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V. SEISMIC REFLECTION SURVEY IN THE CENTRAL PACIFIC BASIN DURING GH80-5 CRUISE

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Introduction

Seismic reflection survey with air gun sound sources was carried out along the ship's tracks shown in Figs. V–1 and 2. Equipments and conditions of the seismic reflection survey are listed in Tables V–1 and 2. The use of wave shape kit, which was our first trial in the Central Pacific, for air gun improved vertical resolution of the profile records. Two air guns were used simultaneously for recovering reduced output energy of air gun by wave shape kit. The good resolution record obtained made it easy to understand the stratigraphy.

Tow-way acoustic travel time in seconds is used in discussions for sediment thickness.

General description of acoustic sequence of the Central Pacific Basin

Two prominent reflective horizons occur above basement arrivals in the northern Central Pacific Basin (TAMAKI and TANAHASHI, 1981). These two horizons have been observed in many places in the northern Pacific and called reflector A′ for the upper one and reflector B′ for the lower one (EWING *et al.*, 1966). The two reflec-

Table V-1 Equipments of seismic reflection survey

Air Gun	Bolt PAR Air Gun 1900C
Compressor	Norwalk APS-120
Hydrostreamer	GSJ type hydrostreamer with 100 hydrophones
Hydrophone	T-1 (Teledyne) or MP-18-200 (Geospace)
Amplifier	Ithaco 451 and Ithaco 3171
Recorder	Raytheon UGR 196B and LSR 1811

Table V–2 Conditions of seismic reflection survey

Ship speed	10 kts
Shot interval	6 sec
Pop interval	31 m
Vertical exaggeration	11
Air gun	BOLT1900C × 2
Chamber of air gun	120 in^3
Pressure	1600 psi
Filter	31.5–125 Hz

