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Outline of the Cruises GDP-11, -15, -21, and -24

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Cruise GDP-11

The research cruise GDP-11 was made using Tokai-Daigaku-Maru II commanded by Captain Magoshichi SATO of Tokai University. The scientific staff aboard consisted of 13 scientists from many universities, a high school, and the Geological Survey of Japan (Table 1), and technical assistants consisting of undergraduate students of Tokai University.

The cruise was carried out from the 10th to 24th of August, 1974. We had to spend one day and one night in a beautiful small enclosed bay in the northwestern side of the Okinawa Main-Island, awaiting the passage of a typhoon.

Table 1. List of Scientists on board (GDP-11).

Kyoto University (Faculty of Science)
Tsunemasa SHIKI (Chief scientist)
Jun-ichi NISHIDA
Present address: Otani University
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Tokai University (Faculty of Marine Science and Technology)
Hitoshi AOKI
Masaaki IGARASHI
Yoshibumi MISAWA
Meguru HOSHIZAWA
Present address: Tokai Salvage Co., Ltd.
Hiroo INOKUCHI
Present address: Faculty of Science, Kobe University
Nara High School
Isao KONDA
Present address: Nikaido High School
University of Tokyo (Ocean Research Institute)
Hidekazu TOKUYAMA
University of Tokyo (Faculty of Science)
Jun-ichi MATSUDA
Present address: Faculty of Science, Kobe University
Osaka City University (Faculty of Science)
Kazumi MATSUOKA
Present address: Faculty of Liberal Arts, Nagasaki University

