V. CONTINUOUS SEISMIC REFLECTION PROFILING SURVEY

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A continuous seismic profiling (air-gun) survey was carried out with neumatic sound source in the eastern Central Pacific Basin and along the geophysical tracks, Japan-Hawaii, Hawaii-the surveyed area and the surveyed area-east of Wake. The surveying distance was as follows.

The surveyed area	2,140n.m.
Japan-Hawaii and the surveyed area-east of Wake	1,590n.m.
Hawaii-the surveyed area	1,480n.m.

The surveyed area is northerly and easterly defined by the seamounts and guyots of the Christmas Ridge and it is largely occupied by deep sea basin. The detailed survey was carried out at its western part, while, a few surveyed lines run in the eastern part of the area.

Method

During the survey, the Bolt 1900B type air-gun was used for sound source with chambers of 80 and 120 cubic inches and with high pressure of 1,300 to 1,600 psi (approximately 90–110 kg/cm^2). The hydrophone streamer cable is towed behind the ship. The Teledyne Exploration Co. Model 24257 was used for detecting reflected waves, which has 100 detectors of Recon HP-1 or GSC MP-7 crystal hydrophones. The hydrophone

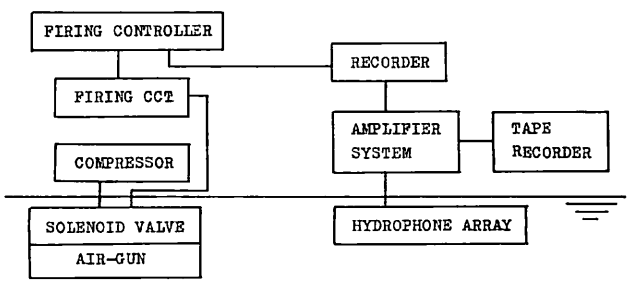

Fig. V-1 Schematic block diagram of air-gun system.

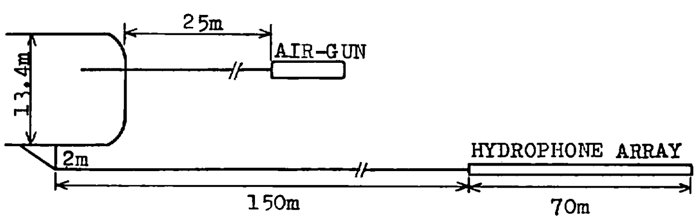

Fig. V-2 Towing condition of air-gun.

amplifier system Model 24220 of Teledyne Co. was used as a receiving system. The reflected information is ultimately fed into the Raytheon Model 196B recorder.

A schematic diagram of the air-gun profiling system and towing condition behind the ship are illustrated in Figs. V-1, 2.

Results

Eastern Central Pacific Basin

In the eastern area of the surveyed area thick turbidites are distributed, where bottom topography is rather smooth as compared with that at the western area. The thickness