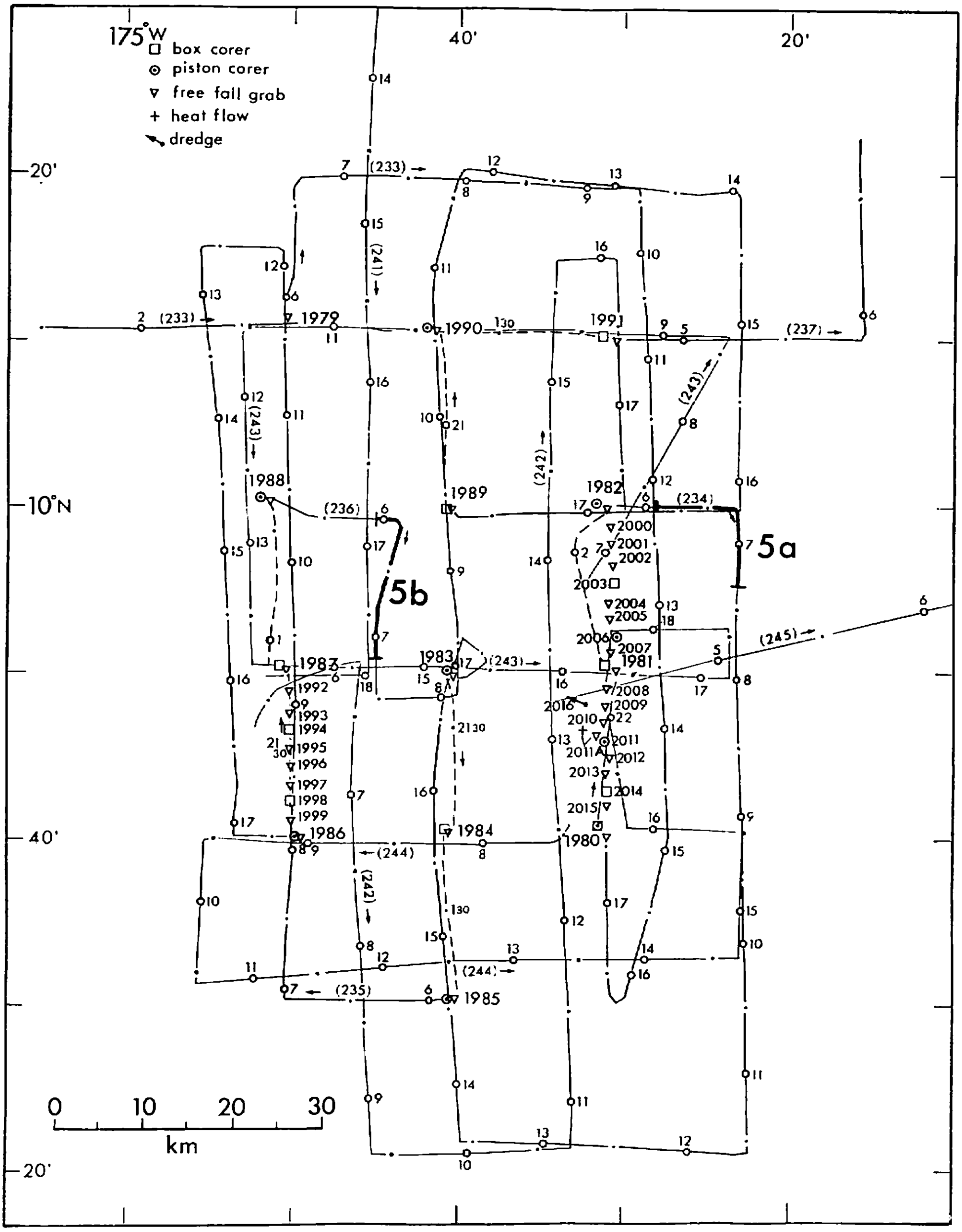

Fig. V–1 Tracks for seismic reflection survey in the detailed survey area I. Open circles with numbers show ship's position in every hour and the GMT days and hours. Solid line shows localities of the profiles in Fig. V–5.

tors and basement arrivals are very good tracers for identifying acoustic sequences. TAMAKI and TANAHASHI (1981) identified three sedimentary units above the basement and called them Unit I, Unit II A, and Unit II B in descending order and correlated them with previous DSDP deep sea drilling results (Fig. V–3). Reflector