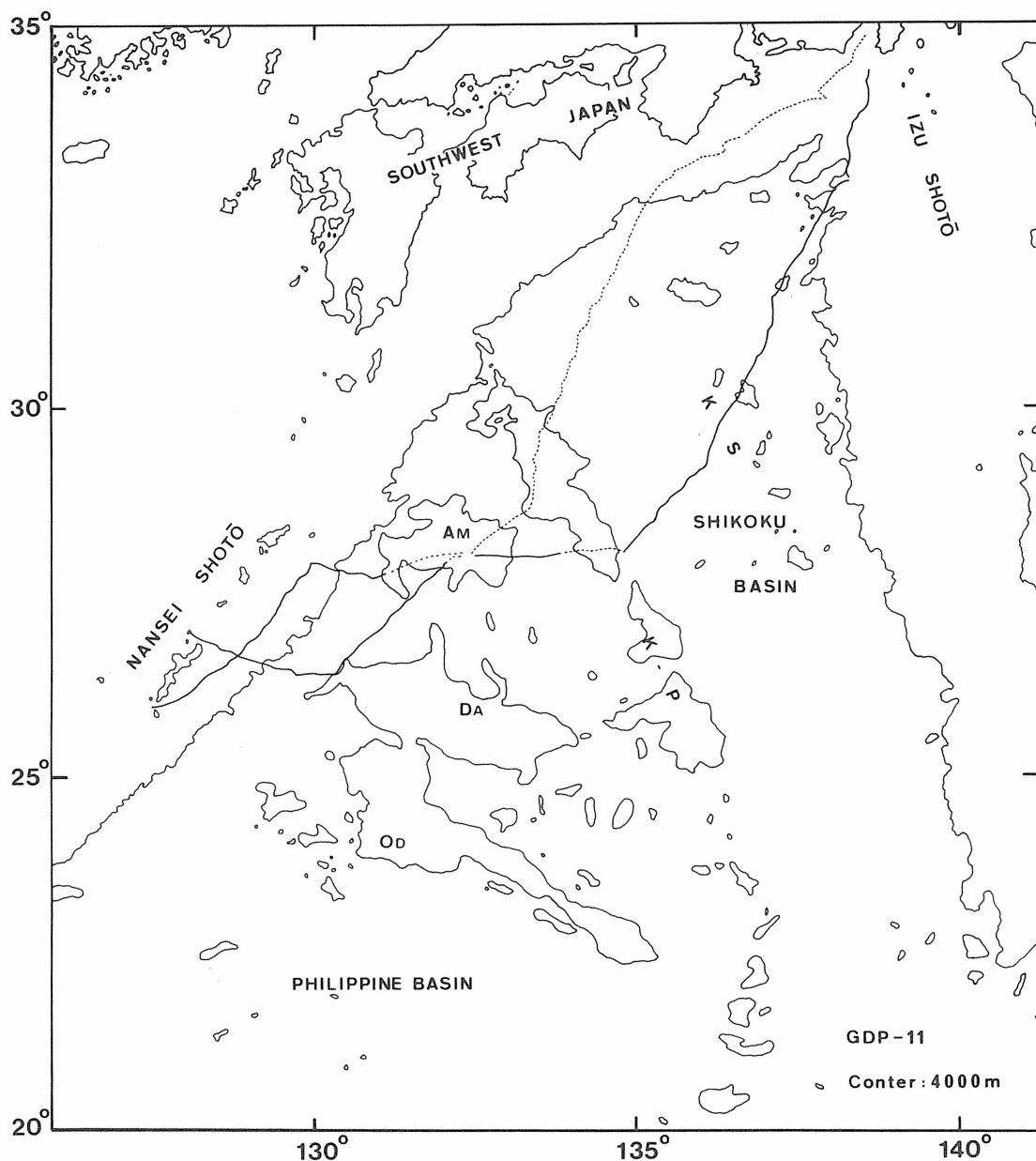


Fig. 1. Ship's track chart of the cruise GDP-11. AM: Amami Plateau, DA: Daito Ridge, Od: Oki-Daito Ridge, K-P: Kyushu-Palau Ridge, KS: Kinan Seamount chain.

Accordingly, our research works were focused on the geology of the Amami Plateau which represents the northern-most one of the three ridges in the northwestern margin of the Philippine Sea (Fig. 1). Successful researches had already been carried out at the northern end of the Kyushu-Palau Ridge, during Cruise GDP-8.

The most unexpected achievement of the research was the discovery of many specimens of *Nummulites* (Fig. 2) and other larger foraminifers (RM. GDP-11, 1975; KONDA, 1975; KONDA, HARADA *et al.*, 1975; SHIKI, AOKI *et al.*, 1975). It has been known that this fauna

occurs from the middle Eocene strata of Hahajima, Bonin Island, and signifies shallow sea environment (KONDA, MATSUOKA *et al.*, 1977).

Another striking result of this cruise was collection of gravels of plutonic rocks such as biotite hornblende tonalite, biotite granodiorite, and augite gabbro from the narrow ridge of the "plateau". Basalt, andesite, and phosphate rock were also found from the peaks in the plateau. Although these gravels were covered by thin or thick crust of manganese oxides, they were considered to represent the constituent rocks of the ridge and the peaks of the Amami Plateau (RM. GDP-11, 1975; SHIKI, TOKUOKA *et al.*, 1975; AOKI, 1975; SUWA and AOKI, 1975; AOKI, KIM *et al.*, 1975). Of these rocks, K-Ar age of the entire rock of tonalite sample is 65.5 ± 2.0 m.y. and the age of hornblende contained is 75.1 ± 2.4 m.y. The least altered rocks of basaltic and andesitic composition have the K-Ar ages of 85.1 ± 2.1 and 82.4 ± 2.2 m.y. It was noted that the tonalite is low in K content, very low in Rb content, and surprisingly high in K/Rb ratio. These facts strongly indicate that this tonalite is different in origin from the ordinary continental granite. On the other hand, the Sr isotope ratio of the other mafic rocks seems to be identical with that of volcanic rocks occurring in the island arcs (MATSUDA *et al.*, 1975; MATSUDA, 1983).

A short but interesting gravity core of calcareous ooze was obtained from a site in the western part of the plateau. It reveals a hiatus between the upper Pliocene and the upper Pleistocene and faunal change suggesting the increase of water depth of about 1,000m during the late Pleistocene (NISHIMURA *et al.*, 1977).

