GEOMORPHOLOGY OF IZU-OGASAWARA ARC AND TRENCH

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The area surveyed includes three parallel ridges and a deep sea trench running in a N-S direction. The ridges construct the Izu-Ogasawara Arc. In order to understand the topographical characters of the arc-trench unit a bathymetric survey was carried out on three traverses across the arc-trench system and a longitudinal traverse along the Nishi-Shichito Ridge which had been little surveyed previously. The survey equipment used was the Precision Depth Recorder (NEC, model NS-16, 12 kHz frequency).

The followings are brief descriptions of geomorphology, based on the profiles obtained by the surveys.

1. Nishi-Shichito Ridge

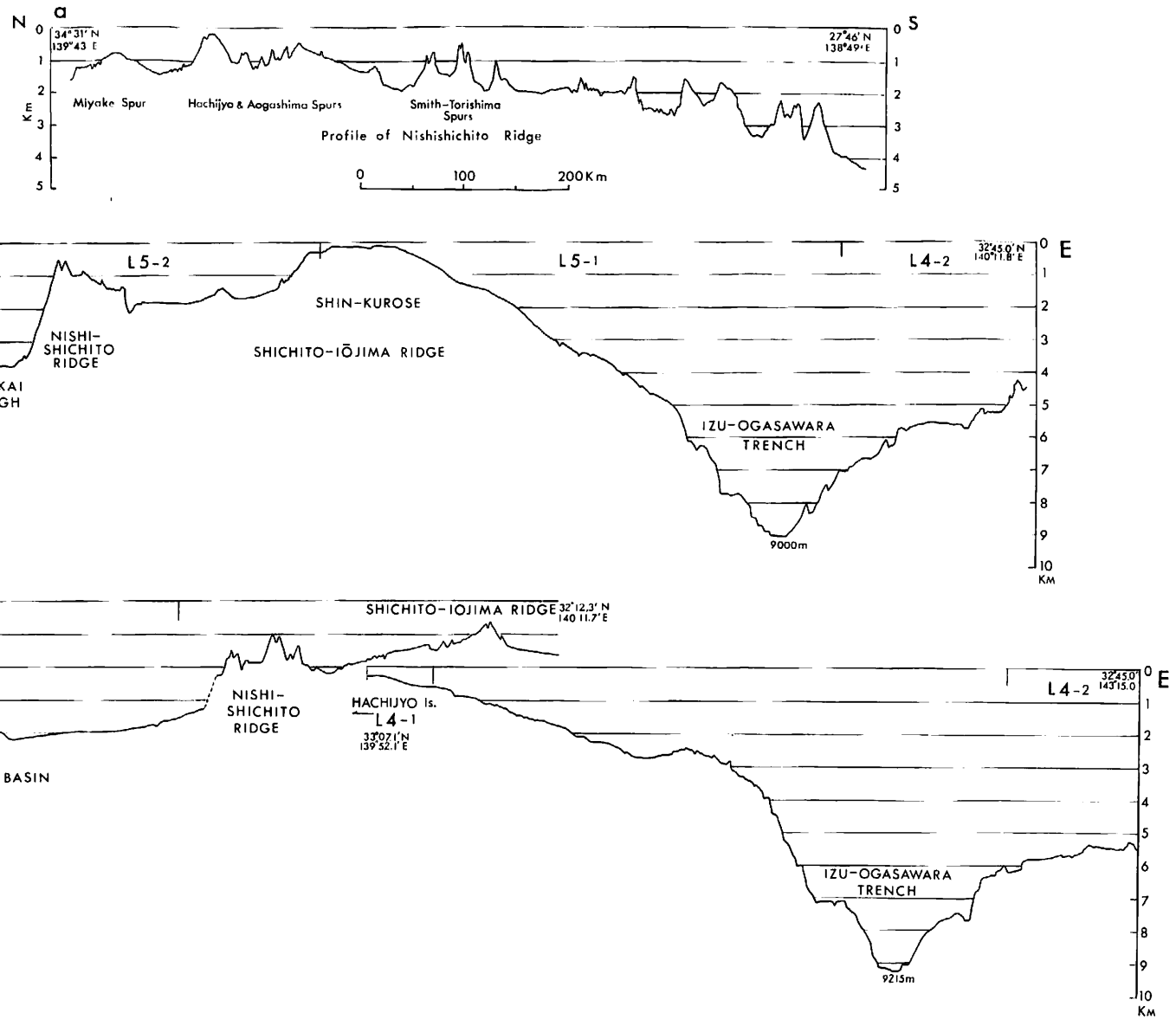
A longitudinal profile of the Nishi-Shichito Ridge along the traverse is shown in Fig. 13-a. The depth of the ridge becomes greater from north to south. The ridge has an irregular profile; there are some topographical features of steep depressions, terraces, steps and small hills. Depressions are observed near the Hachijyo and Aogashima Spurs, between the Smith and Torishima Spurs and near the southern margin of the profile. These depressions are somewhat similar to grabens in form. South of the Torishima Spur a terrace occurs at a depth of 2,000 m. The terrace is probably correlated with the deep sea terraces off the southwestern coast of Honshu with regard to their respective depths. Two small benches are found on the slopes of the hills at 1,200 m and 1,600 m.

