5. *Observations of the Deformation of the Earth's Surface at Aburatsubo, Miura Peninsula. Part I.*

By Takahiro HAGIWARA, Tsuneji RIKITAKE, and Juhei YAMADA,

Earthquake Research Institute.

(Read April 20, Sept. 21, 1948.—Received April 10, 1949.)

1. The crustal movements of the peninsulas associated with the destructive earthquakes are of great interest in this country. In order to study the secular deformation of a peninsula, the writers began continuous observations of the deformation of the earth's surface at Aburatsubo, near the southern extremity of the Miura Peninsula, the situation being shown in Fig. 1. The instruments were installed in a gallery drilled in the Tertiary sandstone in the site of the Marine Biological Station of Tokyo University. The general view of the topography is shown in Fig. 2. The observations were commenced in March, 1948.

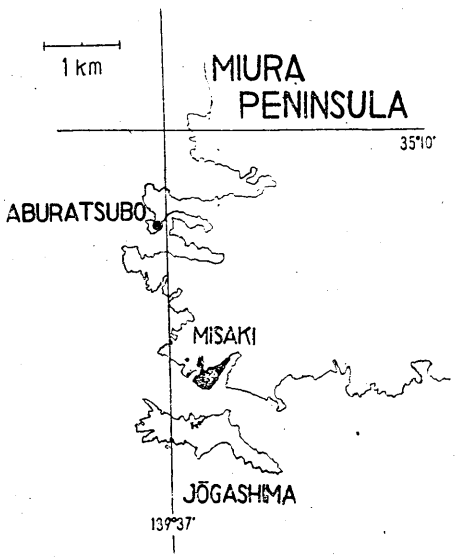

Fig. 1. The map of the southern extremity of Miura Peninsula.

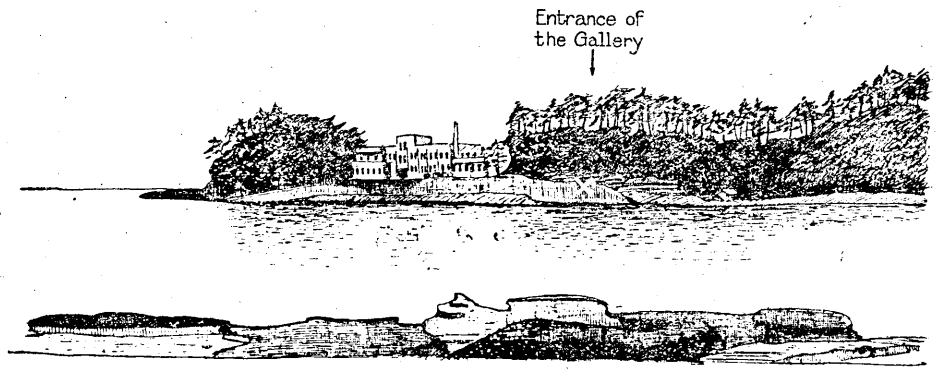

Fig. 2. General view of Aburatsubo sketched from the east-side.

2. A pair of Ishimoto-type all-silica tiltmeters, a pair of water-tube tiltmeters with remote controlling device and the silica-tube extensometers of various types were set up in the gallery as shown in Fig. 3.

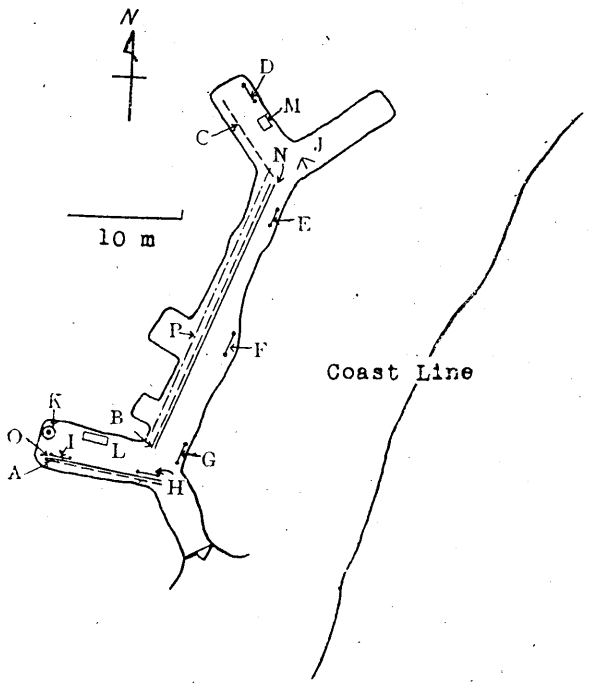

Fig. 3. The plan of the gallery.
A, B, and C: Silica-tube extensometer.
D, E, F, G, H, and I: Silica-tube extensometer, the length of which is 1 m.
J: Silica-tube extensometer for simultaneous recording of three components.
K: Silica-tube extensometer for vertical component.
L and M: Ishimoto-type all-silica tiltmeter.
N and O: Water-tube tiltmeter.
P: Superinvar-wire extensometer.

