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II. PRELIMINARY RESULTS OF SEISMIC PROFILING SURVEY OF THE SAGAMI AND SURUGA TROUGHS AROUND THE IZU PENINSULA

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Introduction

The surveyed area is the western margin of the Sagami Bay and the Suruga Bay around the Izu Peninsula (Fig. II-1, II-2). The peninsula is the northern margin of the Izu-Ogasawara volcanic arc on the Philippine Sea plate, and colliding and intruding into Honshu arc. The collision zone is structurally complicated, and partly covered by Quaternary volcanoes. Several models have been proposed to interpret the collision tectonics, and agreement has not been reached. There is a seismic gap in the Suruga Bay and offshore of the Tokai district, and may be attacked by a large earthquake in the near future. Detailed geologic structure of this area has not been studied and the relation between active faults and the earthquake have not discussed. The purpose of the survey was to clarify offshore tectonics and active structure in this area.

The area is divided into three areas based on structure, and brief description for each area is given in this report. A marine geological map will be published based on detailed interpretation of the profiles and samples collected by this survey.

Seismic survey system

Seismic profiles were acquired by single-channel and 48-channel systems. Survey lines are 2 miles apart for NW-SE trending lines and about 4 miles for NE-SW lines (Fig. II-2). Most of the lines were surveyed with a single channel system and multi-channel survey was conducted only for restricted areas. Sub-bottom profiler (3.5 kHz), PDR (12 kHz), proton geomagnetic meter and gravity surveys were conducted during the seismic survey.

The single channel system is composed of a GI gun and a hand-made hydrophone streamer. The ship speed was 10 kts during the survey. The data was recorded with a line scan recorder along with a digital data recorder. The multi-channel survey was conducted at 4 kts and two GI guns were used for seismic source. The digital data of both single and multi-channel seismic surveys were processed by a workstation based seismic data processing system to improve their quality.

The western margin of the Sagami Bay

The western margin of the Sagami Bay can be divided into northern and southern parts by the E-W trending Manazuru knoll (Fig. II-2). The northern part is mainly