Cross-sections of the ridge are shown by the traverse lines 1–1, 2–2, 3–3 and 5–2 in Fig. 13-b, c, d and e. These sections traverse the axis of the ridge at right angle or obliquely and the profiles show a much more irregular topography than those of the Shichito-Iojima and Ogasawara Ridges. The irregularity of the Nishi-Shichito Ridge may reflect a more complicated tectonic history than those of the other ridges.

A rock fragment similar to the rocks of the Miocene green tuff series was obtained at Station 40 on the ridge and thin younger sediments cover the ridge. From this evidence it is considered that the Nishi-Shichito Ridge subsided during young age.

2. Shichito-Iojima Ridge

The Shichito-Iojima Ridge comprises the main part of the Izu-Ogasawara Arc. According to the Bathymetric Chart of the Adjacent Sea of Nippon, Sheet II published by the Maritime and Safety Agency, the northern half of the ridge is broad whereas the southern half is narrow. The profiles of the northern half of the ridge along traverse lines L3, 4 and 5 are illustrated in Fig. 13-c and b. In these profiles, the eastern flank of the ridge is a broad, smooth and gentle slope, which continues eastwards to the steep wall of the trench. The western slope of the ridge is short and irregular. A small basin at the depth of 2,100 m lies between the ridge and the Nishi-Shichito Ridge. On the top of the Shin-Kurose Bank between the Miyake and Hachijyo islands two benches are found at 130 m


a
N
S
34°31'N
139°43'E
27°46'N
138°49'E
Km
Miyake Spur
Hachijyo & Aogashima Spurs
Smith-Torishima Spurs
Profile of Nishishichito Ridge
0 100 200Km
b
W
E
33°51.0'N
137°50.5'E
L5-2
L5-1
L4-2
32°45.0'N
140°11.8'E
SHIN-KUROSE
NISHI-SHICHITO RIDGE
SHICHITO-IŌJIMA RIDGE
NANKAI TROUGH
IZU-OGASAWARA TRENCH
9000m
Km
c
W
E
31°30.3'N
136°56.0'E
L3
SHICHITO-IOJIMA RIDGE
32°12.3'N
140 11.7'E
NISHI-SHICHITO RIDGE
HACHIJYO Is.
L4-1
33°07.1'N
139°52.1'E
L4-2
32°45.0'
143°15.0
SHIKOKU BASIN
IZU-OGASAWARA TRENCH
9215m
Km