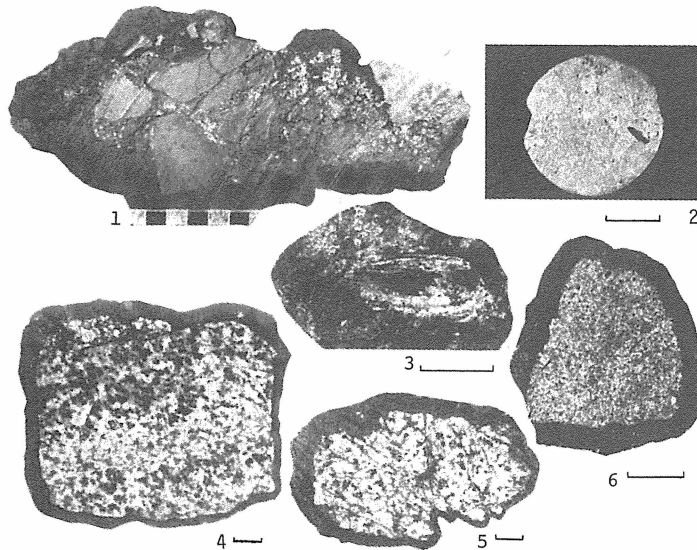


Fig. 2. Rocks and larger fossils obtained from Amami Plateau.

- 1: Angular fragments of andesitic tuff cemented by "phosphate rock", encrusted with ferro-manganese oxides. (GDP-11-9).
 - 2: Individual specimen (micro-spheric form) of *Nummulites boninensis*. (GDP-11-9).
 - 3: A bivalve fossil in a phosphate rocks (GDP-11-9).
 - 4: Biotite hornblende tonalite, thinly covered by manganese oxide. (GDP-11-17). 75.1 ± 2.4 m.y. K-Ar age (total rock), 75.1 ± 2.4 m.y. K-Ar age (hornblende).
 - 5: Biotite hornblende granodiorite, with clashed texture. (GDP-11-17).
 - 6: Oxi-hornblende-bearing andesite. (Manganese nodule) (GDP-11-17).
- (1: Scale 6cm, 2~6: Scalecm)

Cruise GDP-15

A few months after Cruise GDP-11, a striking discovery was made during the cruise of the Geological Survey of Japan (GH74-7). That is, crystalline schist of low pressure type was dredged in the eastern part of the Daito Ridge (MIZUNO, NOHARA *et al.*, 1975; MIZUNO, OKUDA *et al.*, 1976; YUASA and WATANABE, 1977). Needless to say, since then we have intended to clarify the geological setting of the schist and the entire geology of