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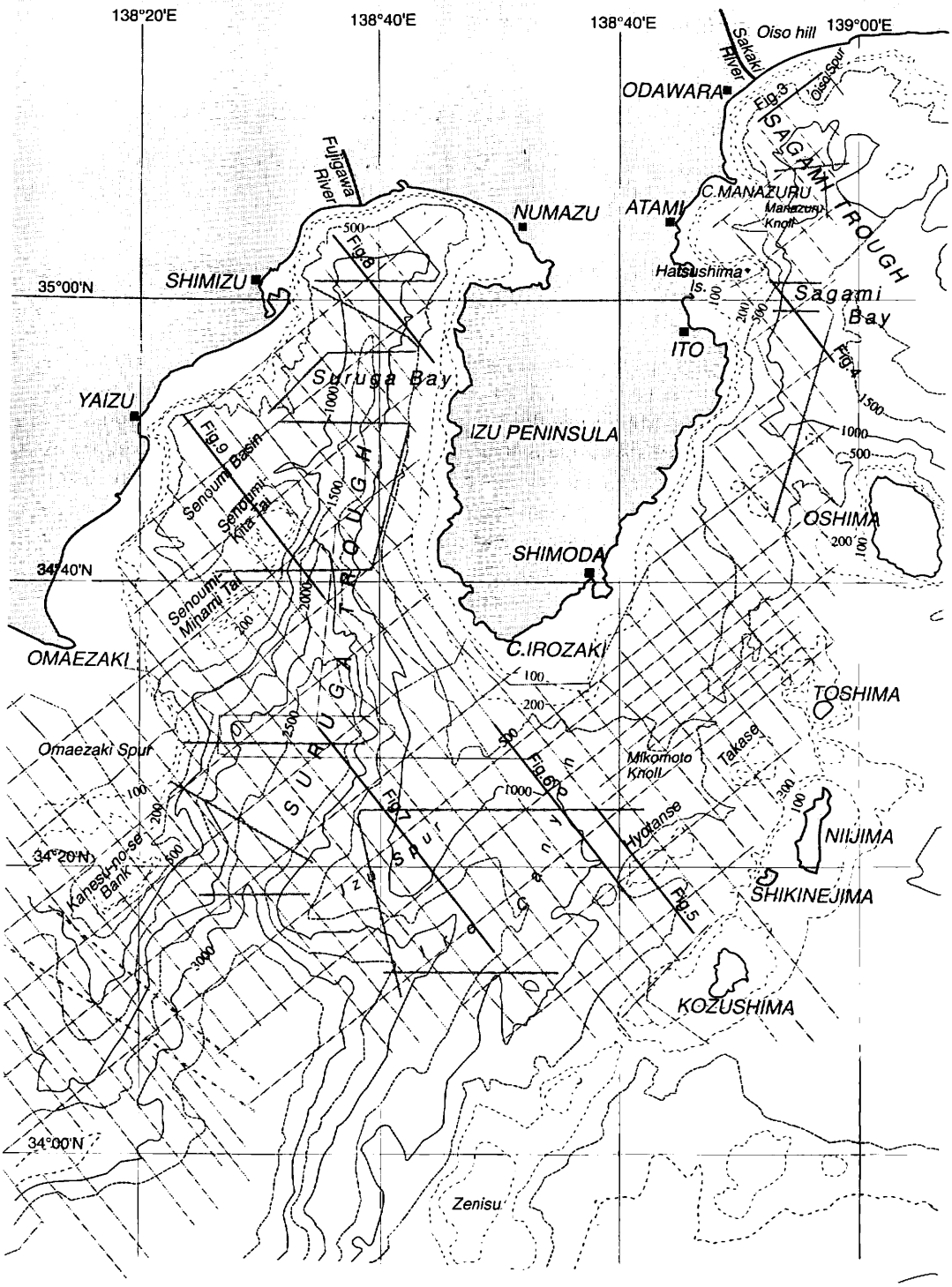

Fig. II-1 Single channel seismic survey lines (thin grid lines) and multi-channel seismic survey (thick lines and dashed lines) around the Izu Peninsula and Suruga Trough.

