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3. *Further Studies of Microseisms by Observation.*

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Observation of microseisms was commenced in Japan by J. Milne early in 1885, however, the nature of microseisms are not clear even now. And now exact observations are required for the study of microseisms at many places on many occasions. The aim of this paper is to publish data on microseisms observed different places.

Tripartite Observations at Shinkawa, Mitaka, Tokyo

Three horizontal seismographs were set in the grounds of the Mitaka Branch of the Transportation Technical Research Institute, which is situated in Shinkawa, Mitaka. Positions of temporary stations in the grounds are shown in Fig. 1. The instruments used for the observations were mechano-optical horizontal pendulum seismographs[1] which were employed in many observations carried out by the writer and others in studies of microseisms. Constants of the seismographs were $T=10$ sec., $V=2000$ and critical damping.

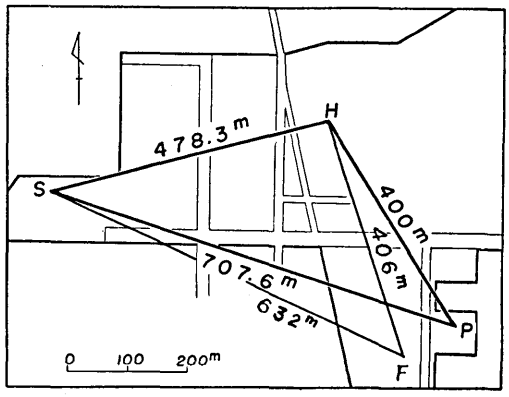

Fig. 1. Observation net in the grounds of Mitaka Branch of the Transportation Technical Research Institute, Mitaka, Tokyo.

The observations were made on the occasions of large microseisms (Fig. 2), and the results are shown in the following diagrams (Figs. 3 and 4).

On Sept. 26 and 27, 1955, a violent typhoon (called Typhoon No. 22 of 1955) was about 800 km from the stations on the southern sea. Air pressure at the centre was about 940 mb. The propagation direction of

1) F. KISHINOUYE, *Bull. Earthq. Res. Inst.*, **20** (1942), 215-219.

the microseismic waves was southerly on Sept. 26 and northerly on Sept. 27. So the results in the first day were favourable for the theory that microseismic waves are generated in the storm area, but those on the next day were the opposite.

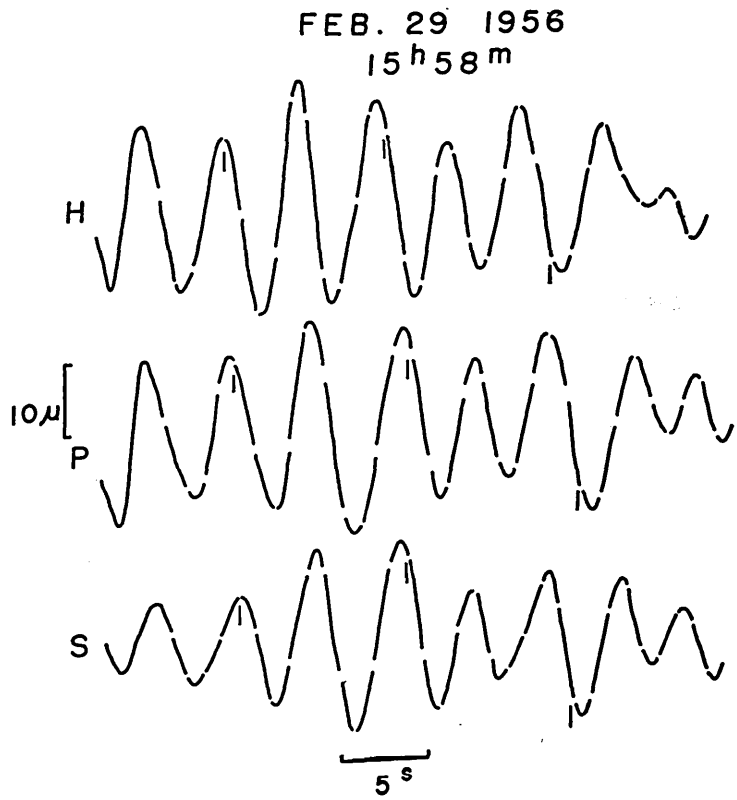

Fig. 2. Tripartite observation at Shinkawa.

On Oct. 27, 1955 the weather conditions were typical for winter in Japan, namely a high pressure air mass covered the eastern Siberia and there was a low pressure over the northwestern Pacific Ocean. Strong northwestern wind blew over the Japan Islands and the sea was very rough around the islands. In this case microseismic waves were propagated from the south east where the sea was very rough.