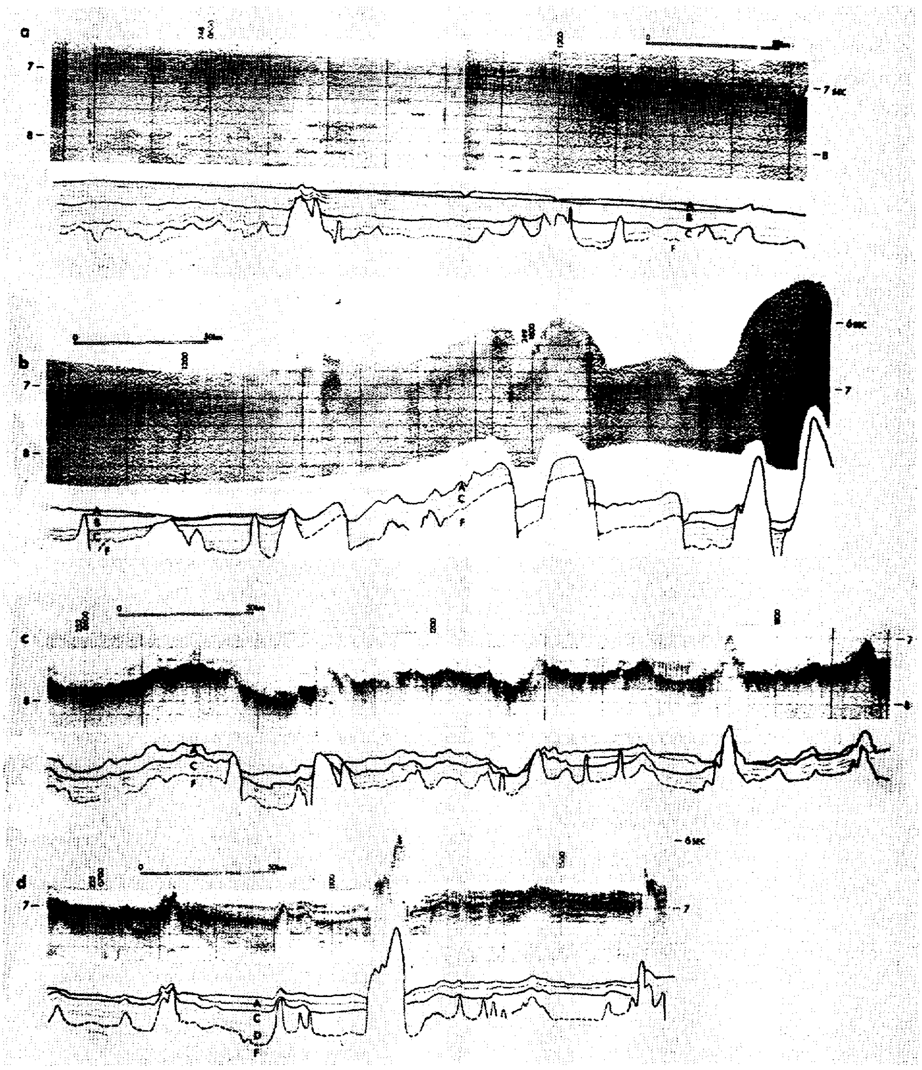

Fig. V-3 Reflection profiles in the surveyed area.
A: upper transparent layer, B: turbidite layer, C: densely stratified layer, D: lower transparent layer, F: acoustic basement.
Surveyed tracks being shown in Fig. I. in detail and in Fig. V-4 roughly.

of the turbidite layers measure approximately 0.5 sec. being overlain by the transparent layer of 0.1 sec. thick at the western half of its distribution area (Fig. V-3-a).

There, the flat plain of the basin very gently declines westwards with the slope angle of less than 1 : 1,000. Thus, the plain can be termed abyssal plan. The turbidites might have been supplied from the eastern Line Islands High.

Beneath the turbidite layer, the densely stratified layer and acoustic basement are recognizable in the profile (Fig. V-3-a), in descending order. The acoustic basement has a rough surface of high relief and is partly exposed on the sea floor.

The turbidite layer is also found on the summits and flanks of deep sea hills in the median part of the surveyed area, which represents the eastern margin of western hilly area. The layers are eroded and deformed by the younger structural movement. Therefore, the hills in the area which represents also the western peripheral one seem to have been formed during or since the deposition of the turbidites. Structural deformation may have continued until Recent times (Fig. V-3-b).

In the western half of the surveyed area, the turbidite layer is very poorly developed, and the upper transparent layer, densely stratified layer and acoustic basement are discriminated, in descending order.

The upper transparent layer of 0–0.5 sec. thick has a uniform pattern and is rather thicker in the southwestern part compared with that at the northwestern part. The layer changes facies northwesterly, and in the northwestern area it tends to have slightly stratified pattern (Figs. V-3-c, d).

As suggested by the sampling results (see Chap. X.), the uniform upper transparent layer in the southwestern part may have the composition of a high ratio of biogenic ooze, while the layer in the northwestern part may be composed of a high ratio of pelagic clay or alternation of ooze and clay.

The densely stratified layer represents the western prolongation of that in the eastern half area. It is generally overlain by the upper transparent layer in the western half. The northwestern periphery of the layer is not clear in acoustic pattern, suggesting an

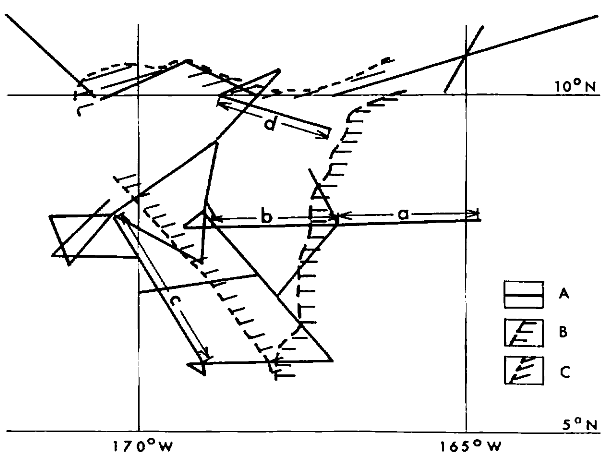

Fig. V-4 Showing the distribution limits of turbidites (B) and densely stratified layer (C).
A: surveyed line.
a, b, c and d: situation of each profile in Fig. V-3.

increasing amount of pelagic sediments. The distribution area of the layer is shown in Fig. V-4, together with that of the turbidite layer.