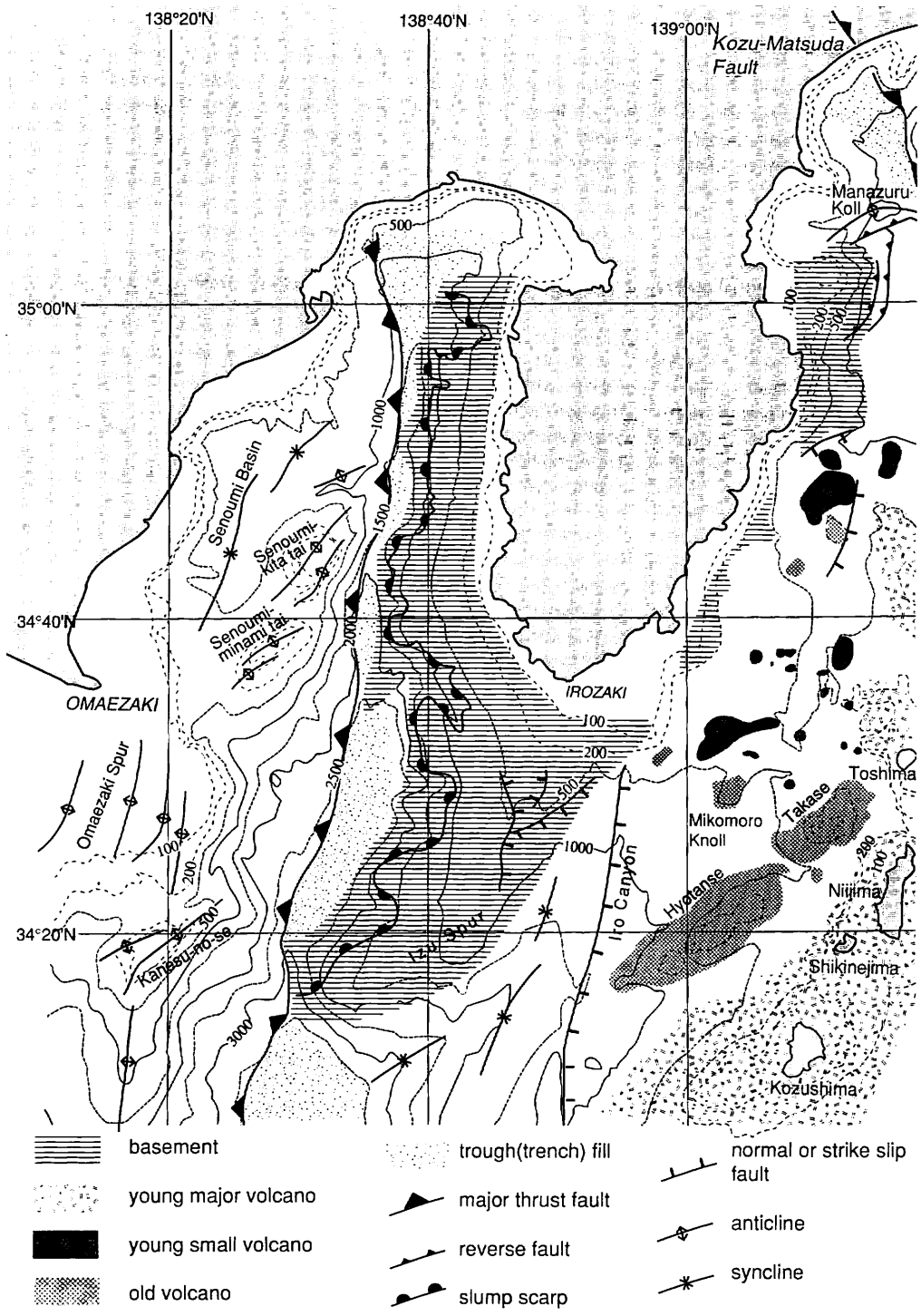

Fig. II-2 Structural map around the Izu Peninsula and the Suruga Trough.

occupied by the NNW trending 6 km wide depression between topographic highs to the east and west. The depression which is a NW extension of the axial channel in the Sagami Trough is underlain by delta slope sediments supplied by the Sakaki River more than 0.6 s in thickness (Fig. II-3). The western high is composed of basement with thin sedimentary cover and forms a bulge to the east of the Cape Manazuru. The eastern high composed of sediments shows a plateau like morphology. The western margin of the eastern high is bounded by a linear and continuous fault scarp. The plateau and the scarp continue onshore to the Oiso Hill and the Kozu-Matsuda Fault to the northwest.

Okochi (1990) interpreted that the Manazuru knoll is a structural ridge accompanied by a thrust that is a western branch of the major thrust of the plate boundary in the Sagami Trough. Multi-channel seismic profiles have clearly shown that this ridge is an asymmetric anticline above a thrust. The ridge continues to a basement high including Hatsushima Island changing its trend to southwest and south. There is a small basin to the north of the Hatsushima Island.

The southern part is divided into a landward slope and a floor of the Sagami

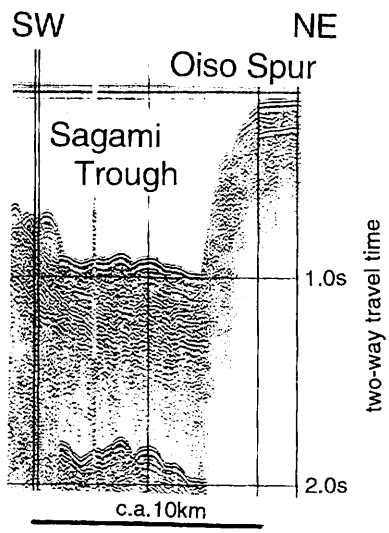

Fig. II-3 Seismic profile of the delta slope in front of the Sakaki River. The steep slope between the Sagami Trough and the Oiso spur is presumed to be an active fault which is continuous to the Kozu-Matsuda Fault.