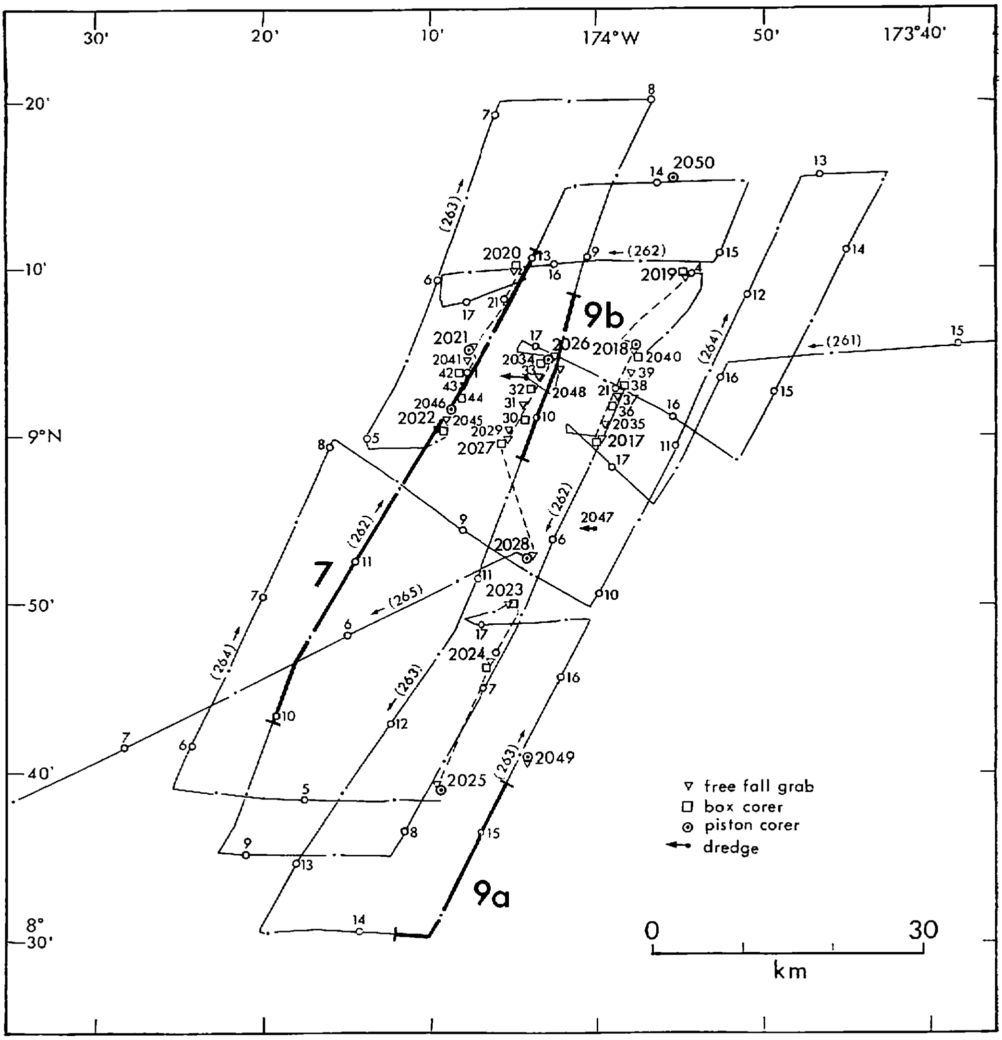

Fig. V-2 Tracks for seismic reflection survey in the detailed survey area II. Solid line shows localities of the profiles in Figs. V-7 and 9).

A′ and B′ constitute the tops of Unit II A and Unit II B respectively.

Unit I, which is acoustically transparent to semi-transparent, is correlated to clay or ooze of the Quaternary to middle Eocene. Unit I, in some places, contains calcareous turbidites which show acoustically reflective flat lying pattern. Reflector A′ is confirmedly correlated to the top of the middle Eocene chert bed. Unit II A is correlated to chert, marl, limestone, sandstone and volcanic turbidites of Cretaceous to middle Eocene age. Reflector B′ is estimated to be correlated to basalt flows above basement, and Unit II B to complex of basalt flows and volcanogenic turbidites. These basalt flows and volcanogenic turbidites appear to have deposited in the basement depressions. The basement composed of basalt is of early Cretaceous age, which is

