III. BATHYMETRY OF THE GH79-1 AREA

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Introduction

Bathymetric survey was carried out with a NEC 12 kHz Deep-Sea Precision Depth Recorder (12 kHz PDR) throughout the GH79–1 main and detailed survey areas. Based on the depth data corrected for velocity of sound in seawater by MATTHEW's table and the recaluculated positions (MIYAZAKI, this cruise report), bathymetric maps in the main and detailed survey areas were made (see Figs. I-4, 6), modified from WINTERER (1972)' map (in WINTERER, EWING, *et al.*, 1973). Local bathymetric maps around each sampling station were made also.

Regional bathymetric maps made by each Hakurei-Maru cruises in the central Pacific (GH74–5, 76–1, 77–1, 78–1, and the present cruises) were compiled to a new Bathymetric Chart of the Northern Central Pacific Basin (Plate III-1 in pocket at back of this cruise report).

Regional bathymetry of the central Pacific including the present area has been shown by WINTERER (1972) and discussed in relation to tectonic evolution of the region (WINTERER, 1976a, b; ORWIG and KROENKE, 1980).

Bathymetry of the main survey area

The main survey area extends westward from the northern province of Line Islands chain and includes the west-northwest trending middle row of Cross Trend chain which branches out from the Line Islands chain approximately at 10°N, 165°W (see Fig. I-1). Bathymetric profiles along each survey line are shown in Figs. III-1, 2.

Topographic arrangement in the area is dominantly in west-northwest direction, quite consistent with that of the Cross Trend chain (see Fig. I-4). The topography appears to be divided into a rolled zone with broad mounds and a clustered seamounts zone.

The rolled zone occupies the southwestern to western part of the main survey area, connected to the clustered seamounts zone to the northeast, and to the linear topography zone accompanied by the Magellan Trough to the southwest (Plate III-1), both without a definite boundary.

Deep-sea floor of the rolled zone ranges from 5,000 to 5,500 meters in depth, and the maximum depth of about 6,000 m occurs in a small depression at 11°50′N, 175°10′W. General arrangement of relief shows a vague linearity in the Cross Trend direction, together with two broad mounds.

The broad mounds are centered approximately at 11°N, 174°50′W and 12°30′N, 177°W. They rise from the deep-sea basin, with irregularily circulated base line, about 170 km and 200 km, respectively, in diameter. The shallowest depth of the eastern one (centered at 11°N, 174°50′W) is about 3,500 m and occurs at the central-southern