The water-tube tiltmeter, as schematically shown in Fig. 4, has water-reservoirs at the ends, the head of the water being measured with the micrometers with a sharp platinum-point. The moment at which the micrometer touches the water-surface is detected electrically with a neon-lamp. The change in inclination is obtained from the difference of reading of both ends. The lengths of the tiltmeters are respectively 25m for S22°E component and 10m for E9°S one. As to the remote controlling system, a pair of self-synchronous motors are used. When the observer rotates a dial attached to one of the motors, the micrometer at distant point is rotated synchronously with another motor. According to the results of

the calibration, the errors due to the remote controlling system was found to be negligible.

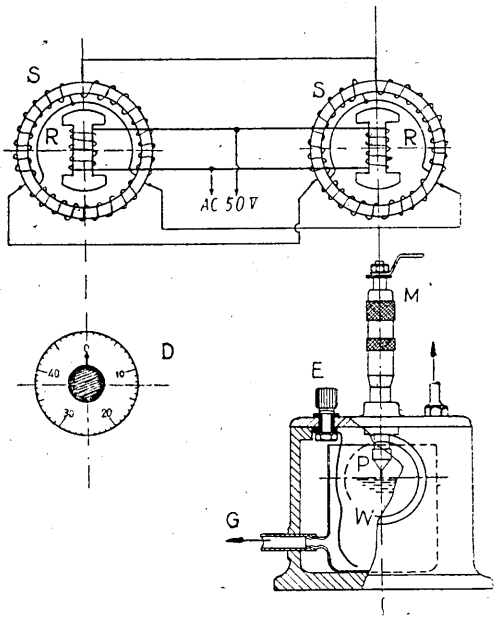

Fig. 4. The schematic view of the main part of the water-tube tiltmeter and the circuit for self-synchronous motors.
S: stater R: rotor D: dial M: micrometer E: electrode
P: platinum W: water G: glass tube.

Two silica-tube extensometers are installed parallel to the tiltmeters, their lengths being the same with those of the tiltmeters. Silica-tubes, 7mm in diameter and 1m in length, are jointed by thin phosphorbronze band and supported on the metal rollers lying on the smooth glass plates. One end of the extensometer is fixed to the concrete-block, the base of which is buried in the ground. Another end is placed on a roller of which the diameter is 6mm, its rotation being magnified with optical lever as schematically shown in Fig. 5. Thus, it is easy to record the relative movement between the tube and the ground with sensitivity of 10^{-7} per unit length.

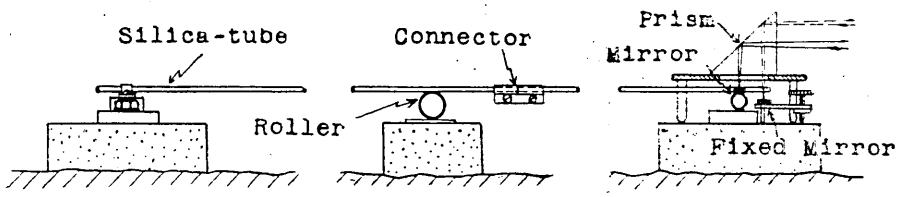

Fig. 5. The schematic view of the main part of the extensometer.

After some months, an extensometer with 8 m's length is added to the direction E65°S. In addition, there were also installed in the gallery a silica-tube extensometer for vertical movement, the short silica-tube extensometers with which the extension of the earth's surface in three directions can be simultaneously recorded on a sheet of paper, and one component of the superinvar-wire extensometer. However, the description in detail of these instruments will be postponed.

3. As already reported by R. Takahashi[1], tilting of the earth's surface caused by tidal loading is remarkable at Aburatsubo. The writers found that the extension and contraction of the earth's surface due to the ocean tide are also very large amouting to the order of 10^{-7}—10^{-6} per unit length. The results of simultaneous observation are shown in Fig. 6. The

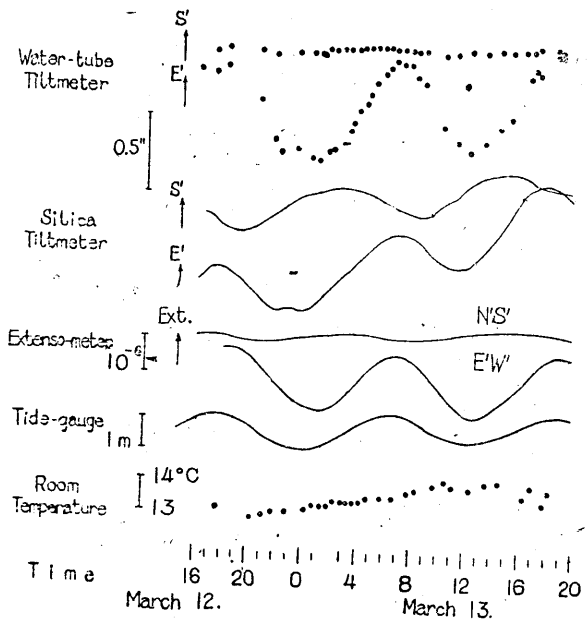

Fig. 6. The results of the simultaneous observations on Mar. 12~13, 1948. N'S' and E'W' denote respectively N22°E and E9°S.

interpretation of the results will appear in due course. As to the secular variation, the discussion will have to await further observation.

