REPORT ON THE CHILEAN TSUNAMI OF 1960

By

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Dr. H. Umemura, the architecture division of the Tokyo University, Dr. T. Watanabe, the geological division of the same University, and I were despatched to Chile to investigate the earthquake effects, and to cooperate to the restoration from the earthquake and tsunami disasters. Our investigation trip was very short, being only ten days, nevertheless, it was done very efficiently by the kind arrangements made by the Chilean government. We are very grateful for these arrangements.

Since Prof. Flores and Dr. Steinbrugge had already told about the damage caused by the earthquake vibrations, I'd like to limit my talk to the damage caused by the tidal waves which wielded their powerful influence on the Japanese coast as well as on the Chilean coasts.

Judging from the arrival times of the tsunami front at various localities and the sense of the initial motion of the first wave, observed both in Chile and in Japan, the tsunami seems to have been generated by the sinking of the sea bottom adjacent to the Chilean coast extending from Puerto Saavedra down to Chiloe Island. The sinking of the coast which was observed at several points along the coast from Puerto Saavedra to Ancud may be a part of this crustal deformation. The deformed area may be seen in Fig. 1.

Following photographs show the terrible scenes caused by the present tsunami at several parts of the Chilean coast. Photo 1 is the scene of Puerto Saavedra. Here lived some 3,000 people, but no one lived when I visited there. Only three houses are left. 32 persons were killed and 101 were lost. The height of tsunami was about 8 m. Photo 2 shows the subsidence of the land arround the city of Valdivia. The amount of sinking had been estimated as 1.6 m.

Photo 3 is the scene of Corral, a small village to the west of Valdivia. Here all houses, 800 in number, were washed away. The height of tsunami was about 9 m above m.s.l. 50 persons were killed and 20 lost. Photo 4 shows a part of Ancud, in Chiloe Island. Here 250 houses were washed away and 500 persons were lost. The height of tsunami was about 8 m. At all these places, more or less sinking of the land was noticed.

The long waves of tsunami, generated as mentioned above, were propagated into all parts of the Pacific Ocean, but a large percentage of their energy was concentrated again on the coast of Japan as shown by the refraction diagram in Fig. 2. The thick lines are wave fronts and dotted

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lines trajectories. Fig. 3 shows the record of this tsunami obtained by a special tsunami recorder provided with a band-pass filter. This is installed on a detached island in the North-eastern part of Honshu Island, Japan. Figs. 4 - 6 show the tide-gauge records of the tsunami obtained respectively at Onahama, Hachinohe and Miyako on the Pacific coast of Japan.

Distribution of heights of tsunami above m.s.l. as observed at various tide-gauge stations are given in Figs 7 and 8. The heights are generally large on the NE part of Honshu, gradually diminishing towards Kyushu. Local distribution of these heights has some special feature compared with ordinary near-tsunamis which originate from the vicinity of Japan. This comparison is shown in Fig. 9. This is believed to be due to the long perioded waves of the recent tsunami.

We will next show some of the scene of disasters caused by the tsunami. Photo 5 is the scene of attack of the tsunami waves observed at Kisennuma. Photo 6 show the scene at Onahama harbour. Photos 7 and 8 are respectively the scenes of Onagawa and Kiritappu, Hokkaido. Photos 9 - 11 are parts of Ohunato harbour. Photos 12 - 14 are respectively the scenes of damage at Shiogama, Ishinomaki and Mangoku bridge. This bridge was damaged by scouring. Photo 15 is the scene of the destruction of a low sea wall at Funakoshi, while Photo 16 show the famous sea wall at Taro.

The total damage to the public facilities in Japan amounted to $ 70,000,000. Other damage are not yet estimated but may easily amount to 5 times of that of public works. Total loss of lives were 180 but some 150,000 people were afflicted.

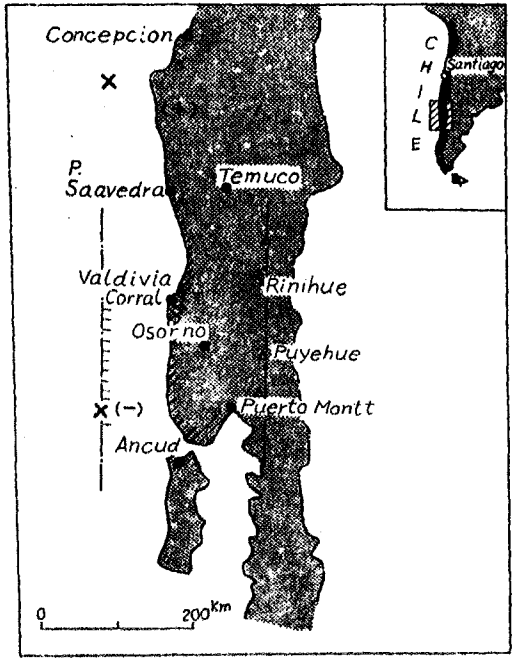

Fig. 1 Meizoseismal region of the Earthquake of May 22 and accompanying orustal deformations.