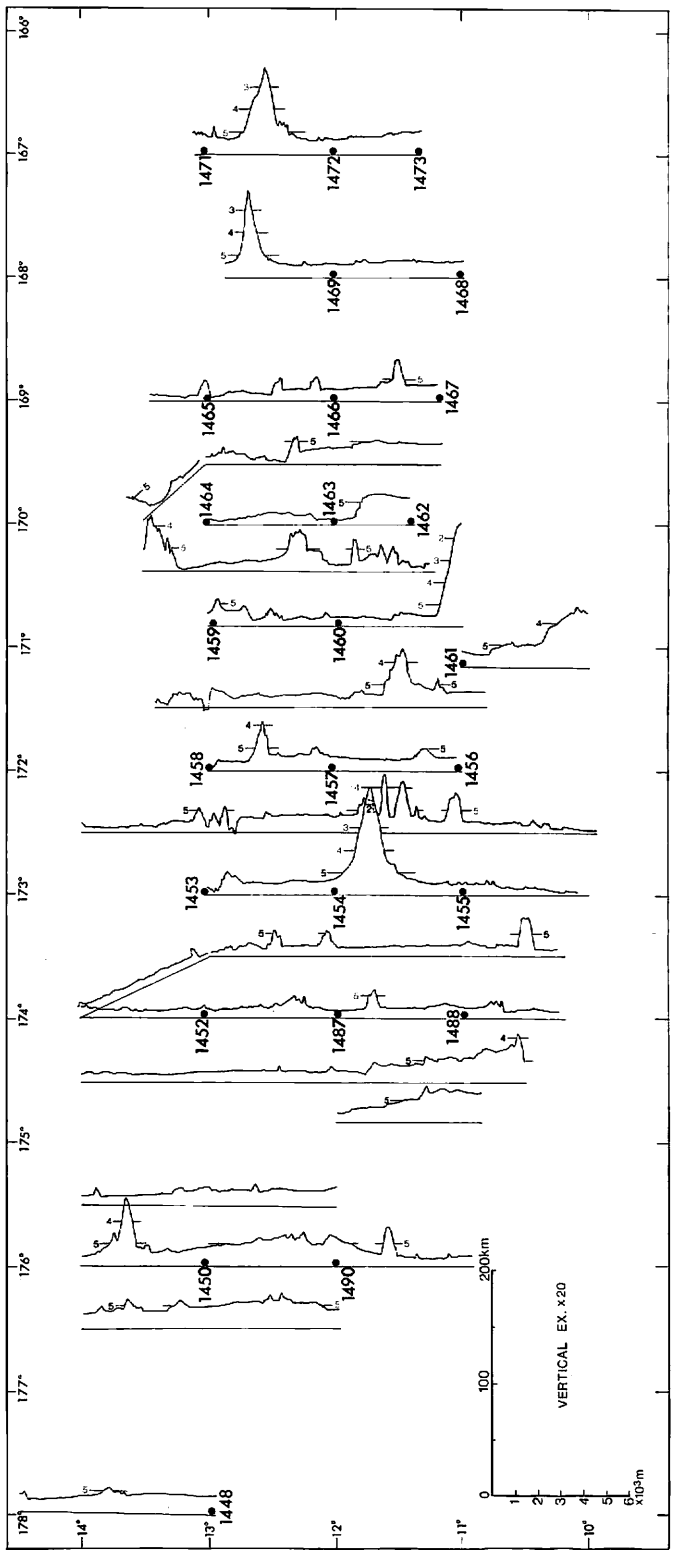

Fig III-1 North-south topographic profiles in the main survey area.

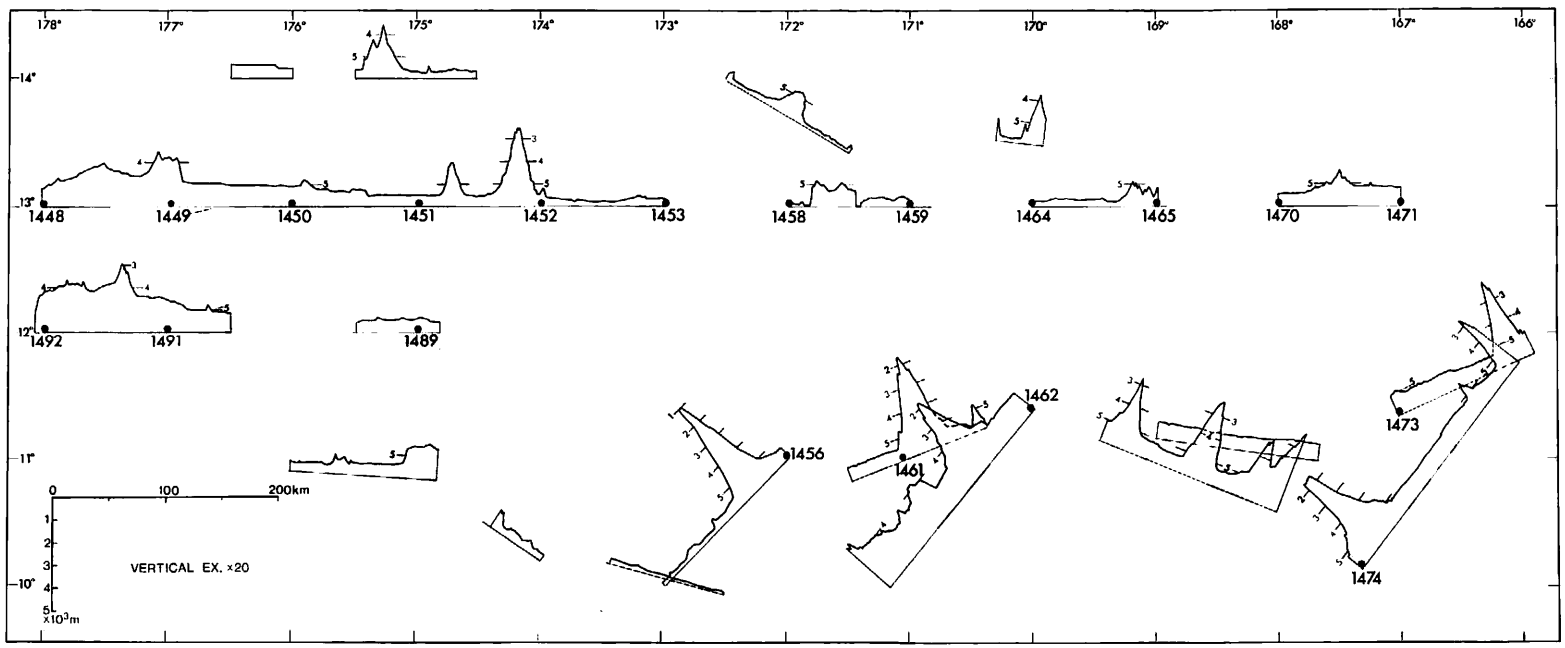

Fig III-2 East-west topographic profiles in the main survey area.

