PART II

XIV. CLAY MINERAL DISTRIBUTION IN SEDIMENT SAMPLES FROM THE GH79-1 AREA IN THE CENTRAL PACIFIC BASIN

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Samples and Method

Thirty-four samples from the box core surface and seventy from four piston cores were provided for clay mineral analysis. The clay fraction ($<2\,\mu m$) obtained through the sedimentation technique was analyzed quantitatively and qualitatively with X-ray diffractometer, following the method by SUDO *et al.* (1961) and OINUMA (1968).

Results

Four clay mineral species, i.e. illite, montmorillonite, chlorite, and kaolinite occur in all the samples, though the relative amount of those varies from sample to sample.

The distribution of clay minerals in surface sediment samples

Illite is the most dominant constituent among the four species (Fig. XIV-1). The content of illite ranges from 51% to 30%, being rich in the western part and poor in the central part of the area. The average content of illite in 12 samples from the detailed survey area is 39%, which is identical with that (39%) of 22 samples from the main survey area.

Montmorillonite concentration (Fig. XIV-2) is the most variable, ranging from 50% to 11%. The relatively low concentration area (11–20%) is in the western part, on the other hand the higher concentration of that (31–50%) is in the central part. This shows an opposite distribution pattern to that of illite. The montmorillonite concentration in the detailed survey area ranges from 40% to 21% and is 30% on the average. This is very similar to the average content (27%) of montmorillonite in other 22 samples.

Chlorite concentration in the main survey area ranges from 34% to 13% and 25% on the average (Fig. XIV-3). Regional distribution pattern of chlorite does not resemble that of montmorillonite but illite; the relatively high concentration (25–34%) is in the western part while the lower (13–24%) is in the central part. The concentration of chlorite in the detailed survey area ranges from 34% to 13% and the average content is 24% which is very similar to that (26%) of other 22 samples.

Kaolinite concentration (Fig. XIV-4) ranges from 12% to 6% and is 8% on the average. The distribution pattern of kaolinite is not characteristic as compared with those of the others. The average content of kaolinite in the detailed survey area is 8% which is identical with that (8%) of other samples.

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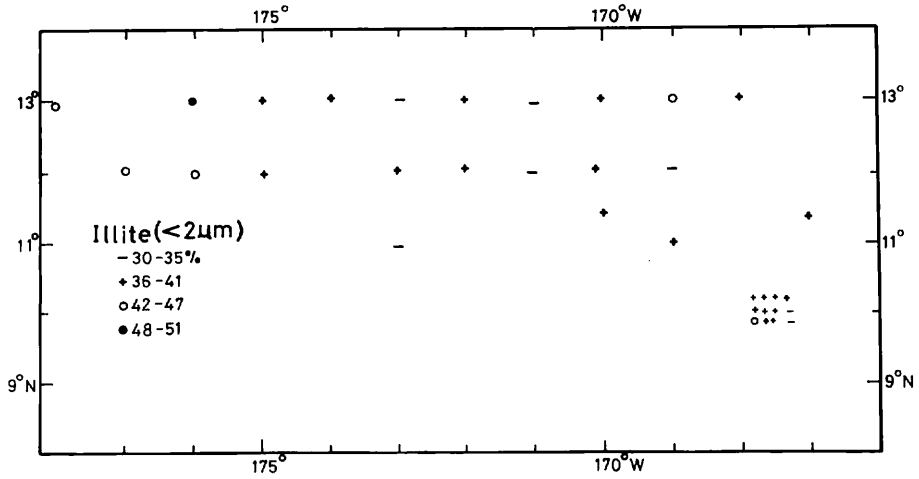

Fig. XIV-1 Distribution of illite.