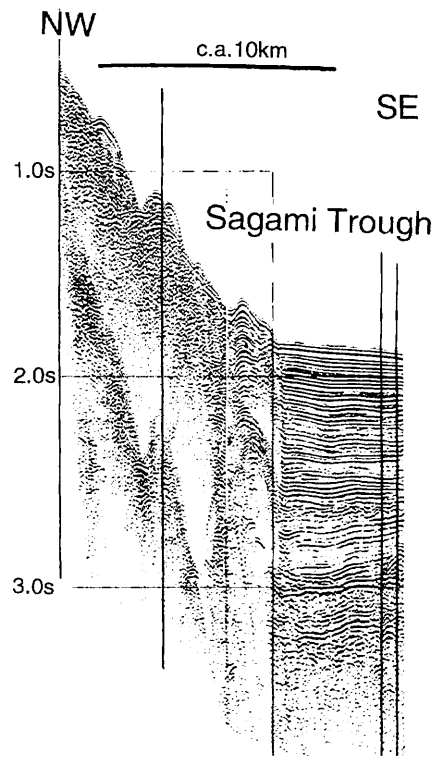

Fig. II-4 Seismic profile of the western slope and floor of the Sagami Trough. West-up fault bound the western margin of the Sagami Trough floor.

Trough. The slope consists of basement forming a seaward bulge from Hatsushima Island to latitude 34° 52′ N for 21 km. The base of the northern part of the slope is bounded by an N-S trending east-down-thrown reverse fault that continues from the Manazuru knoll to the south for 13 km. This fault can be correlated to the west Sagami fault (Nishi-sagami-danretsu) proposed by Ishibashi (1988), and the uppermost sediments in the Sagami Trough is deformed by the fault indicating that the fault is active. The floor of the Sagami Trough is nearly horizontal at 1,100-1,300 m deep, and the sediments up to 1.5 s thick cover the basement (Fig. II-4). The sediments thinning to the south and are not distributed to the south of 34° 52′ N.

Southwestern offshore of the Izu Peninsula and eastern part of the Suruga Bay

The Izu Peninsula is a part of the Izu volcanic arc trending north. Major volcanoes on the arc form NE-SW trending volcanic chains. To the southeast of the peninsula, large-scale volcanoes, Izu-Oshima, Niijima and Kozushima Islands and others align in NE-SW direction. A topographic and structural low elongated in NE-SW lies between the peninsula and the ridges. West of the low, the Izu spur and the western slope of the peninsula consist of a tilted and faulted basement high.

The surveyed area includes two major NE-SW trending volcanic ridge. Southeastern ridge includes Niijima and Kozushima islands and the Zenisu ridge, and northwestern one continues from the Toshima Island to the Hyotanse bank through the Takase bank. The seismic profiles show that the northwestern ridge is older than the southeastern ridge (e.g. see Fig. II-5). The depth of the topographic and structural low at the southeast of Shimoda is about 500 m and descends northeast and southwest.