part, resulting in an asymmetric north-south morphologic profile with northern gentle slope and southern steep one (as large as 8° in inclination). The southern part of the mound is deeply sculptured by a narrow valley and a channel of the Cross Trend direction.

The western mound (centered at 12°30'N, 177°W) occurs at the northwest of the eastern mound, separated by deep-sea floor deeper than 5,500 m. It has more irregular and broader base than the eastern one, with more gentle slope (2.5° to 3.5°). The mound appears to comprise northern and southern highs separated by a broad depression which opens toward the west. Both the highs are connected to merge by the 5,000 m isobath in the eastern half. The shallowest depth of about 3,000 m is found on the southern high.

The western mound has been named the North Magellan Plateau by MAMMERICKX and SMITH (1979). They discussed its origin and suggested that the plateau was separated from the Magellan Rise to the south through the Magellan spreading system (TAMAKI *et al.*, 1979). The similarity of geological structure of the western and eastern mounds as detected by continuous seismic reflection survey (see Fig.VII-8) suggests that the eastern mound may have the same origin as the western mound, and if it is true, certain mechanism of fracturing must have acted to separate the both highs.

The clustered seamounts zone occupies an extensive area of northeast to east of the rolled zone. It comprises isolated small seamounts and ridges and rolled deep-sea floor deeper than 5,500 m in places. Topography appears to be arranged in the west-northwest trend in general. The scattered seamounts and ridges tend to be concentrated in the northwestern-southeastern part and northeastern part, separated by west-northwest trending rather narrow depressional belt.

The northeastern group of seamounts belongs to the Line Islands chain. The seamounts are rather small, with prominent peak of 2,000 to 2,500 meters deep.

The northwestern-southeastern group of seamounts and ridges represents the Cross Trend chain. A depth of those peak is dominantly 2,000 to 2,500 meters, ranging from 1,000 to 3,500 meters. Larger seamounts tend to have shallower depth of peak. Morphology is variable, characterized by prominent peak, not flat, with slopes of several to 15 degrees. Some of the seamounts are narrowly elongated to form small ridge as represented by a irregularily shaped ridge on the southeastern part of the survey area. A part of the ridge, described partly by WINTERER (1976), was surveyed in detail and dredged (Fig. III-3-18). Distribution of the seamounts and ridges seems to be rather irregular, but their general arrangement and elongation of some ridges suggest that they are framed of two structures of west-northwest and north-northwest trends. The west-northwest trend is consistent with a general direction of the Cross Trend chain. The north-northwest trend may represent the fracturing, parallel to the Line Islands chain. The data previously published (NATLAND, 1976) and newly obtained (TOKUYAMA and MIZUNO, this cruise report) as for dredged rocks from the small ridge of the southeastern part show that these seamounts and ridges formed by a Cretaceous undersea volcanism of potassic nephelinite.

Bathymetry of the detailed survey area

The detailed survey area is situated on the immediately south of the small ridge in the Cross Trend chain discussed above and occupies a small part in the northern end of

wide-spread deep-sea basin west of the Line Islands. The area is dominated by a deep-sea floor at depths of 5,160 to 5,270 meters, accompanied by a very small seamount with a peak of about 4,200 m deep at the southwestern part. The deep-sea floor shows a general tendency of gentle inclining toward the northwest from 5,160 to 5,270 meters in depth. A northeast trending trough is developed in the central-northwestern part; it is broad and shallow, with an arcuate axis which terminates in a moat-like small depression in the southeastern end.

Appendix: Local bathymetric maps around sampling sites

Fig. III-3 (1–24) shows the details of the topography at each sampling site in the main survey area. The description of the topography is briefly summarized in Table I-6.

References

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ORWIG, T. L. and KROENKE, L. W. (1980) Tectonics of the eastern Central Pacific Basin. *Marine Geology*, vol. 34, p. 29–43.