Throughout Feb. 29 and March 1, 1956, there was a cyclone on the sea northeast of from Japan and a small cyclone on the Japan sea. Microseismic waves were propagated from the south east, and the sea to the southeast was rough.

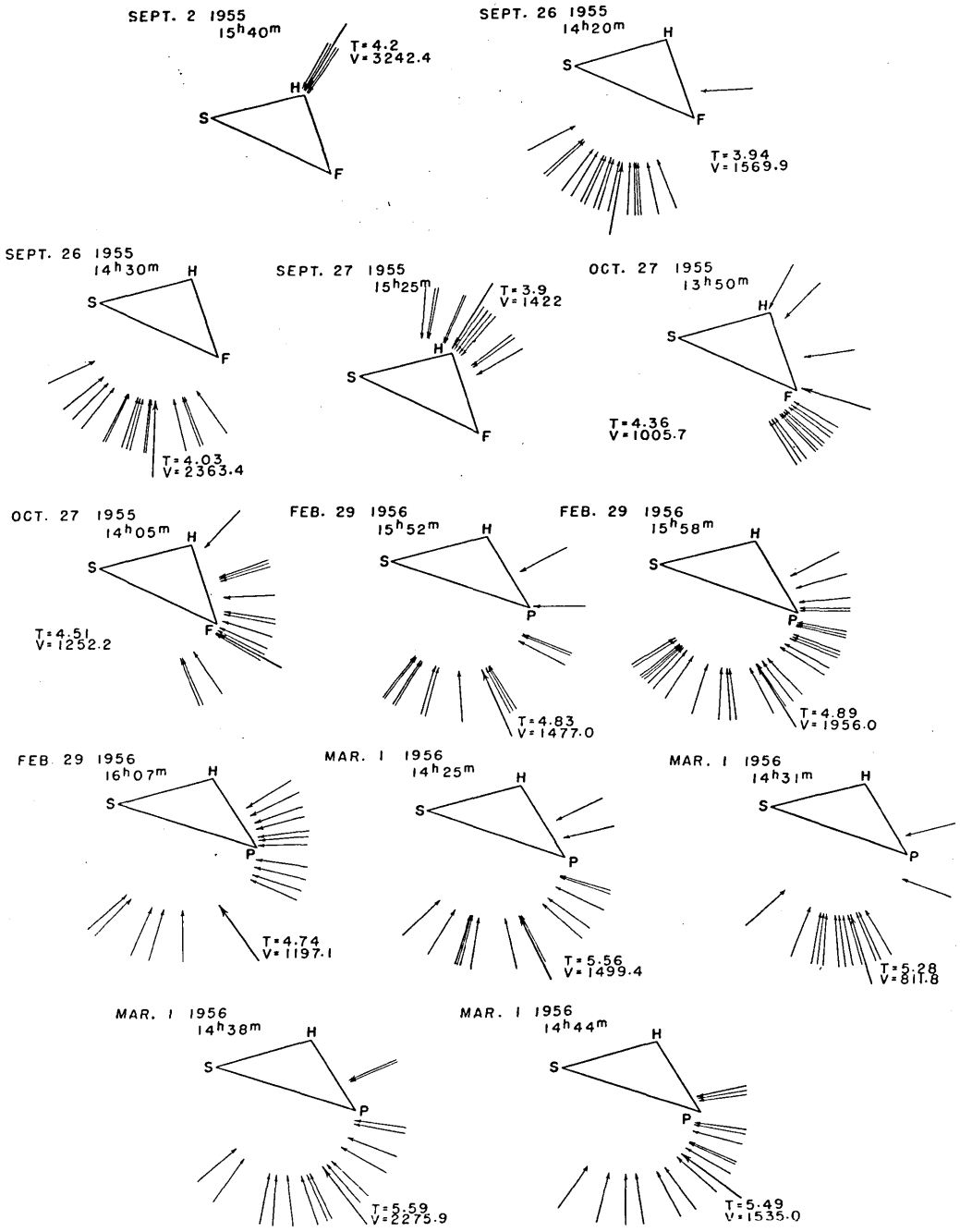

Fig. 3. Results of tripartite observations at Shinkawa.