In conclusion, the writers express their sincere thanks to late Dr. K. Kikuchi, chief of the Marine Biological Station for his numerous courtesies in course of these studies.

1) R. TAKAHASHI, *Bull. Earthq. Res. Inst.*, **6** (1929), 85.

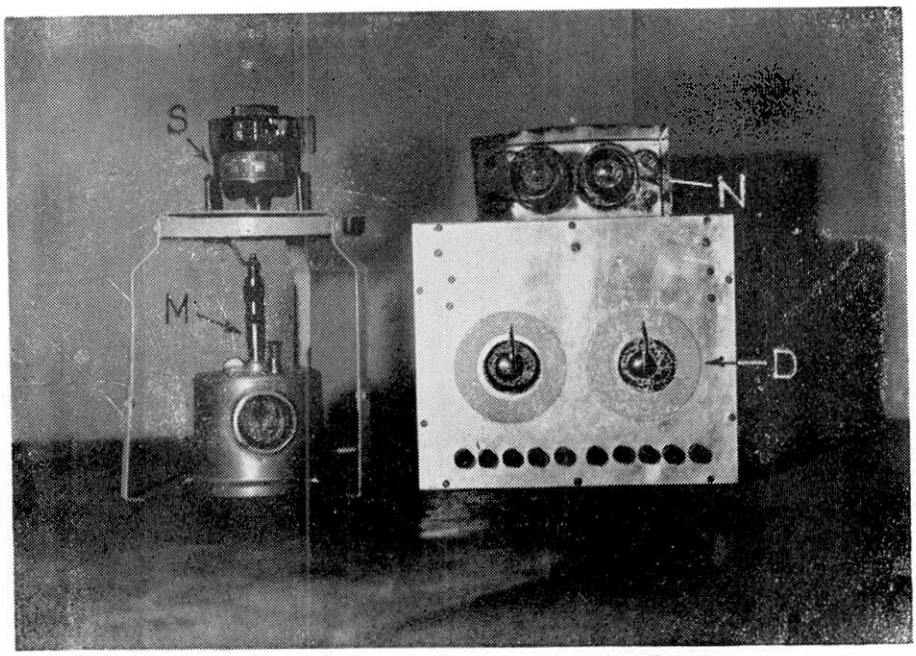

Photo. 1. Remote controlling device for water-tube tiltmeter.
S: Self-synchronous motor. M: Micrometer. N: Neon lamp. D: Dial.

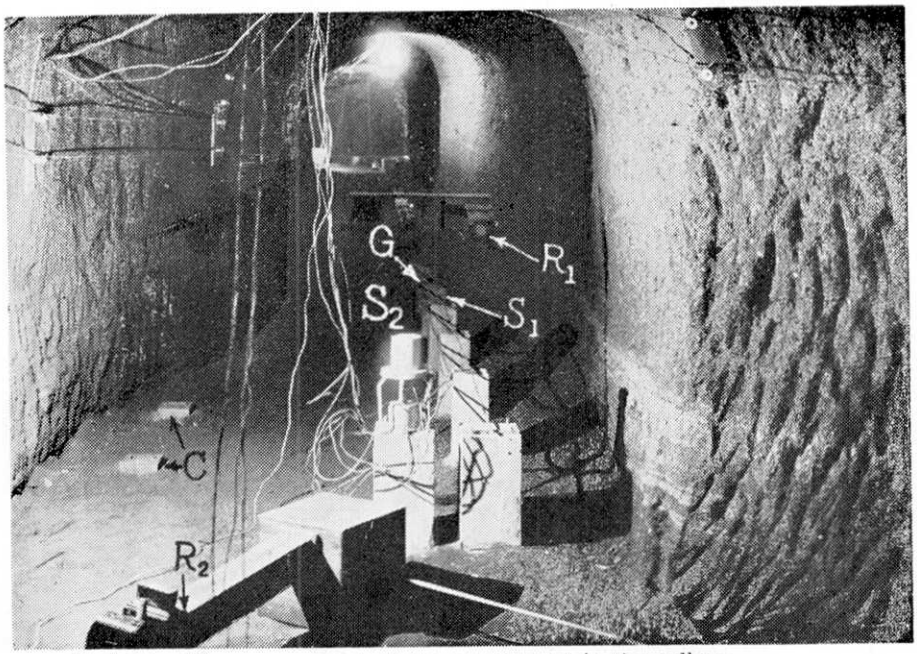

Photo. 2. The arrangement of the apparatuses in the gallery.
R_1: Recorder for superinvar-wire extensometer.
S_1: Silica-tube of the extensometer of N22°E component.
S_2: Self-synchronous motor.
C: Concrete block for 1 m extensometer.
R_2: Recorder for the extensometer of E65°S component.
G: Glass tube filled with water.