TAMAKI, K., JOSHIMA, M., and LARSON, R. L.(1979) Remanent early Cretaceous spreading center in the Central Pacific Basin. *J. Geophy. Res.*, vol. 84, p. 4501–4510.

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

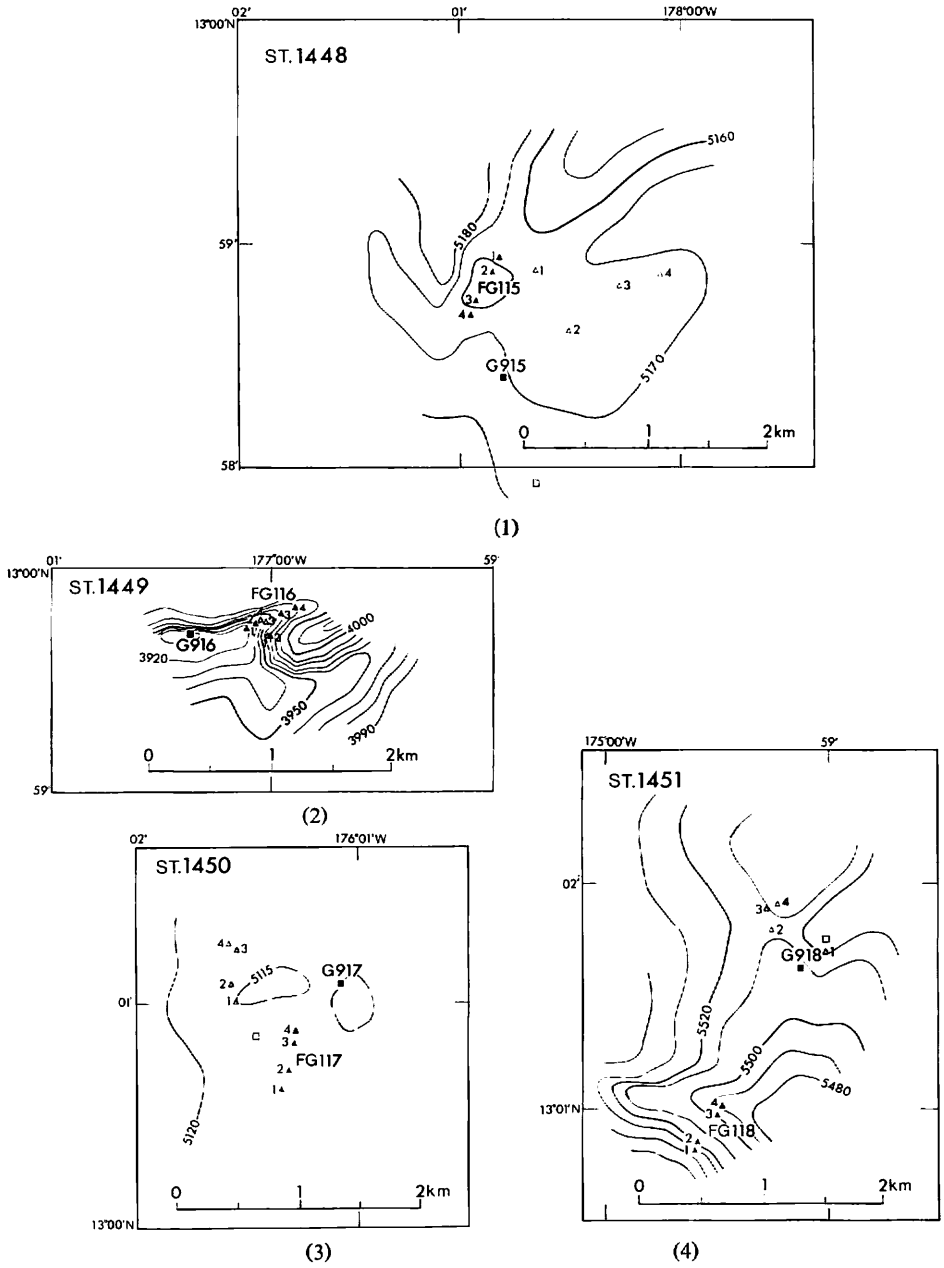
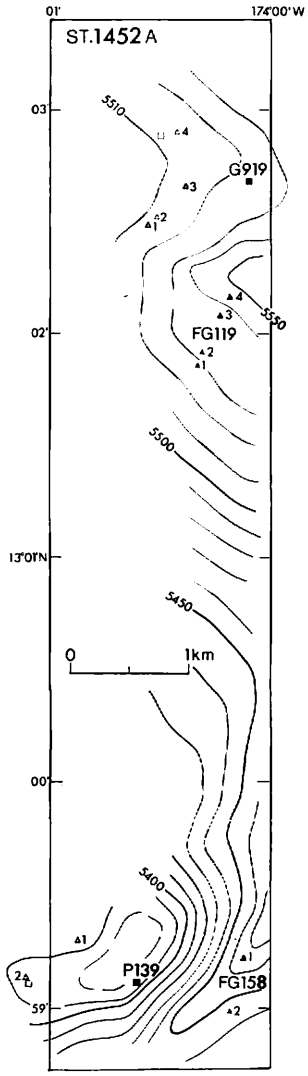