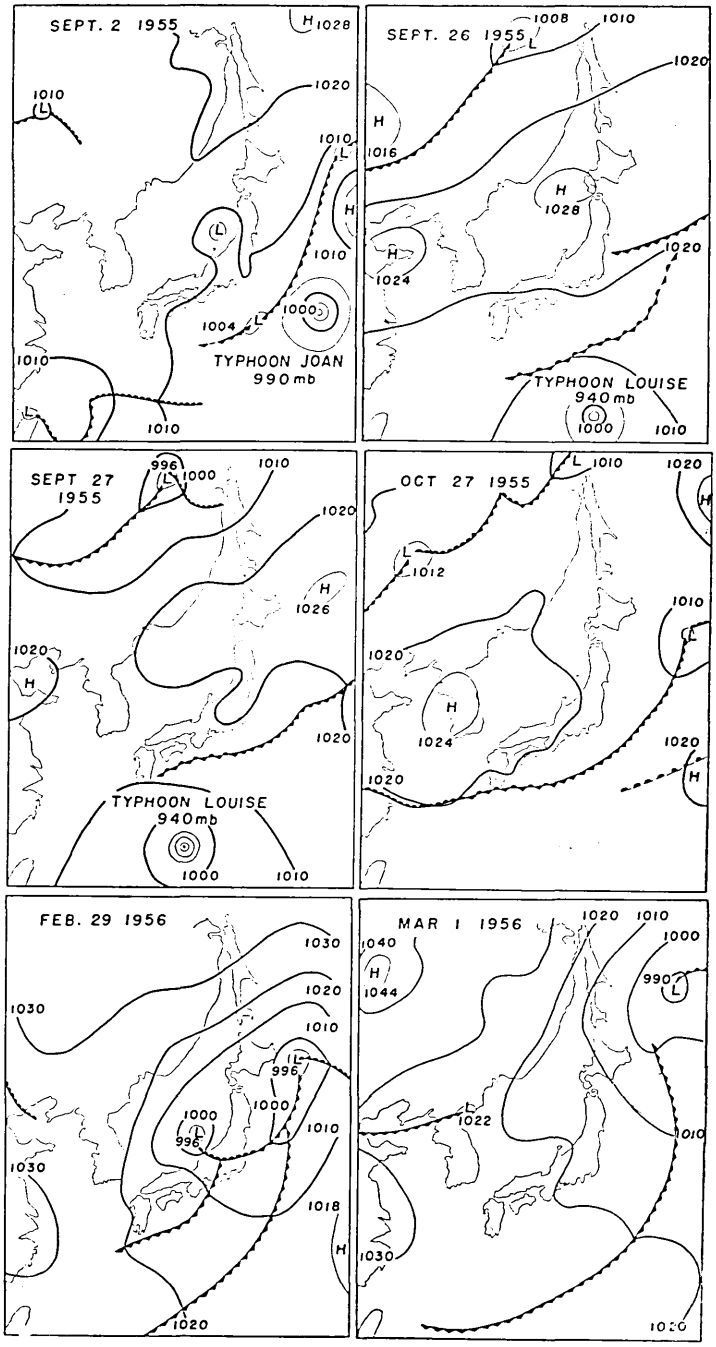

Fig. 4. Weather maps on the observation days.

Other detailed data are omitted now. It may be given as a conclusion that microseisms are surface waves caused by rough sea waves. On the other hand, the direction of microseismic waves prevail to the south at Shinkawa as shown above, but to the northeast at Oosawa, in the grounds of the Tokyo Astronomical Observatory which is situated about 2.5 km west of Shinkawa. From this information on the directions it may by deduced that microseisms are proper vibrations of the ground caused by surface waves propagated from a distant sea-bed.

The periods of vibration and propagation velocity are also shown in the diagrams mentioned above (Fig. 3). The average value of the velocity of propagation was obtained as 1670 m/s. This value is larger than that at Oosawa. In the grounds of the Tokyo Astron. Observatory, the average velocity had been obtained as being about 550 m/s, and the average period of the microseisms was 4.7 sec. at Shinkawa and 4.0 sec. at Oosawa. The velocity at Oosawa was small as compared with that obtained at other places, and the value at Shinkawa may be near to those reported in many papers. Then there was thought to be some error in the observations at Oosawa. The method and instruments were the same at the two places, and observations of the slow velocity were too numerous to be regarded as errors.

The wave lengths of microseismic waves were calculated, multiplying the wave velocity by the period of vibration. The wave lengths were calculated as 7860 m/s at Shinkawa and 2200 m/s at Oosawa respectively. The subsoil conditions at the two places have been surveyed by seismic prospecting[2]. Although both places are covered with soft soil, it is not as deep at Oosawa as at Shinkawa. In another case at Sakata[3] in the North-western area of Japan, the relation between microseisms and subsoil conditions was investigated. In that case microseisms were thought to depend on the subsoil, but the wave length was obtained as constant. So the results in the present paper cannot be explained by the previous theory. The cause of the problem may be the slowness of velocity in the shallow ground surface.