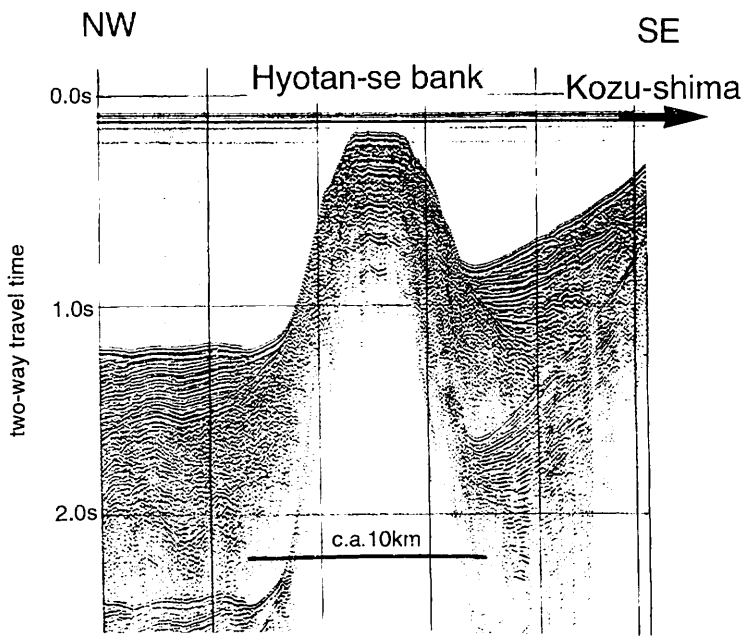

Fig. II-5 Seismic profile of Hyotan-se bank and northern slope of Kozushima Island. Southern flank of the Hyotan-se bank is covered with sediments from Kozushima Island.

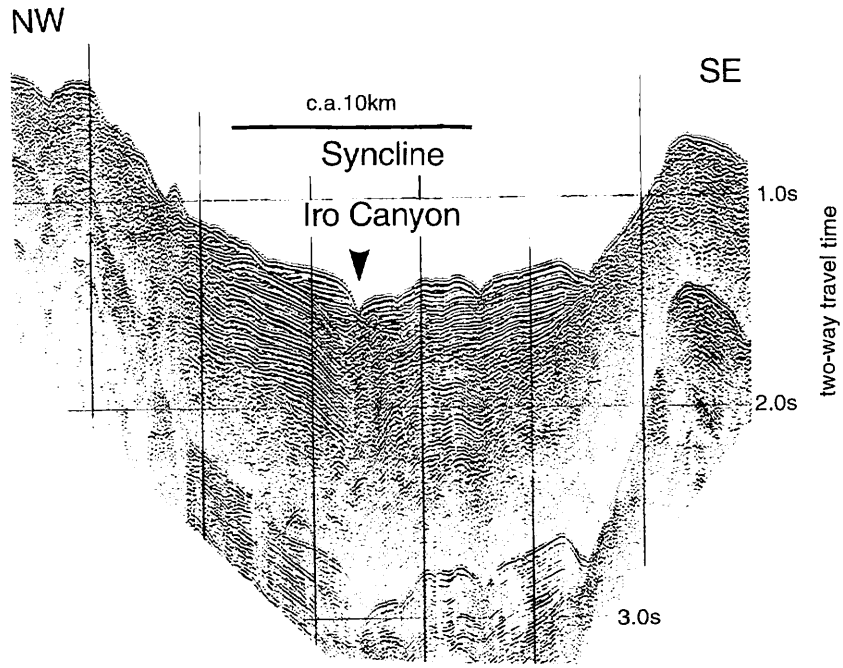

Fig. II-6 Seismic profile of the syncline to the south of the Izu Peninsula and a canyon underlain by a fault.

There are many small volcanic cones in the low to the east of the Mikomoto knoll. The cones can be grouped into young and old cones. The Mikomoto knoll and other a few knolls are old volcanic cones and the other knoll are young.

To the southwest of the Mikomoto knoll, the topographic and structural low is a 10-15 km wide syncline plunging southwest and continues to the Nankai Trough. A fault traverses the syncline and continues to the south from SSW of the cape Irozaki for 40 km, and the Iro Canyon runs along the fault (Fig. II-6). The fault apparently shows east-down-thrown offset of 0.2-0.3 s and may include strike-slip component. The western block of the fault emerges to the south of 34° 16′ N as a basement high which continues to the Zenisu Ridge. The thickness of sediments in the syncline attains up to 1.0 s to the east of the fault, while the thickness decrease less than 0.5 s to the west of the fault. Northwestern side of the syncline is a basement high which extends from Izu Spur to the entire western slope of the Izu Peninsula. The boundary between the syncline and the basement high is a NE trending steep slope in which vertical offset of the basement exceeding 1.5 s, and the sediments in the syncline onlap against the basement.