Fig. III-3 Bathymetric maps around each sampling sites in the main survey area. Solid and open triangles indicate the throw-in and pickup positions of freefall grabs, respectively. Solid squares indicate the bottom-hitting points of box corer and piston corer. Solid circles show the positions of dredge and bottom photography.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FG119
P139
FG158
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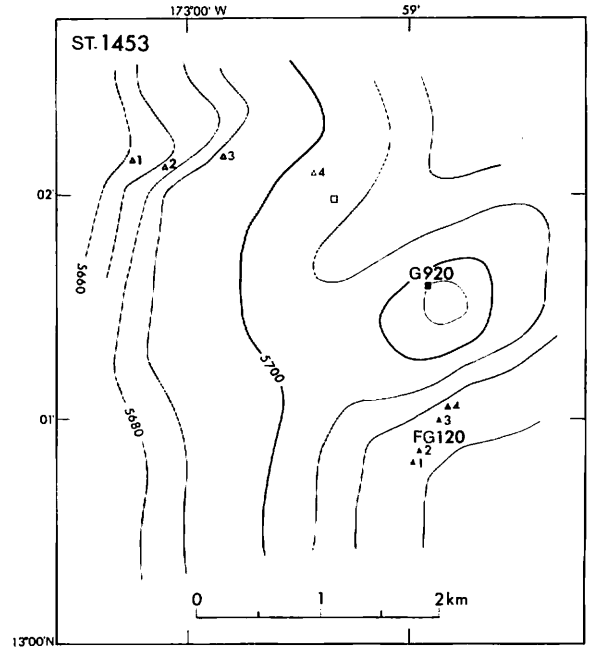
1km