The writer expresses his thanks to the director and members of Mitaka Branch of the Transportation Technical Research Institute for kind help with the observations. He also thanks Miss Mieko Kotaka (now Mrs. Yoshioka), Mr. Yoshio Watanabe and Mr. Hiroshi Takahashi (Mr. Kishi) for their assistance in the observation and arranging of this paper.

2) F. KISHINOUYE, *Bull. Earthq. Res. Inst.*, **35** (1957), 542.
3) F. KISHINOUYE and I. SHIDA, *Bull. Earthq. Res. Inst.*, **37** (1959), 187.

Tripartite Observations of Microseisms at Tateno

For the purpose of obtaining more data about microseisms near Tokyo, tripartite observations were carried out in the ground of the Aerological Observatory at Tateno, Ibaraki Prefecture. It is situated in the Kwantō Plain about 80 km NE from Tokyo. The observations were made in August and September, 1958. This was the International Geophysical Year, then this data may have served as to supplement the world-wide observations.

In the previous studies the writer had used mechano-optical seismographs, and the present observations were made with electric seismographs[4] designed to investigate of microseisms at the start.

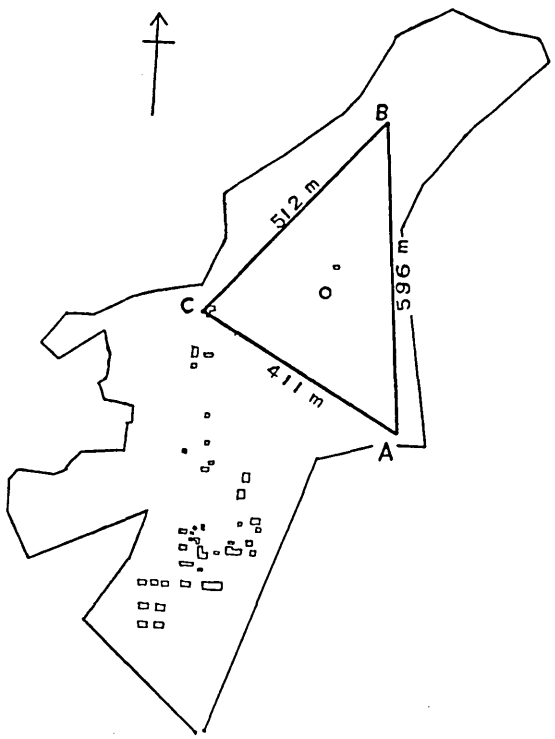

Fig. 5. Tripartite stations at Tateno.

The results of the observations are shown in the inserted diagrams (Figs. 5–8), and it will not be necessary to describe then in detail. As shown in Fig. 7, microseismic waves came mostly from the southeast. The direction of propagation did not point the position of the cyclone centre which in a northerly direction. The mean velocity of propagation was obtained as 1978 m/s, and the average period of vibration 3.67 seconds. The value of velocity is high as compared with those previously obtained by the writer near Tokyo.

The velocity of the microseisms may depend on the subsoil condition as stated before, and to support such an opinion the writer is endeavouring to obtain more data about microseisms by observations at as many places as possible.

4) F. KISHINOUYE and Y. WATANABE, *Bull. Earthq. Res. Inst.*, **37** (1959), 327-335.