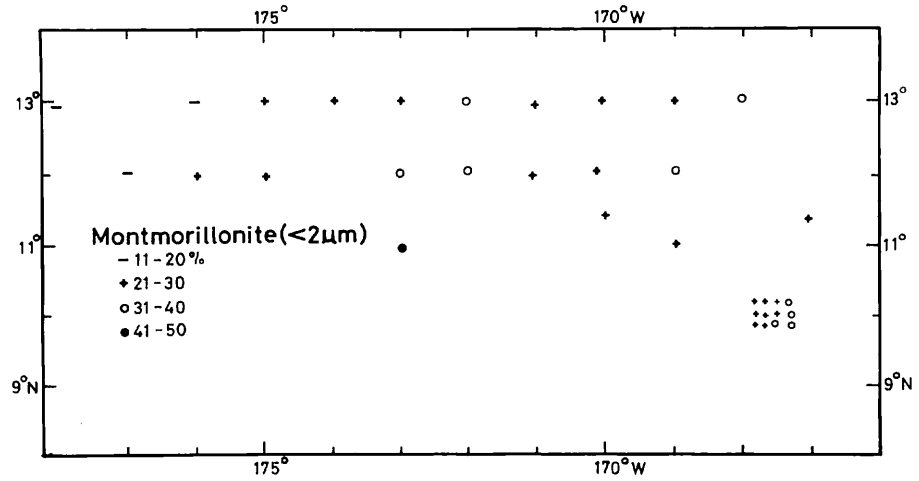

Fig. XIV-2 Distribution of montmorillonite.

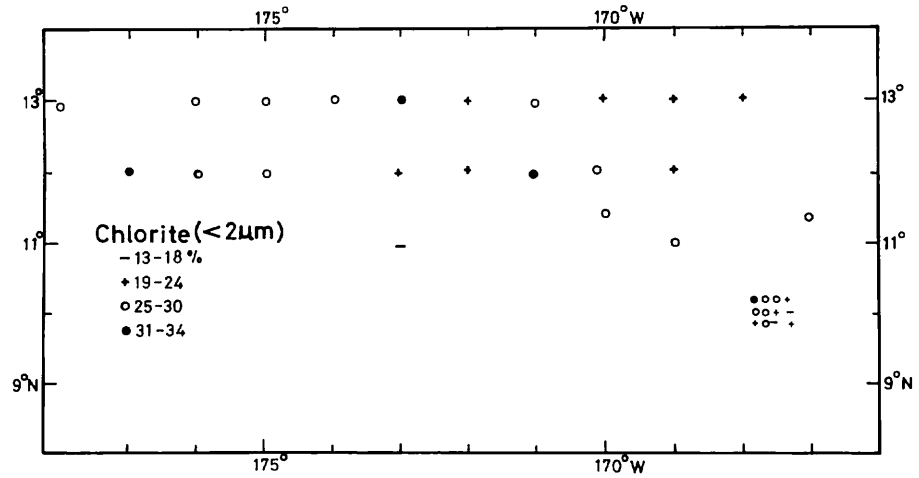

Fig. XIV-3 Distribution of chlorite.

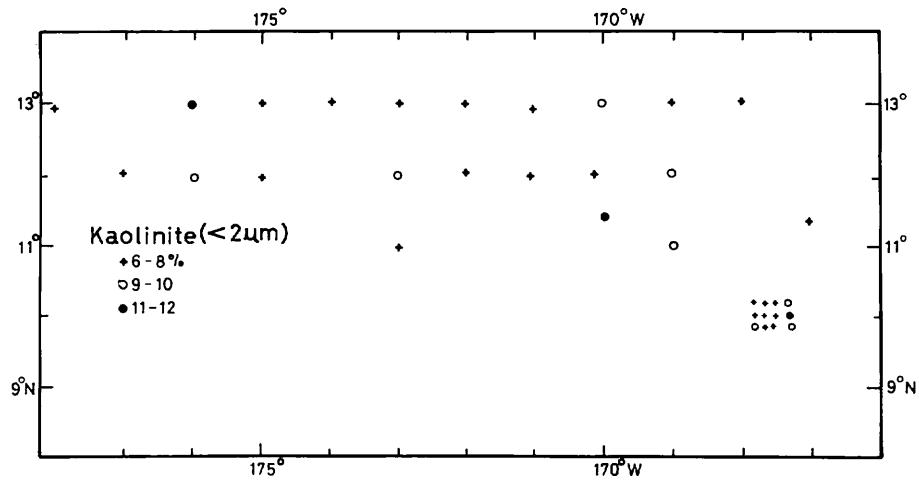

Fig. XIV-4 Distribution of kaolinite.