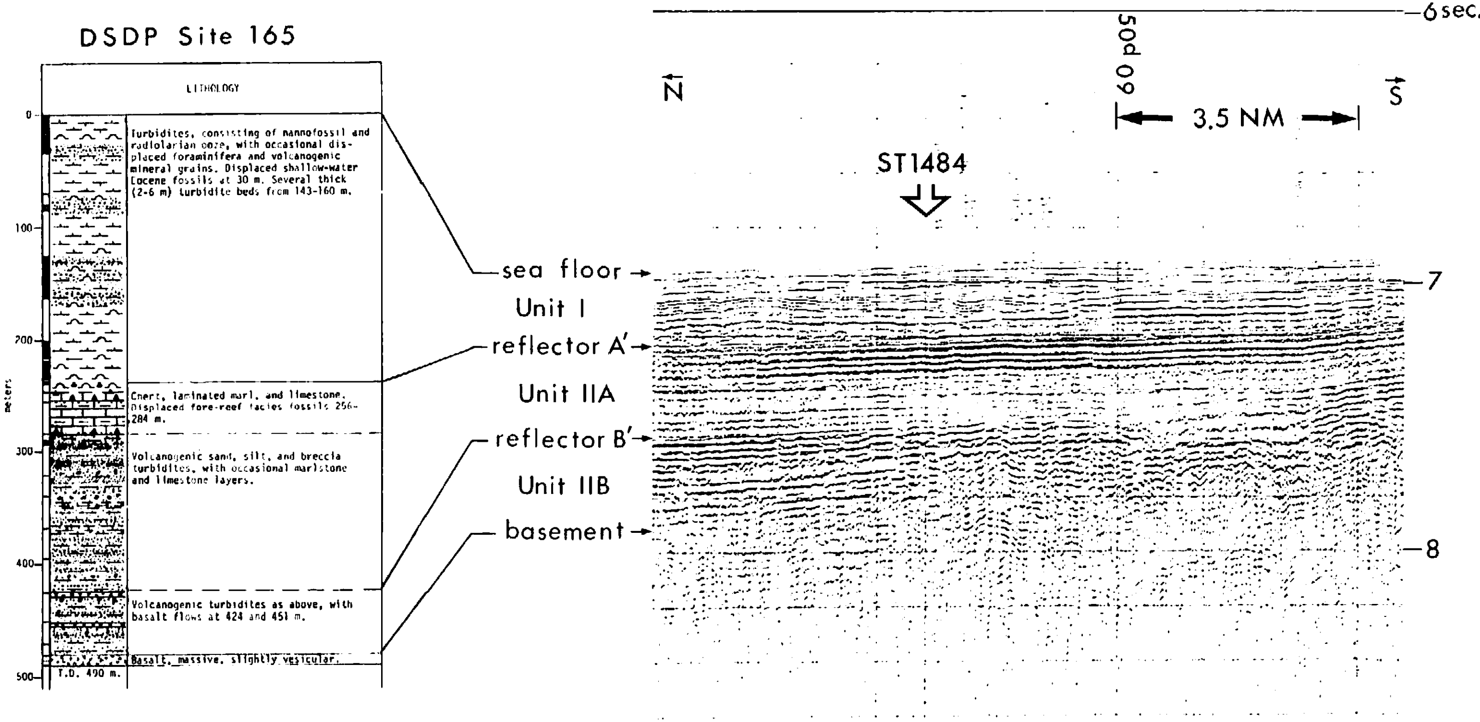

Fig. V–3 Correlation between the seismic record and DSDP site 165 results (Tamaki and Tanahashi, 1981) deduced from the identification of magnetic anomaly lineations (TAMAKI *et al.*, 1979).

Figure 4 shows wave trace of reflection signal. Reflector A′ and B′ is very strong, while sea bottom reflector is so weak that low signal/noise ratio record lacks it. Strong reflector B′ often hides basement arrivals.

Description of the detailed survey area I

The standard acoustic stratigraphy of the northern Central Pacific Basin, Unit I,

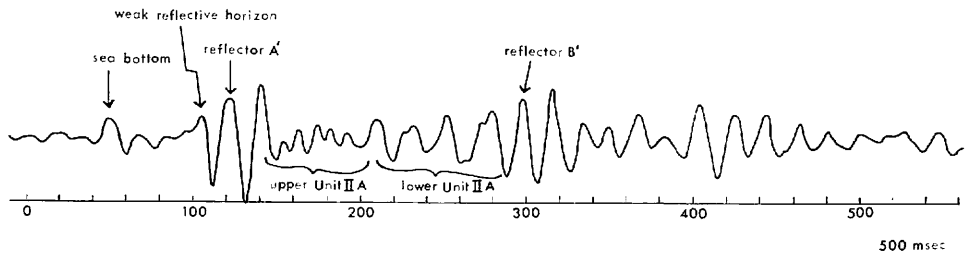

Fig. V-4 Seismic reflection wave traces. Amplitude scale is linear.

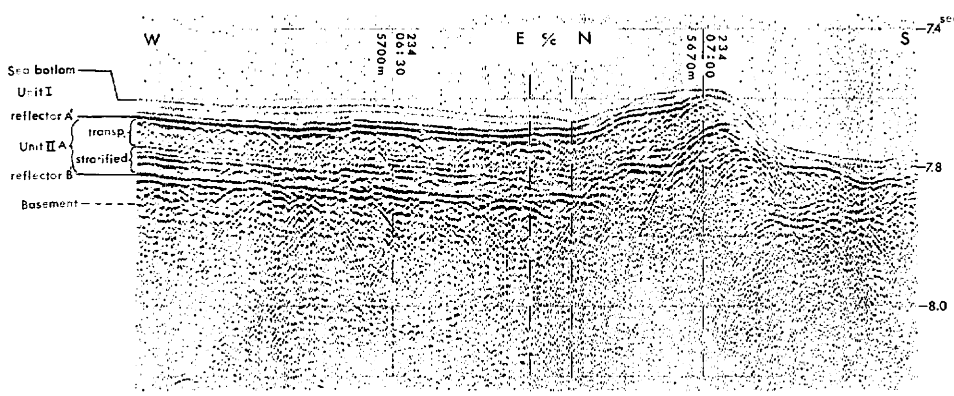

Fig. V-5 (a)