Basement with thin sediment cover less than 0.1 s thick is widely distributed to the southwest to west of the Izu Peninsula. The top of the basement is a smooth wave cut terrace 10-15 km wide and tilting to the west, indicating that the terrace was a part of Izu Peninsula emerging above sea level. Tilted sedimentary sequences of regional and small extent are observed in the fault bounded depression in the basement, indicating that the basement was faulted before the truncation. The western margin of the

basement forms large-scale scarps up to 1.5 s in height trending N-S to NNE direction sub-parallel to the Suruga Trough. Where the slope swells to the trough, the trough becomes narrow. Large-scale collapses widely develop along the scarps, and grow up slope. Some of collapses are connected to canyons incising the slope.

Western part of the Suruga Trough

This area can be divided into the Suruga Trough, structural highs and a basin. The width and sediment thickness of the Suruga Trough varies along the trough, and the variety largely depends on the morphology of the basement to the west of the Izu Peninsula. In the northern end of the trough, north of 35° 02′ N, the trough is 10 km wide and underlain by delta slope sediments 0.7-0.8 s thick of the Fujigawa River. To the south, the trough floor is less than 2 km in width for about 45 km. Between 34° 45′- 37′ N, the trough shows V shaped canyon without flat floor. The trough widens more than 6 km between 34° 20′- 34′ N and is filled by sediments up to 0.6 s