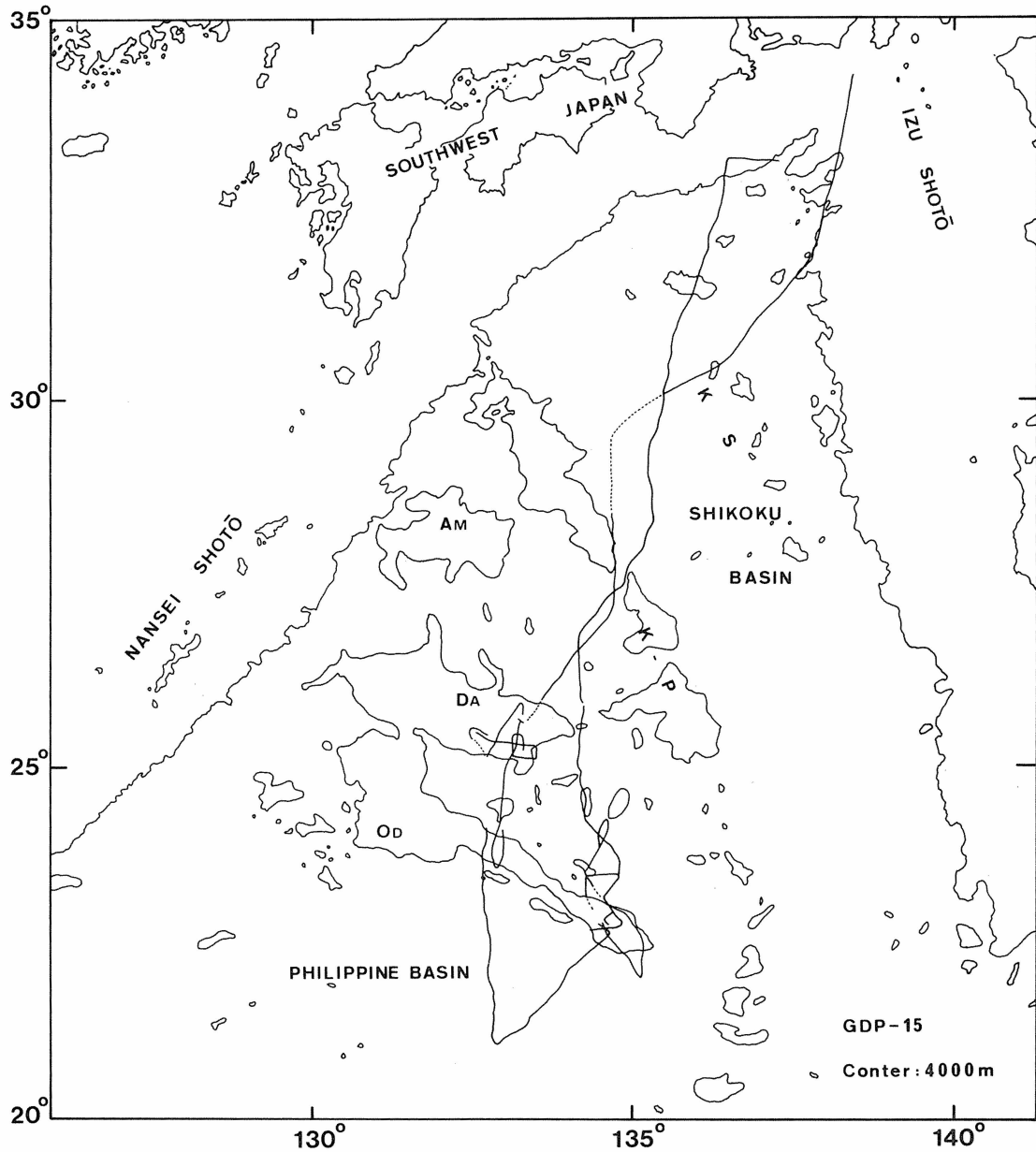


Fig. 3. Ship's track chart of the cruise GDP-15.

the Daito Ridge Group.

GDP-15 was carried out for 16 days from the 15th to 30th of October, 1975, using Bosei-Maru commanded by Captain, Seiichiro. HAYASHI (Fig. 3). The ship's position was ascertained by use of NNSS for the first time besides Loran C and Decca equipment. Participants of the cruise were 13 scientists from many universities and the Geological Survey of Japan (Table 2), and technical assistants consisting of undergraduate students of Tokai University.

The first objective of our study during this cruise was to obtain information on the constituent rocks of the Daito Ridge and the Oki-Daito Ridge. Combined work of dredging and air-gun survey produced good results. Presence of schist in the eastern part of the Daito Ridge was again confirmed by collection of small angular pieces of the rocks. Hornblende biotite diorite was also dredged at the same site, accompanied with acidic effusive rocks, andesite, andesite tuff, arkosic wacke (Fig. 4a), and hornfels of andesite and shale origin, etc. On the contrary, basalt and dolerite were the only igneous constituents of the rocks of the Oki-Daito Ridge, as far as the collected samples were concerned (RM. GDP-15, 1976).

Nummulites boninensis was collected as individual specimens with calcareous ooze from many sites of the two ridges. *Nummulites*-bearing limestone was also obtained from a few places including a hill of monadnock-like topography on the flat top plain of the Daito Ridge (Fig. 4b). Dredging of andesite and andesite tuff from seamounts in the small basins in the Daito Ridge Group Region was another new result of GDP-15 cruise (RM. GDP-15, 1976).

Table 2. List of scientists on board (GDP-15).