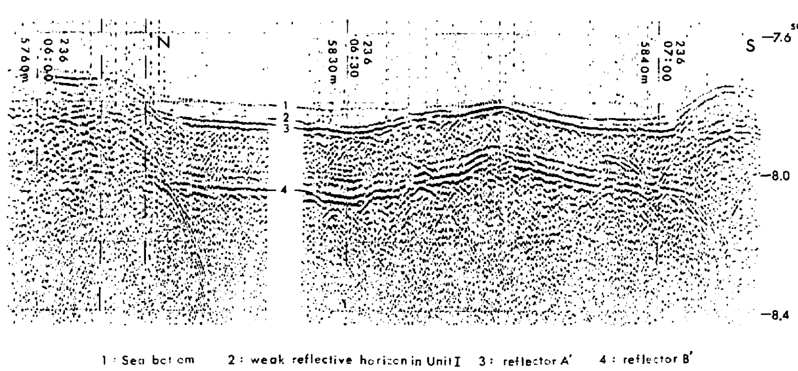

Fig. V-5 (b)

Fig. V-5 Two examples of the seismic profile record in the detailed survey area I. Localities are shown in Fig. V-1.

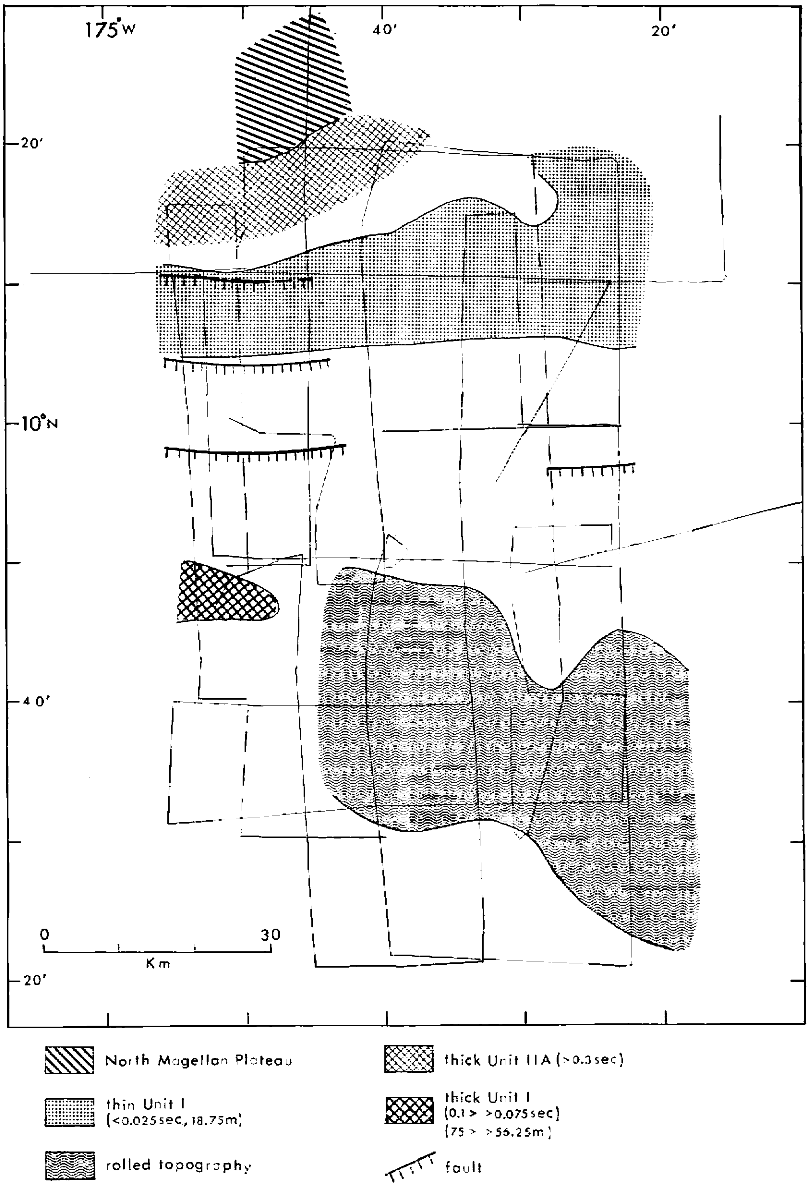

Fig. V–6 Sedimentary unit distribution and basement morphology of the detailed survey area I.

Unit II A, Unit II B, and basement, is well observed in the area.

Unit I is generally transparent and, in many places, includes "weakly reflective horizon" in its lower part (Figs. V–4 and 5). The weakly reflective horizon, which was not observed during our previous cruises, is detected by high resolution record of the present cruise.

The thickness of Unit I never exceeds 0.1 sec (75 m approx.) in the area. Thin

Unit I (less than 0.025 sec, 19 m approx.) is observed in an EW trending zone of the northern area (Fig. V–6). The thickest Unit I is observed around ST1987 where the thickness reaches mostly 0.1 sec (75 m approx.). In the remaining part of the area, the thickness of Unit I is about 0.05 sec (37.5 m approx.).

Unit I tends to become thinner on the topographically high area, and to become thicker in the depressions (Fig. V–5). This tendency, however, is not systematic. Thin Unit I is observed sometimes in the depressions. The observation indicates that the thickness of Unit I does not depend only upon the topography but upon the other factors, such as deep sea currents, upwelling and so on.

Unit II A shows two different facies between its upper part and lower part. The upper part often represents semi-transparency caused by diffraction wave of reflector A′. The lower part is acoustically stratified. A few strong reflectors are observed sometimes in the stratification and it causes decreasing tendency in reflectivity of reflector B′. In such cases, it is difficult to identify reflector B′.

The thickness of Unit II A is generally 0.2 sec. The thickest Unit II A, over than 0.3 sec, is observed at the foot of the North Magellan Plateau (Fig. V–6). The observation indicates that the deposition of Unit II A was controlled by North Magellan Plateau.