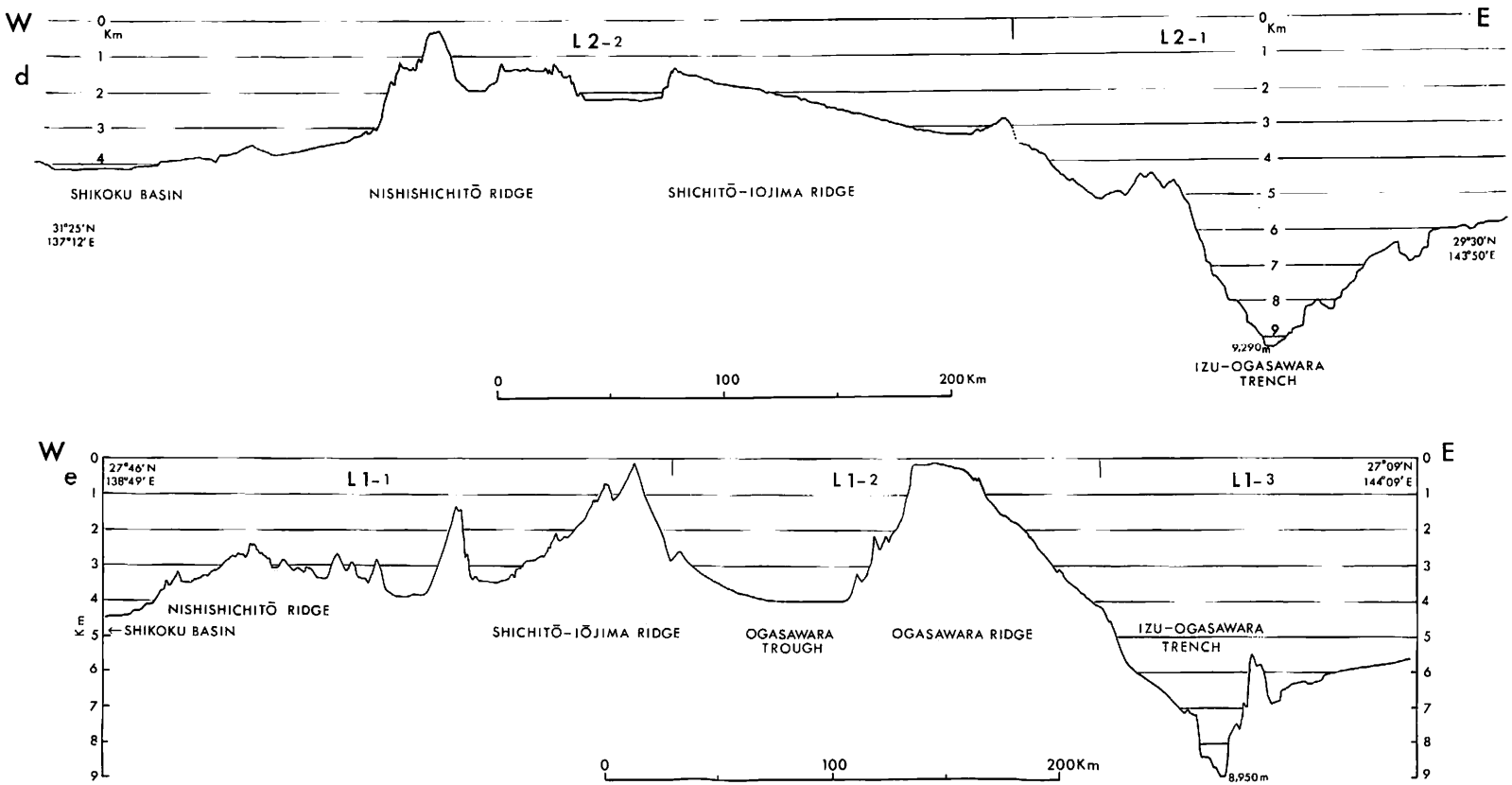


Fig. 13 Bathymetric profiles of the Izu-Ogasawara Arc and Trench.

and 250 m (Fig. 13-b).

The profile along traverse line L2 running across the central part of the area, the ridge is not so prominent and is separated from the Nishi-Shichito Ridge by a flat depression at 2,200 m. The long and gentle slope of the east side of the ridge is interrupted by a small hill at a depth of 2,800 m. There are other hills several hundreds of metres in height at the junction of the eastern slope and the slope of the trench. These hills may be northern extension of the Ogasawara Ridge. The traverse line L1 across the southern part of the area runs about 1 km south of Nishinoshima Island and the traverse line L1-1 is the profile of the island. In these profiles the ridge is separated from the other ridges by distinctive basins at depths of about 4,000 m and the eastern slope is smooth in contrast with the somewhat irregular western slope. The asymmetric profiles of the ridge infer that the ridge was tilted eastward after its formation.

3. Ogasawara Ridge

The Ogasawara ridge runs parallel to the Shichito-Iojima Ridge in the southern part of the area surveyed, but does not continue to the east side of the latter in the northern part of the area. The northern margin of the Ogasawara Ridge is cut by a broad valley which extends from the trench.

The traverse line L1 shows a typical profile of the ridge. The western slope of the ridge is steep and irregular and has a graben like topography. The eastern slope has a gentle inclination and is smooth up to a depth of 4,000 m. This asymmetric topography is common to the Shichito-Iojima Ridge.

The Ogasawara Basin between both the ridges has a smooth bottom at a depth of 4,000 m. The bottom is nearly horizontal in the eastern part of the basin, while it slopes to east in the western part. It is assumed that the slightly inclined bottom consists of a deposits derived from the Shichito-Iojima Ridge.

From the profile data of the three ridges, it is concluded that the Izu-Ogasawara Arc is a block gently tilted eastward and that the arc is characterized by graben and horst structures.

4. Izu-Ogasawara Trench

Profiles of the trench are shown in the traverses L2-1, L1-3, L4-2 and L5-1. The maximum depth recorded in the profiles is 9,290 m. The trench bottom is very narrow and flat.

The profile of the trench is asymmetrical. The western slope of the trench is steep from the bottom to depths of between 4,000 and 5.000 m. On the slope some terraces are present. The terraces at a depth of 7,100 m shown in traverse line L1-3 and L4-2 and these at a depth of 7,700 m in the figure of L4-2 are notable.

The eastern slope of the trench is very irregular and has a graben-like topography. It continues to the sea floor of the Northwestern Pacific at depths of 5,500 to 6,000 m. On the shoulder of the eastern slope small seamounts or hills exist. The profile of the traverse line L1-3 shows a small depression east of a hill which is assumed to be the upper channel of a valley extending to the trench bottom.