(5)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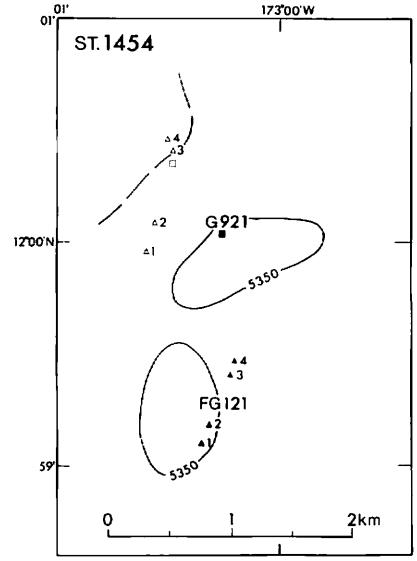
(6)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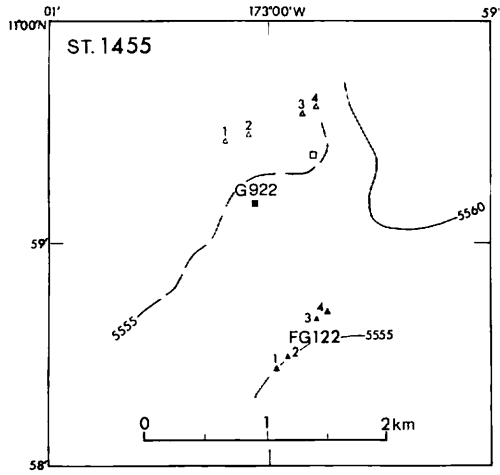
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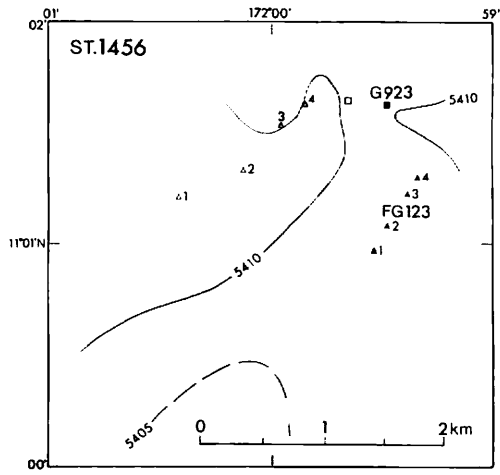
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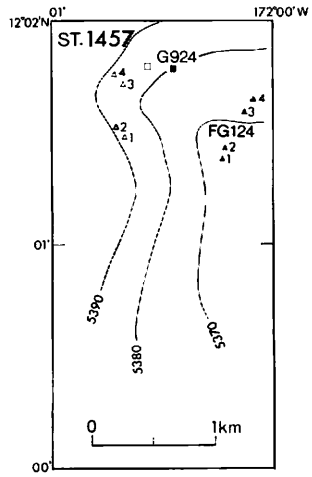
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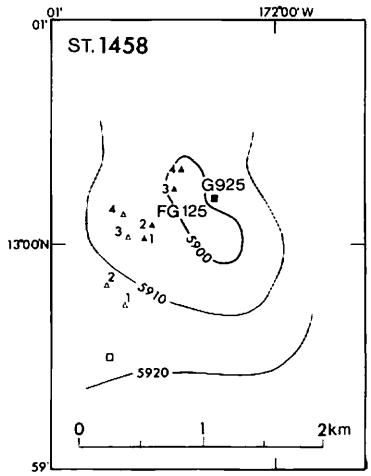
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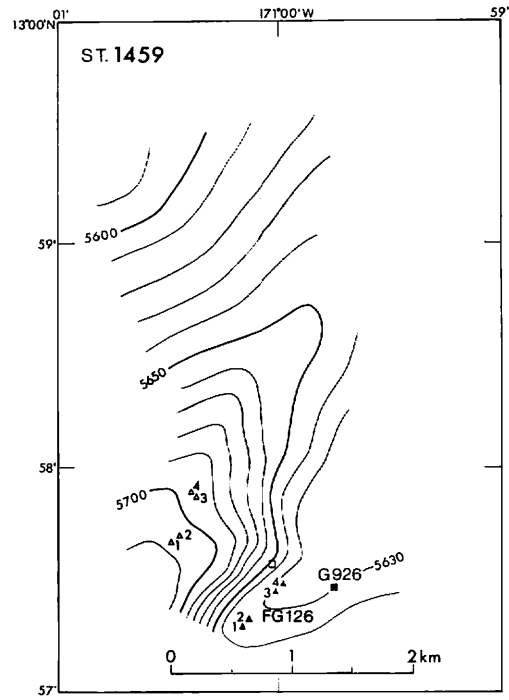
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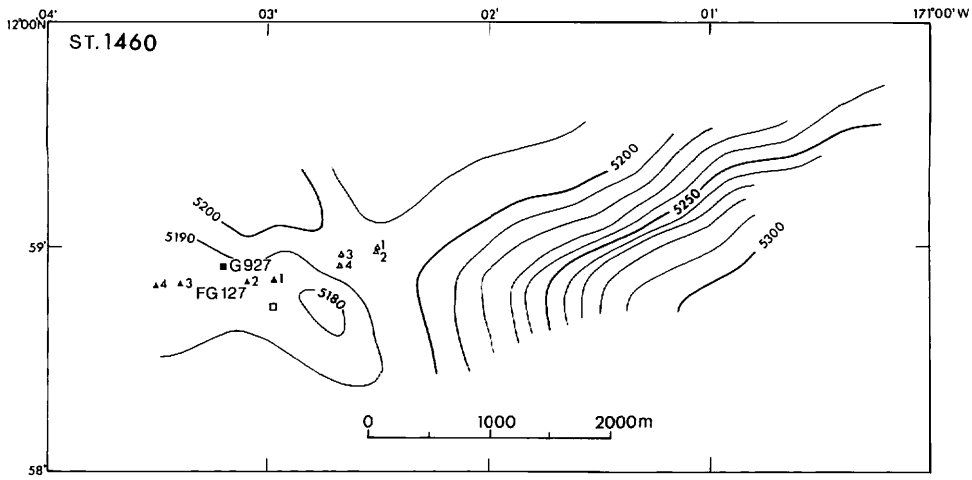