The development of reflector B′ is not common compared to reflector A′. It is developed in the topographically low area. As the strong seismic signals of reflector B′ weaken the basement arrival, it is not easy to detect the basement surface beneath Unit II B. It is assumed that thickness of Unit II B is less than 0.1 sec.

Several EW trending faults are observed in the basement (Fig. V–6). Rolled topography of the basement also shows EW trending. The EW trending basement morphology of the area is concordant with magnetic anomaly lineations. The concordance indicates that the basement morphology observed is originated in crustal accretion event by sea floor spreading of the early Cretaceous. The deposition of sedimentary units appears to be controlled by the basement morphology (Fig. V–6).

Description of the detailed survey area II

The WNW trending Magellan Trough, a fossil spreading center of early Cretaceous, is observed at the center of the survey area (Figs. V–7 and 8). The acoustic sequence of the area is basically same as that of the detailed survey area I excluding the presence of turbidites in Unit I in the south of Magellan Trough. The turbidites, with the thickness of 0.1∼0.15 sec, is distributed only in the south of the Magellan Trough and probably shed from the calcareous deposits on the Magellan Rise, because the turbidites continue to the Rise. Bordering ridge of the Magellan Trough is assumed to have made a barrier against the turbidity current.

Reflector A′ below the turbidites sometimes lacks (Fig. V–9). It is assumed that the turbidity current eroded out siliceous deposits which presently make reflector A′. The thickness of Unit II A below the turbidites is rather thin with the thickness of about 0.05 sec, which also indicates erosion of Unit II A by turbidity current.

The acoustic facies north of the Magellan Trough are generally similar to the facies in the south of the trough except for the observation listed below.