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Geological Survey of Japan
Yoshihisa OKUDA
Kensaku TAMAKI

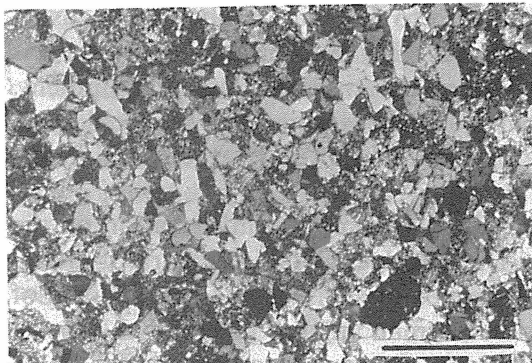


Fig. 4a. Finer-medium grained wacke.
scale: 1 mm

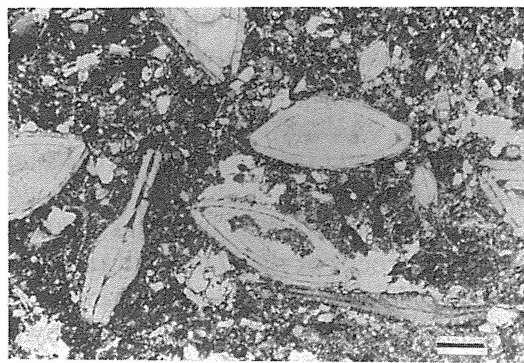


Fig. 4b. *Nummulites*-bearing limestone.
scale: 1 mm

Cruise GDP-21

GDP-21 cruise was carried out from June 29th to 18th of 1976. A staff of 14 scientists (Table 3) and many technical assistants participated in the cruise. The research vessel Tokai-Daigaku-Maru II, was used again and commanded by Captain Kazuo YOSHIDA.

Owing to troubles in the parts of a research instrument and visits of typhoons, we had to change our sailing plan largely, and enter ports three times. However, many additional data for enlarging the knowledge of geology of the Daito Ridge and the Oki-Daito Ridge

Table 3. List of scientists on board (GDP-21).

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Shiro NISHIDA
Tohoku University (Faculty of Science)
Motoyoshi ODA
Doshisha University (Faculty of Technology)
Hiroyuki SUZUKI