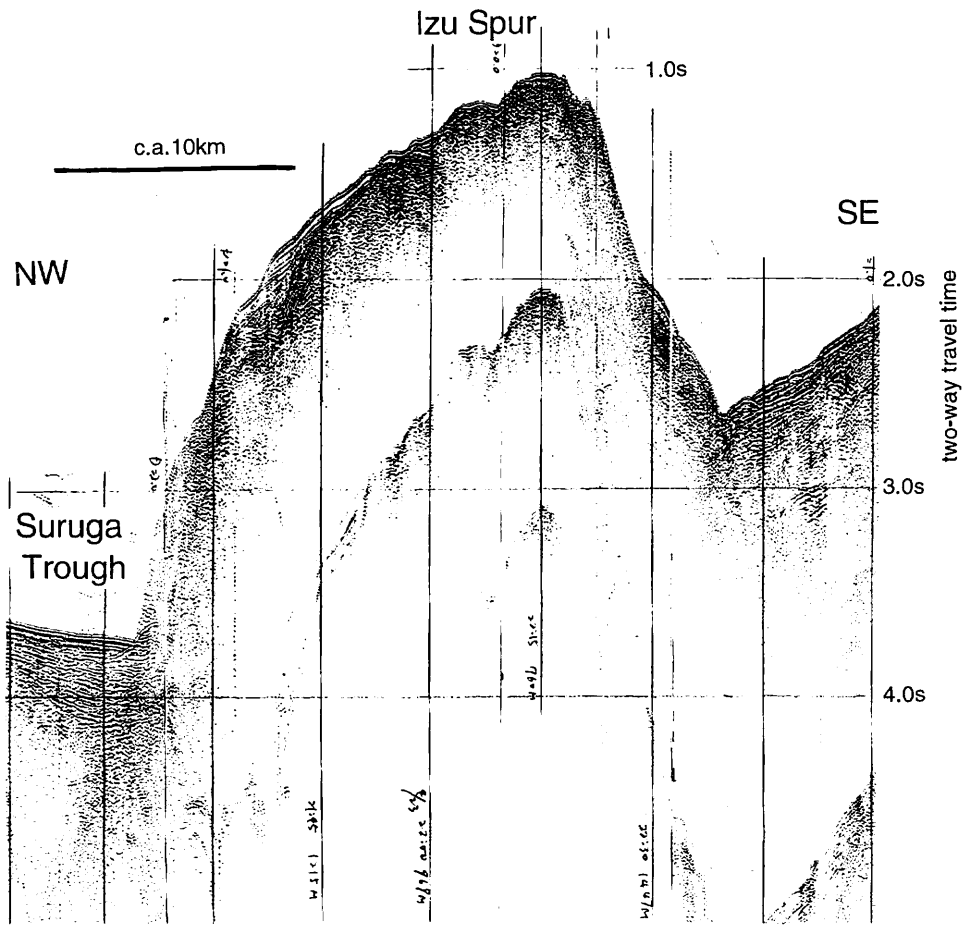

Fig. II-7 Seismic profile of the Izu Spur. The spur is composed of basement high and its eastern and western margins are bounded by steep and large-scale basement offset.

in thickness. The trough becomes narrow because Izu Spur extends into the trough south of the 34° 20′. To the south of the spur, the trough becomes wide and connects to the Nankai Trough.

The Senoumi-kita-tai and Senoumi-minami-tai banks are major structural highs sub-parallel to the Suruga Trough and a minor high has grown under the sea bottom to the north of the banks. These highs are NE trending 15 km long anticlinorium and lie in sinistral en echelon arrangement. The top of the banks are truncated flat surfaces about 50 m in depth and their northwestern slope is underlain by NE dipping reflections. The southeastern slopes are very steep up to 2,000-2,500 m high form the Suruga Trough. The slopes include small-scale terraces in places and no coherent reflections are observed under the slope, except the lower slope to the south of the Senoumi-minami-tai bank. The basin to the west of the structural highs is about 25 km long and about 10 km wide elongated in NNE direction. The sedimentary sequences are thicker than 0.7 s but its base can not be observed in the seismic profiles.

The Omaezaki Spur is a structural uplift extending to the south of the cape Omaezaki. Its surface is a wave cut terrace about 25 km wide. The Kanesu-no-se Bank

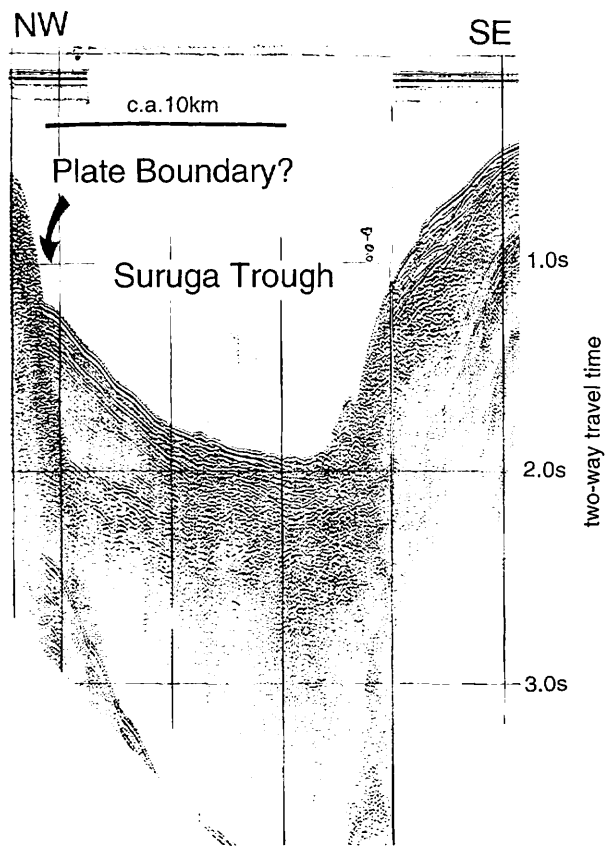

Fig. II-8 Seismic profile of the northern margin of the Suruga Trough. The western boundary of the trough is presumed to be the plate boundary. The eastern slope of the trough consists mainly of basement.

is another structural uplift to the south of the spur. The bank is about 25 km long and 5 km wide. Structure of the Omaezaki Spur is not clear due to lack of coherent reflections and inferred to be composed of three or more anticlines trending in N-S to NNE direction. The western anticlines of them extend to southwest. The Kanesu-no-se bank is an anticline which continues to southwest. Most of the fold axes trends in N-S to NNE in the Omaezaki spur and to the south of the spur, in contrast, the folds trend in NE direction in the Suruga Bay and off Tokai area.