1. The weakly reflective horizon in the lower part of Unit I is common compared

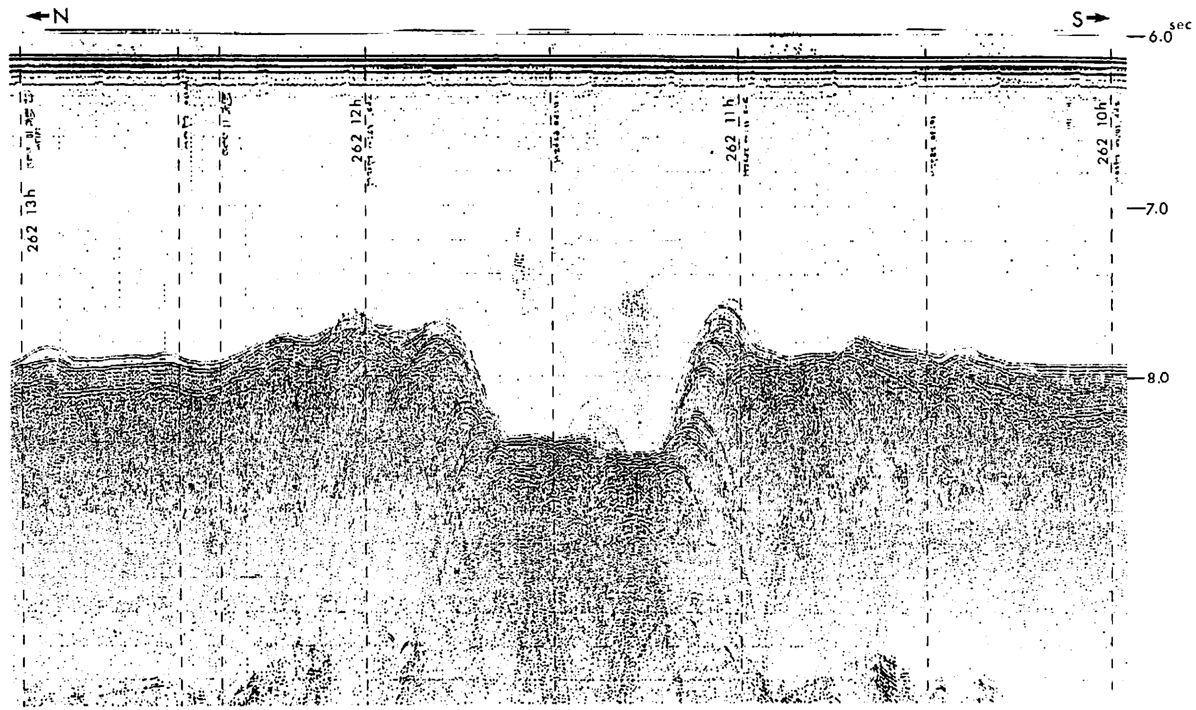

Fig. V–7 Seismic profile of the Magellan Trough.