We do not yet have data for a geological interpretation of the acoustic layers. However, the results of DSDP Leg 17 (Winterer, Ewing et al., 1973) are available.

The left hand end of the track of 248 day shown in Fig. V-3-a is very closely situated to the Site 165 by DSDP, where we obtained a piston core of about 5.5 m length (St. 114). Also, the DSDP data revealed the acoustic profile obliquely running in the direction of NE-SWW, from eastern seamount to the southern part of our area via Site 165. From a comparison of both DSDP's and our data, the following possible correlation is deducible.

1) The acoustic basement corresponds with basement basalt; 2) the closely stratified layer includes early Eocene-upper Cretaceous chert, limestone and volcanogenic turbidites; 3) the turbidites layer corresponds with Miocene-middle Eocene turbidites; and 4) the uppermost transparent layer of the eastern half area represents Quaternary-upper Miocene deposits.

The interpretation of acoustic stratigraphy of western half area is somewhat difficult, because of the lack of data in the vicinity of the area. The more or less thick upper transparent layer, however, seems to be extensively developed also in the profile of Site 165-Site 166 by DSDP, and the layer is most likely correlated with Quaternary-middle Eocene radiolarian ooze, covering the rocks of chert, radiolarian ooze and volcaniclastics of the lower horizon at Site 166 in the vicinity of Magellan Rise.

Japan—Hawaii

Along the Shatsky Rise, having a broad top of approximately 70n.m. along the track, thick layered sediments of about 0.6 sec. are developed, while about 0.2 sec. thick layered sediments are found on the slope of the Rise (Fig. V-5-a). Layered sediments along the margin of the top are deformed and eroded where ridges and rough topography is present. This suggests that structural deformation has occurred at the margins of the top of the Rise since the deposition of the layered sediments.

In the oceanic floor, four layers are acoustically distinguished. They are the upper transparent layer, the upper opaque or transparent layer, the lower transparent to semi-transparent layer, and the lower opaque layer. The lower opaque layer is partly distinguished in two layers of the upper stratified layer and the lower basement.

Dense stratified layers are observed in the two horizontally smooth basins at the east side of the Emperor Seamount Chain, which may suggest the possibility of turbidites. The thickness of the layer is approximately 150 nautical miles and 350 nautical miles in each basin. (Fig. V-5-b)

Hawaii—the surveyed area

The surveyed lines by air-gun between the Hawaii Islands and the sampling stations are restricted in the southern area.

Bottom topography is rough and consists of many small hills. Sedimentary layers are thinner in the northern area with an approximate thickness of 0.3 to 0.4 sec. except those in the depressional area where a little thicker sediments are present.

No upper transparent layer is found in the northern area, while the upper transparent layer increases in thickness gradually towards the south.

Sediments are quite different in thickness along both sides of the Clarion Fracture Zone or along the western extension of the fracture zone, Sediments at the north side of the fracture zone are approximately 0.3 to 0.4 sec. in thickness and are thinner as compared with those on the south side where sediments are approximately 0.8 to 1.0 sec. in thick-