(12)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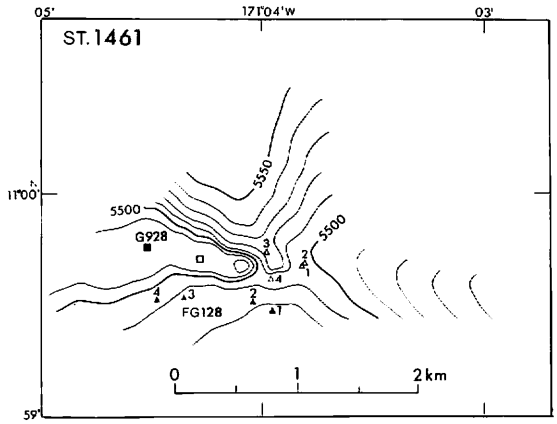
(13)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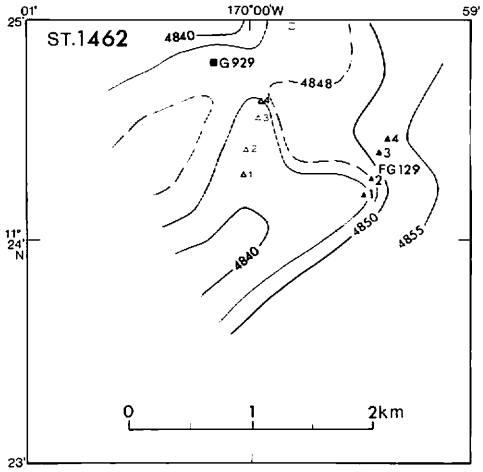
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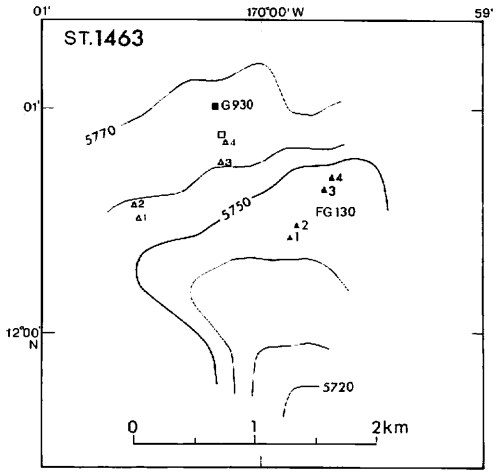
(15)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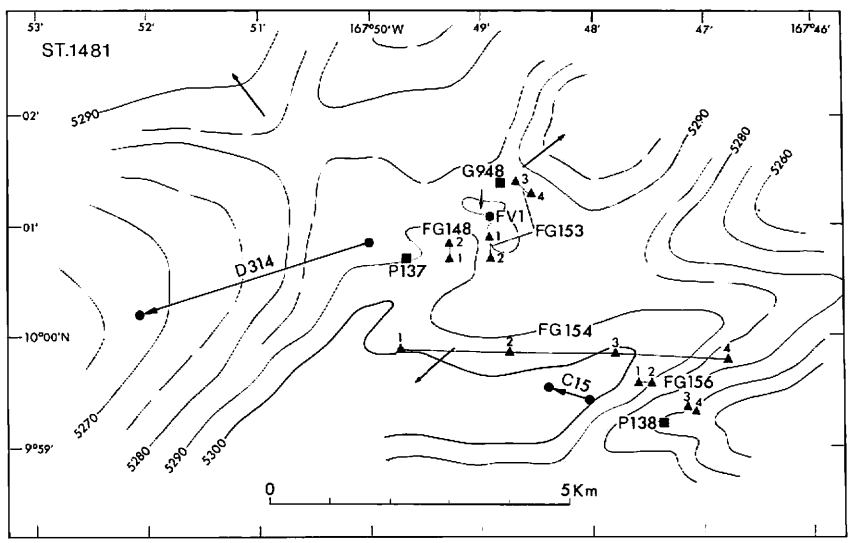
(16)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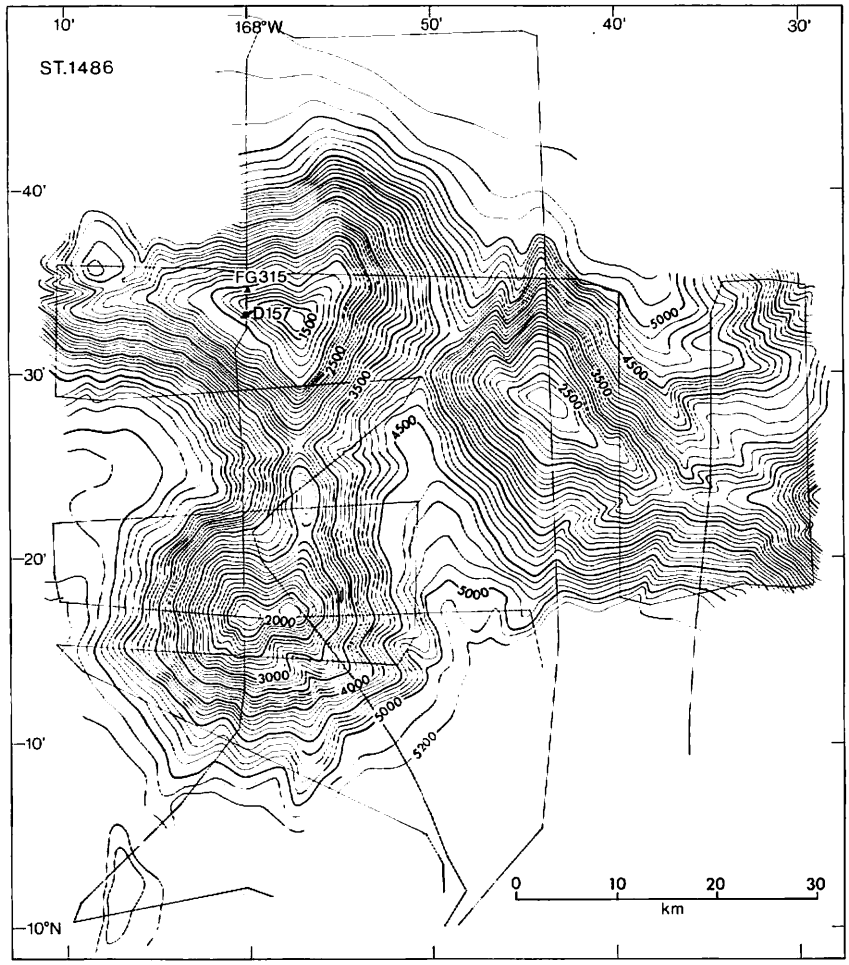
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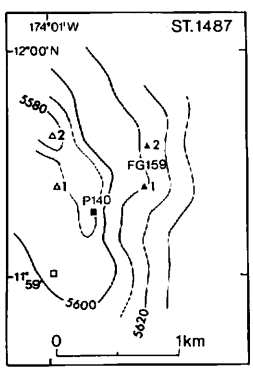
km