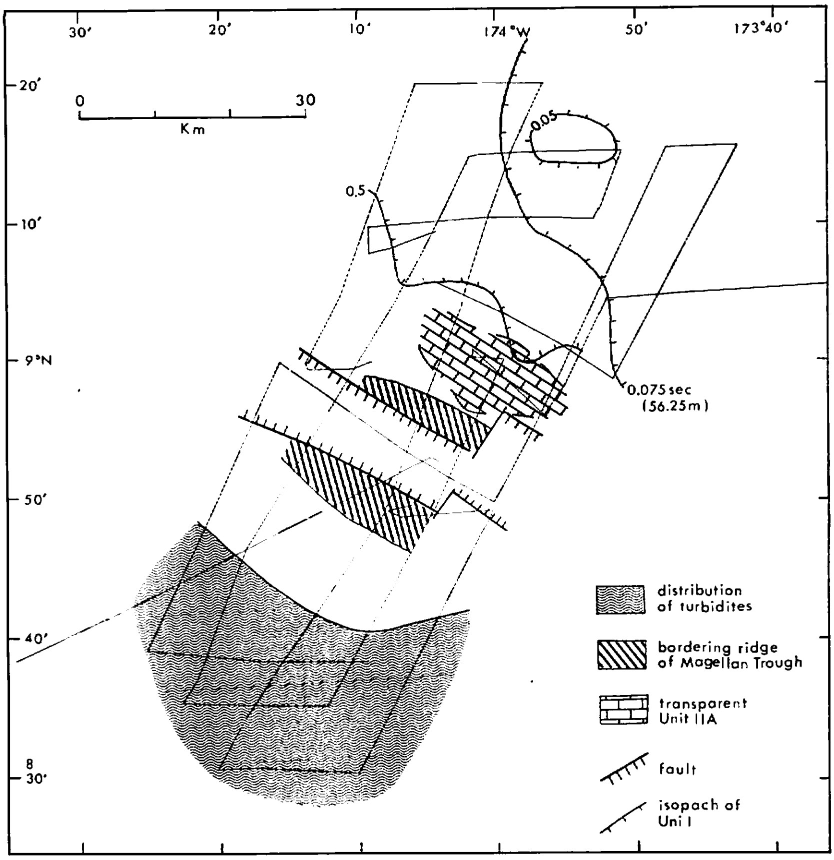

Fig. V-8 Sedimentary unit distribution and basement morphology of the detailed survey area II.

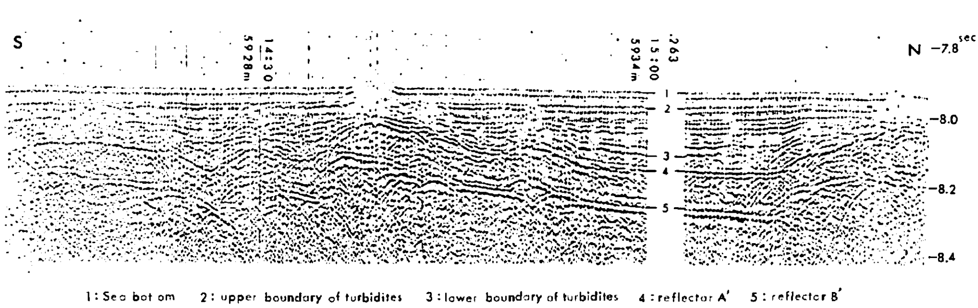

Fig. V-9 (a)

Fig. V-9 Two examples of the seismic profile record in the detailed survey area II. Localities are shown in Fig. V-2.

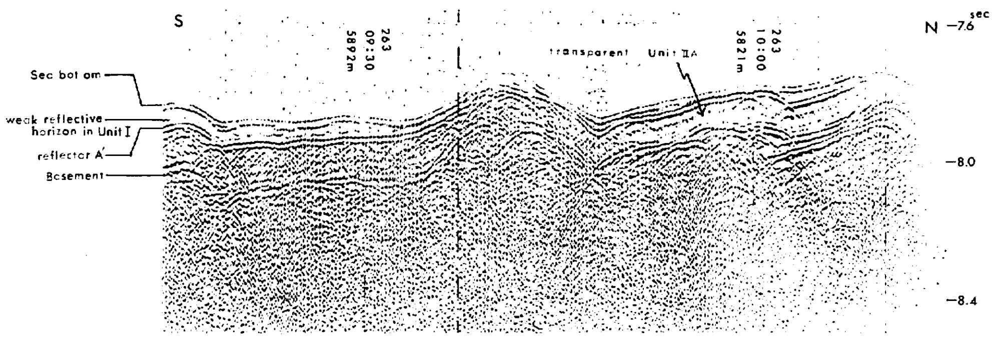

Fig. V-9 (b)

to in survey area I.

2. The stratification in the lower part of Unit II A is not remarkable.
3. Wholly transparent Unit II A is localy observed (Figs. V–8 and –9).

The weakly reflective horizon may be correlated to siliceous ooze recoverd at ST2026.

In the bottom of the Magellan Trough, Unit I with the thickness of 0.025 sec and rather thick Unit II A and B (0.3 sec in thickness) are observed. Left lateral displacement of the trough axis is remarkable in the eastern area.

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