Table XIV-1 Relationship between the sediment type and the average concentration of each clay mineral.

	Calcareous ooze and clay		Zeolitic clay		Siliceous ooze and clay
Illite	42%	>	40%	>	37%
Montmorillonite	20	<	26	<	31
Chlorite	28	>	26	>	24
Kaolinite	10	>	8	=	8

The relationship between the sediment types and clay mineral compositions

Table XIV-1 shows the relationship between the sediment type and the avearge concentration of each clay mineral. The concentration of the clay mineral species is the highest in calcareous ooze and clay samples except for montmorillonite. The relationship between the clay mineral composition and bottom sediment type was outlined by the previous work (AOKI, 1977). Roughly speaking, montmorillonite concentration tends to be rich in pelagic clay (red-clay or zeolitic clay) and kaolinite abundance to be rich in calcareous ooze and clay. Illite and chlorite concentrations are richer in calcareous or siliceous ooze and clay than in pelagic clay. However, the pre-Quaternary samples of surface sediments tend to be rich in montmorillonite without any relation to the sediment type.

The vertical variation of the clay mineral composition

Clay mineralogy of Core P141* was studied from the top to the bottom. X-ray diffraction pattern is shown in Fig. XIV-5. It indicates common presence of the four clay mineral species which occur in surface sediment samples. The vertical variation of the clay mineral composition is shown in Fig. XIV-6.

Montmorillonite concentration markedly increases downward in the core. On the

*St. 1488 at 10°58.74'N, 174°00.91'W (water depth, 5541 m). Core P141, 4.65 m long, consists of dark brown clay throughout.