(18)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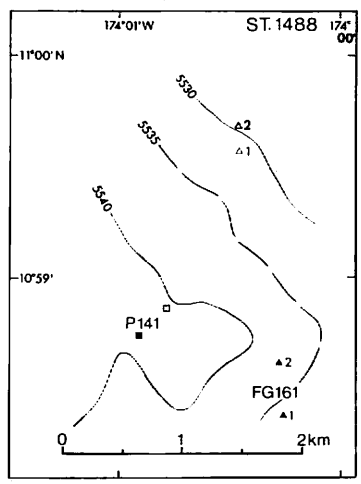
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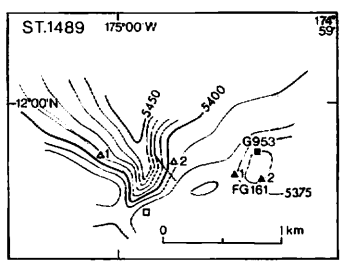
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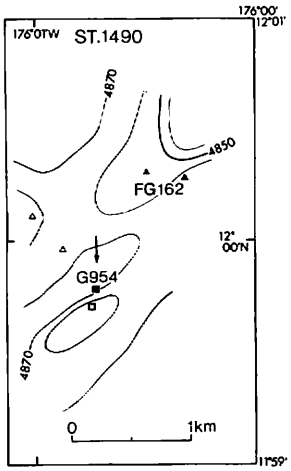
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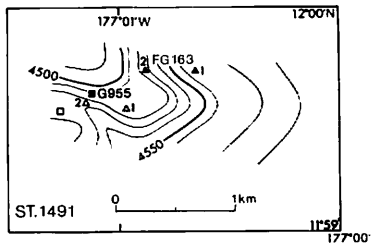
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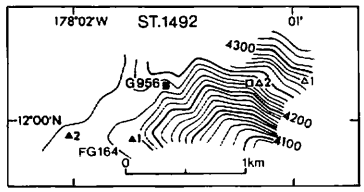
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