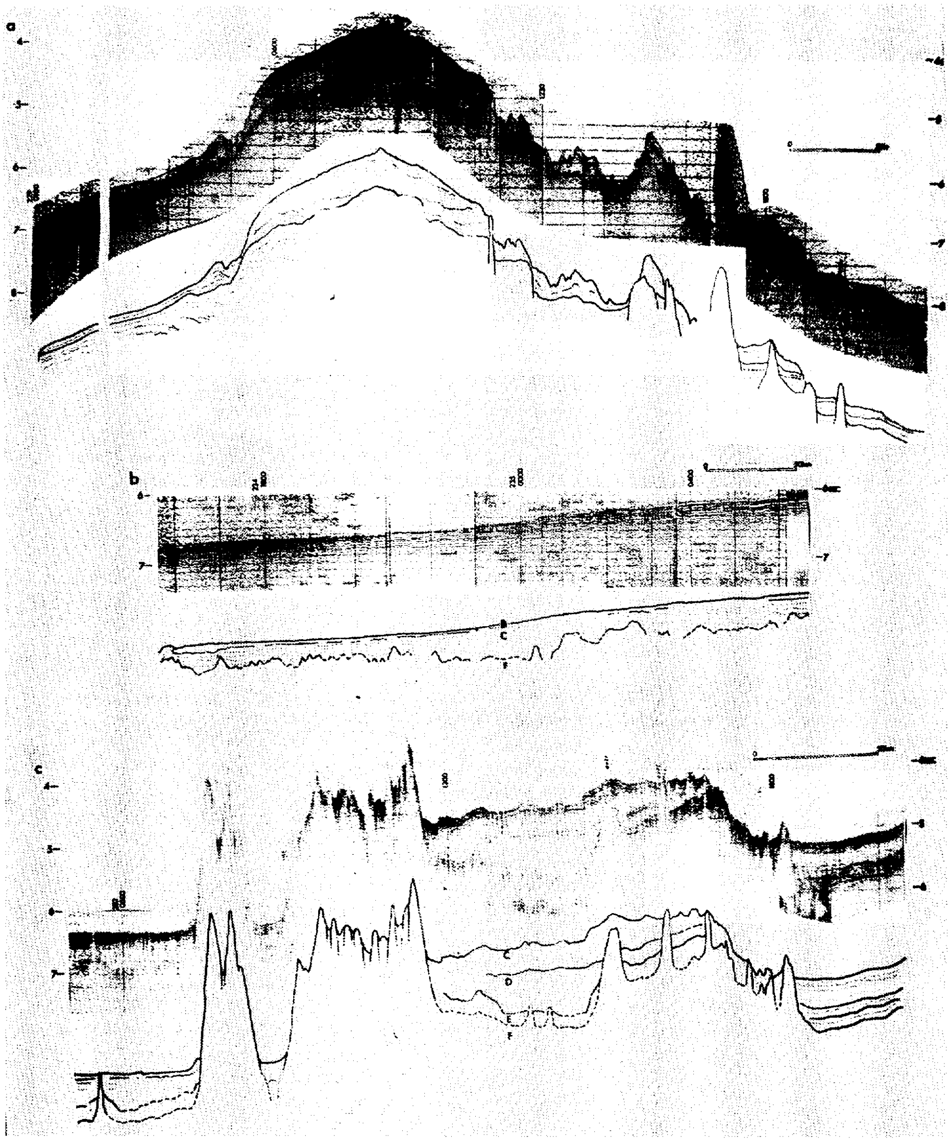

Fig. V-5 Reflection profiles of a part of Japan-Hawaii and the surveyed area-east of Wake.
a: Shatsky Rise area, b: east of Midway, c: east of Wake. E: lower opaque layer. A-D and F coincide with those in Fig. V.3.

ness.

The upper transparent layer is approximately 0.03 sec. in average on the north side of the fracture zone, while the layer is 0.05 to 0.1 sec. on the south side.

The surveyed area—east of Wake Island

Five layers are acoustically distinguished by seismic reflection profiling. They are the upper transparent layer, the upper opaque layer, the lower transparent layer, the lower opaque layer and the basement. (Fig. V-5-c)

Distributional pattern of sedimentary layers is quite different as compared with that of the surveyed area in the eastern Central Pacific Basin. No upper transparent layer or partly thin cover of the layer with the maximum thickness of 0.05 sec. is found in the area. Whereon the upper opaque layer is eroded in the northern area of the station number 146.

The thickness of the sedimentary layers is an average of 0.3 sec. to the south of the station number 147, while in the northern area the layer is 0.6 to 1.3 sec.

This is due to an increase in the thickness of the lower transparent layer. The maximum thickness of the lower transparent layer amounts to 1.0 sec. in the northern margin of the surveyed area.

The lower opaque layer is distinguished from the acoustic basement by the stratified reflectional pattern, and the layer is present in depressional areas of the basement.

Reference

Winterer, E. L., Ewing, J. I., et al. (1973): *Initial Reports of the Deep Sea Drilling Project*, vol. 17, Washington (U.S. Government Printing Office), xx+930p.