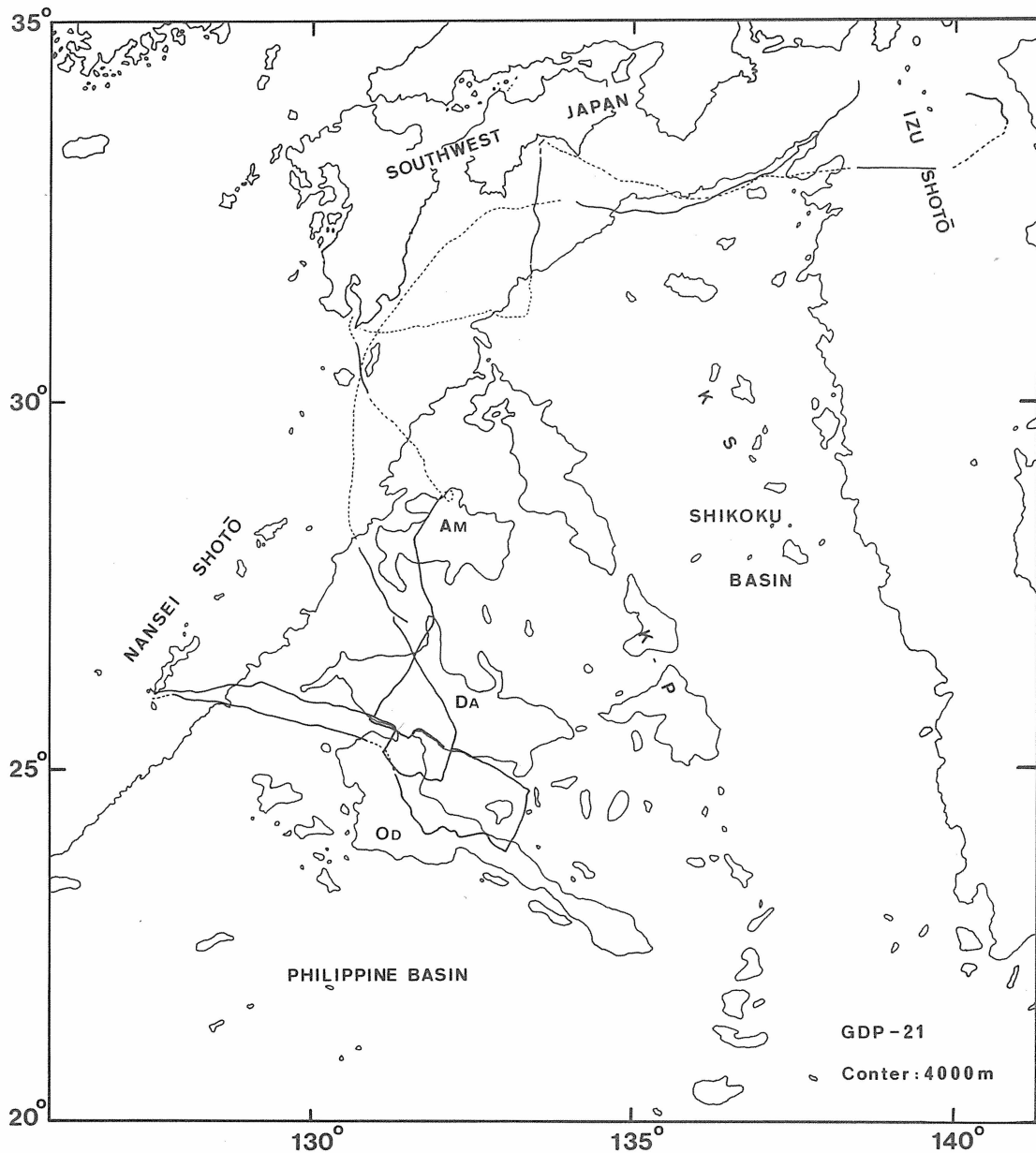


Fig. 5. Ship's track chart of the cruise GDP-21.

were obtained by dredging, coring, air-gun survey, and proton survey (Fig. 5). Geologic stratigraphy of sediments on the ridges and basins in this region, which had been proposed from the results of the former cruises (MISAWA and HOSHIZAWA, 1975; MIZUNO, OKUDA *et al.*, 1975; OKUDA *et al.*, 1976), was examined and fundamentally confirmed (MISAWA *et al.*, 1976). These developments in the study made it possible to draw a geological map and structural cross sections, although of small parts of the region (MIZUNO, OKUDA, and TAMAKI, 1976; SHIKI *et al.*, 1979).

Wide distribution of *Nummulites*-bearing limestone covered by thin (several ten centimeters) calcareous ooze of the upper Pleistocene and Recent, on the top plain of the ridges, was made almost certain. Blockwise structure and lateral change of depth of the flat top topographic plains (shallower in the northwestern side and deeper in the southeastern side of the ridges) were also pointed out (RM. GDP-21, 1977; SHIKI, 1979). Piston corings were concentrated on the flat top of the ridges. Only very short cores were obtained. However, a core 47.5cm long showed interesting sequence of magnetization (RM. GDP-21, 1977).

Furthermore, a detailed study of manganese nodules revealed interesting knowledge concerning the history of subsidence of the ridges (HARADA and NISHIDA, 1975; HSARADA *et al.*, this volume). Some manganese nodules have nucleous which consist of *Nummulites*-bearing phosphorized limestone and late Pliocene Discoaster-bearing pelagic calcareous ooze encrusted by manganese oxides (RM. GDP-21).

Cruise GDP-24

This was the last GDP cruise, the aim of which was to obtain geological data by dredging and coring. The investigation was carried out from the 2nd to 15th of November 1977, by Bosei-Maruru (Captain S. HAYASHI), again. Fifteen scientists from seven universities (Table 4) and many technical assistants from the Tokai University participated in the cruise.

Table 4. List of scientists on board (GDP-24).