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Okochi, N.(1990) Active geological structures and tectonics in Sagami Bay area.

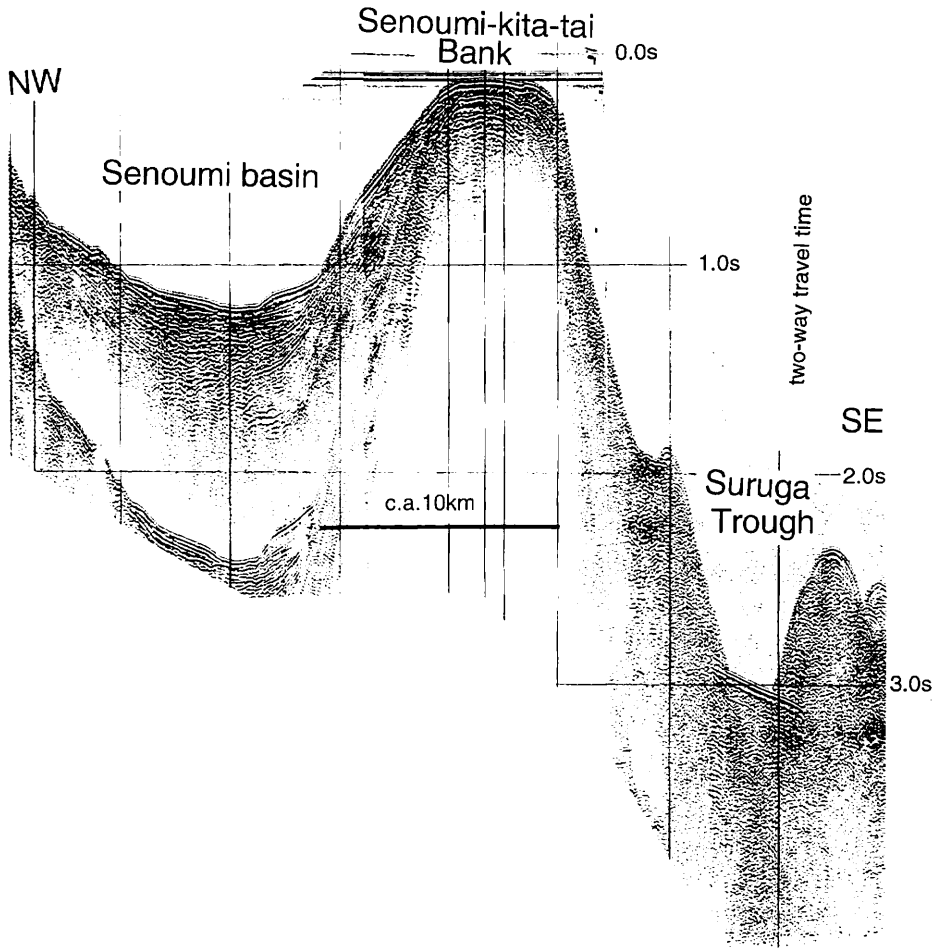

Fig. II-9 Seismic profile of the Senoumi basin, Senoumi-kita-tai Bank and Suruga trough. The Senoumi-kita-tai Bank is an asymmetric anticline, and unconformities under the western limb of the anticline indicate recent rapid uplift of the bank.

Journal of Geography (*Chigaku Zasshi*), **99**, 38-50 (in Japanese with English Abstract).