect some particular oxidation-reduction environment and effect of terrigenous sediment from the island arc. The tuffaceous layer suggests possible recent volcanism in this area or in its vicinity. The P-2 is composed mainly of homogeneous clay which corresponds to pelitic sediment. The sediment of P-3 is thought to have been transported because test of planktonic foraminifera is eroded and brown colored.

Gradation from silty clay to very fine sand is observed in the sample P-5, but this may not be turbidite of the Tunghai Continental Shelf origin because the sampling site was in a basin where turbidity current could be trapped by surrounding knolls.

Analysis of radioactive isotopes was done using the samples P-2, P-5, P-6 and P-7. Samples were taken every 5 cm along these cores. The results are shown in Table 2. The analytical equipment used is HP Ge Coaxial type pick up. Excess Pb-210 was observed in the first 10 cm from the surface in P-2 and P-5, and in the top 20 cm in P-7. In the deeper parts, Pb-210 activity is equilibrated with parent nuclide Pb-214, or with Ra-226. From this equilibrium indicating that it passed five half times, sedimentation rates of the samples are estimated to be 100 cm/1,000 years (P-2 and P-5), 130 cm/1,000 years (P-6) and 200 cm/1,000 years (P-7).

All sediment samples described in this report are in safekeeping at the Department of Marine Sciences, University of the Ryukyus and Ocean Research Institute, University of Tokyo.

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## DELP 1988 年度沖繩トラフ海域研究航海報告

### 4. DELP 88, 第5海工丸航海で採取された堆積物資料について

琉球大学理学部	}	津 軽 良 介
		玉 城 祐 一
高知大学理学部		佐 光 本 徳
琉球大学理学部		木 村 政 昭
九州東海大学農学部		嶋 村 清

第5海工丸を用い沖繩トラフで実施された DELP 1988 年度第2次航海では柱状採泥器を用いて6地点から柱状表層堆積物試料を採取した。3地点は南部沖繩トラフ、3地点は中部沖繩トラフの熱水活動が盛んな“なつしま84海盆”に位置する。

試料は主に均質な灰色(7.5Y4/1)シルト質粘土から成り、顕著な堆積構造は級化層理を示す乱泥流堆積層からなる P-1 試料を除いて見られない。

放射性核種の分析をもとに堆積速度を計算した結果、P-1 及び P-5 試料は 100cm/1,000 年、P-6 試料は 130cm/1,000 年、P-7 試料は、200cm/1,000 年と見積られる。浮遊性有孔虫の同定結果によれば、採取試料の年代は現世である。

堆積物の特徴と分析結果から、沖繩トラフの堆積環境を考察する。