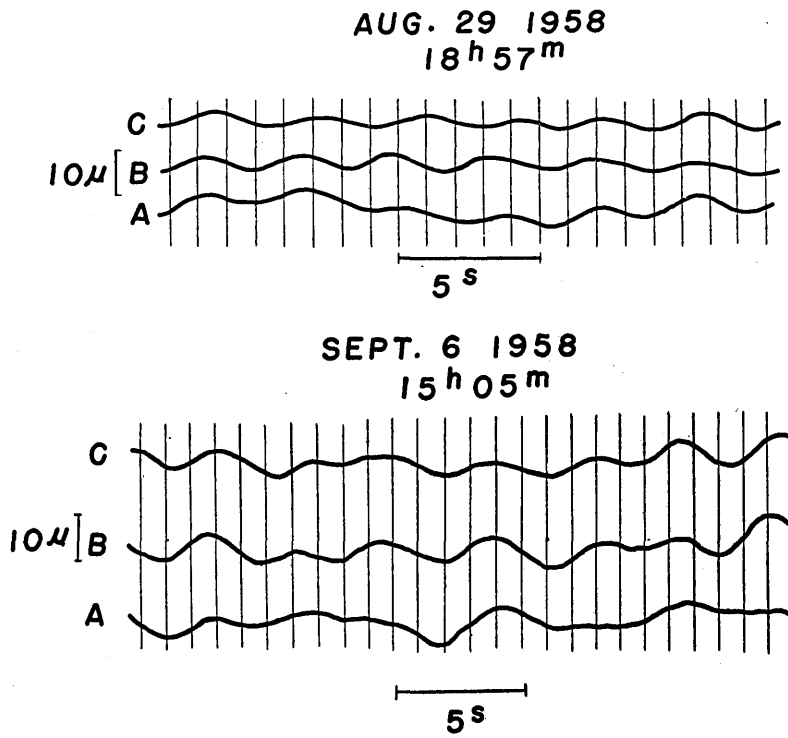

Fig. 6. Tripartite observations at Tateno.

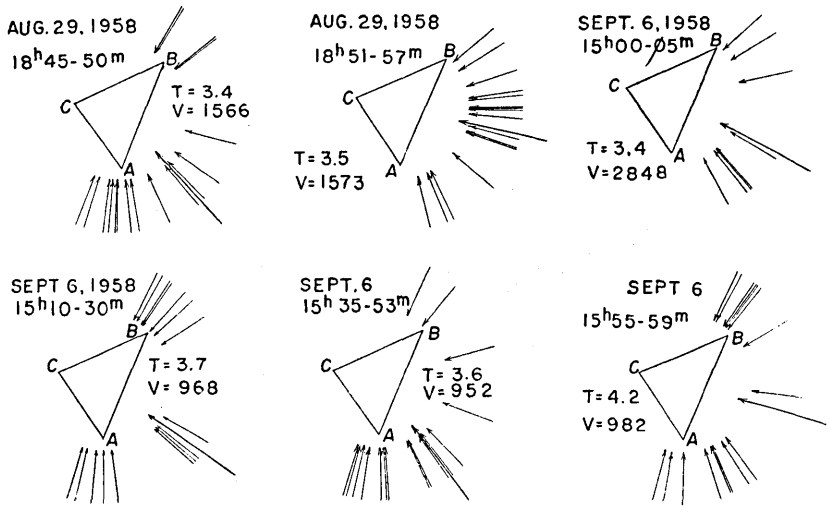

Fig. 7. Results of tripartite observations at Tateno

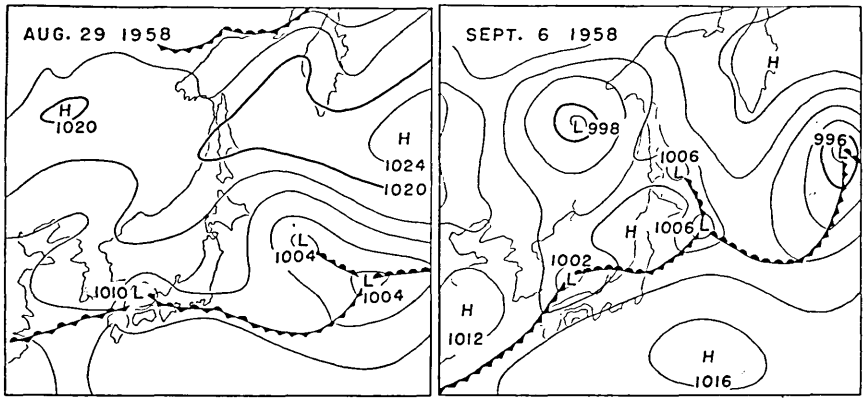

Fig. 8. Weather maps on the observation days.

In conclusion, the writer offers his thanks to Mr. Jirō Kawase, director of the Aerological Observatory, for permission to set up observation in the grounds of the Observatory. He expresses his gratitude to Mr. K. Inami and Mr. Y. Kuroki for their assitance in the observations.

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3. 観測による土地の脈動の研究　続報

地震研究所　岸　上　冬　彦

土地の脈動の研究について多くの論文が発表されているが，まだ解決されていない，今日必要なのは多くの場所で多くの時日に正確な観測結果である．その観点でこの観測結果を見たい．

三鷹市大沢にある東京天文台で，以前，三点観測の結果を発表したが，そこと僅か 2.5 km 東に離れた三鷹市新川にある運輸技術研究所三鷹支所内で三点観測をした．その結果，伝播速度に大差があつた．この 2 カ所の地盤については地震波探査が行なわれてあるが，この速度の差について地質的の差によるかも知れないという程度で数量的の解釈はできてない．

1958 年の地球物理観測年に茨城県館野にある高層気象台の構内において三点観測を行なつた．その結果，東京附近としては大きな伝播速度 1978 m/s を得た．このような大きな値も地盤の影響として考えた．