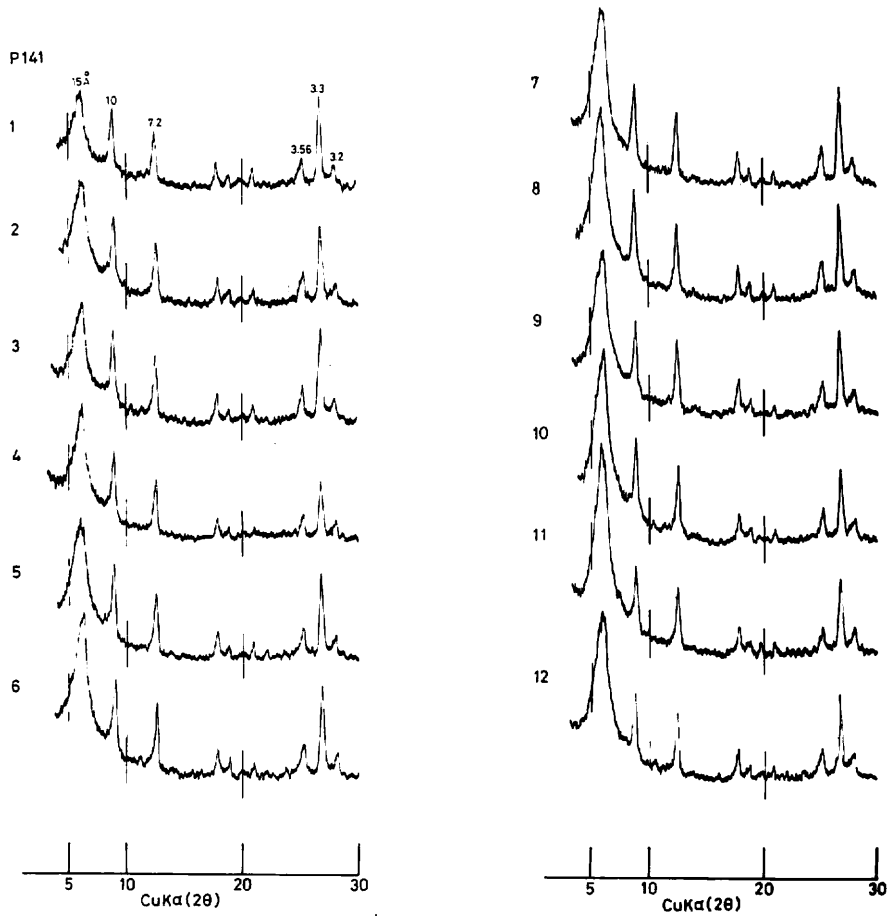

Fig. XIV-5 X-ray diffraction pattern of Core P141. 1. 17–19 cm 2. 56–58 cm 3. 89–91 cm 4. 134–136 cm 5. 179–181 cm 6. 224–226 cm 7. 270–272 cm 8. 304–306 cm 9. 348–350 cm 10. 394–396 cm 11. 448–450 cm 12. 463–465 cm.

contrary chlorite and illite concentrations decrease with depth. Kaolinite abundance does not show a significant change with depth. Preliminary observation of other three cores (P137, P138, and P140) shows almost similar vertical distribution of clay minerals to Core P141. Similar results have been observed in the clay mineral compositions of core samples from the GH74–5 and 76–1 areas (AOKI and OINUMA, 1978).

The increase of montmorillonite concentration and the decrease of chlorite and illite abundances downward in the core seem to be closely related to volcanic activity and weathering on land and in the sea since the Tertiary age.

The most outstanding feature of the clay mineral composition in the core samples observed in this study is a remarkable increase of montmorillonite concentration downward in the core. Montmorillonite concentration tends to be richer in older sediments than in Recent ones. It has no correlation to the sediment type. The difference of the clay mineral composition in the Recent and pre-Quaternary sediment samples may give us

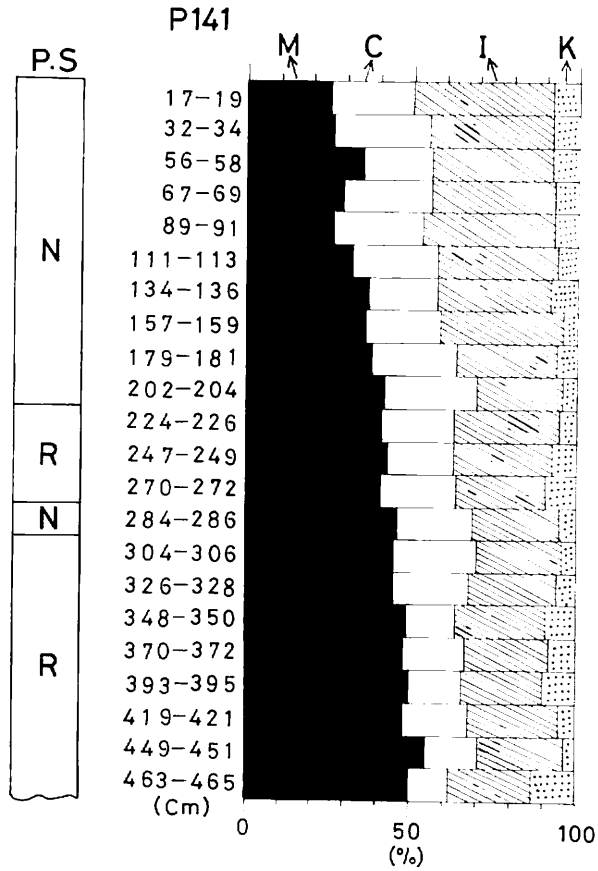

Fig. XIV-6 Vertical variation of clay mineral composition. M: montmorillonite C: chlorite I: illite K: kaolinite P.S: paleomagnetic stratigraphy (JOSHIMA, this cruise report); R: reversal epoch N: normal epoch.

a clue to solve clay mineralogical and sedimentological problems in the Central Pacific Basin since the Tertiary age.

References

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