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Yoshibumi MISAWA
Takashi SUDO
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Toyo University (Natural Science Laboratory)
Saburo AOKI

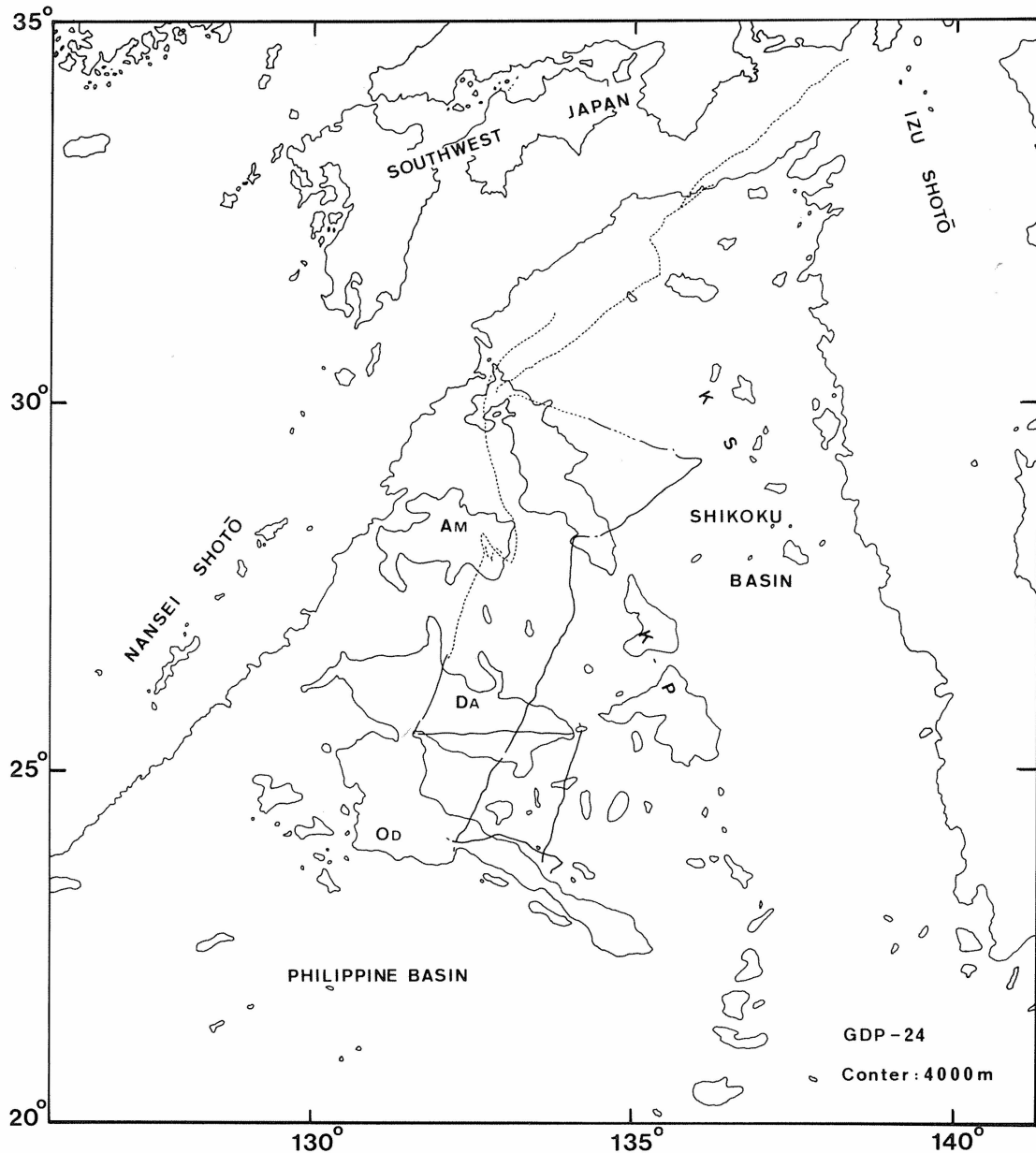


Fig. 6. Ship's track chart of the cruise GDP-24

Three typhoons drew nearer and disturbed our works. However, we could obtain dredge and core samples from 15 stations. Continuous seismic reflection survey and continuous measurement of total geomagnetic force were made to accomplish the researches in the Daito Ridge Group Region. These investigations were carried out in spite of bad weather (Fig. 6).

The most significant result of the researches in this cruise was collection of the Late Oligocene Foraminifer-Nannoplankton chalk from the eastern margin of the Daito Ridge

(RM. GDP-24, 1978). Confirmation of pelagic sediments of the age offered a precious information on the post-Eocene sedimentary condition and geohistory, which had been absent in whole the Daito Ridge Group Region.

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