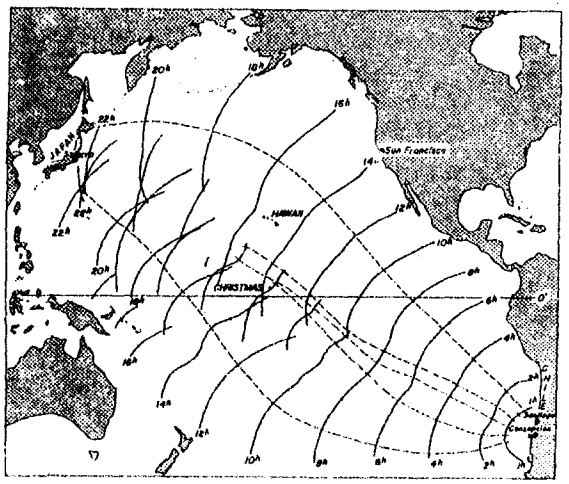

Fig. 2 (after Dr. K. Yoshida)
Refraction Diagram of the tsunami of May 22.

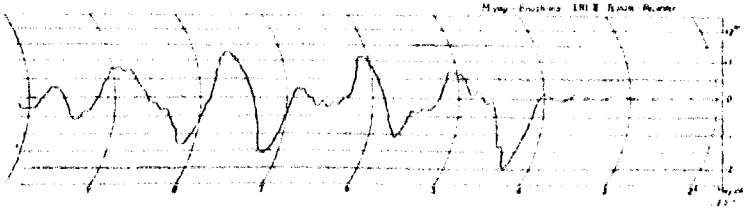

Fig. 3 Record of tsunami obtained at Miyagi Enoshima by ERI-III type tsunami recorder. (Time from right to left)

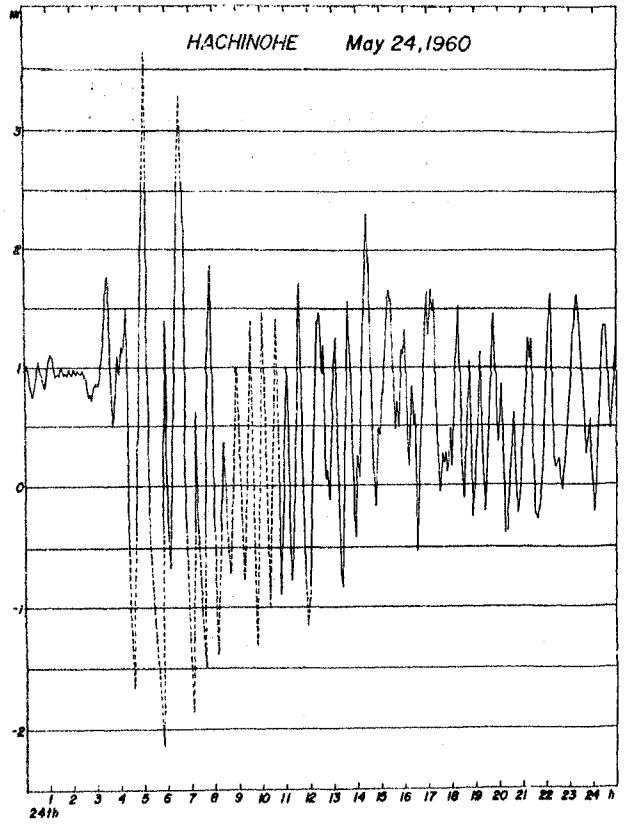

Fig. 4 Tide-gauge record at Hachinohe, Japan

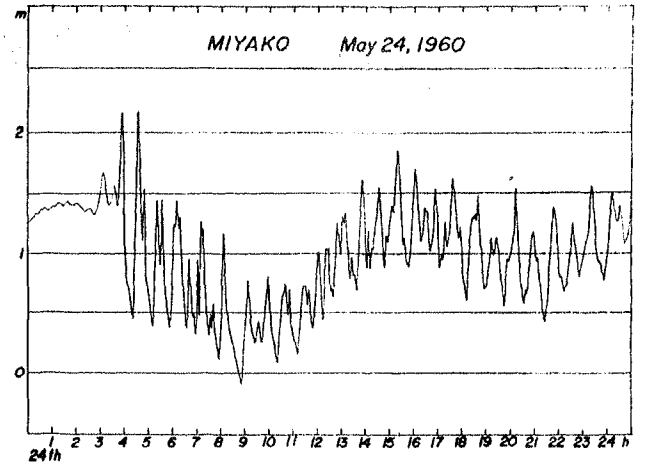

Fig. 5 Tide-gauge record at Miyako, Japan

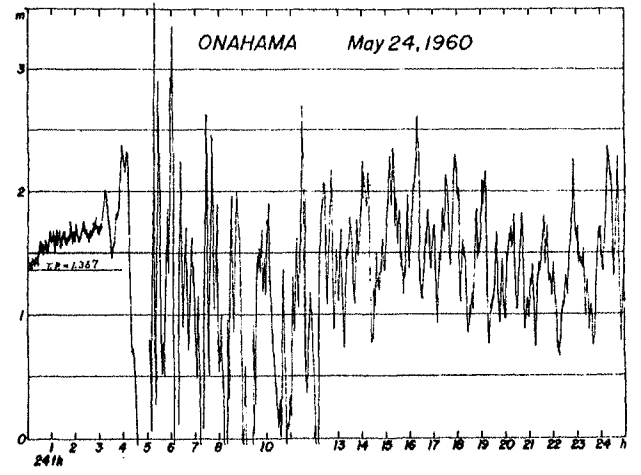

Fig. 6 Tide-gauge record at Onahama, Japan

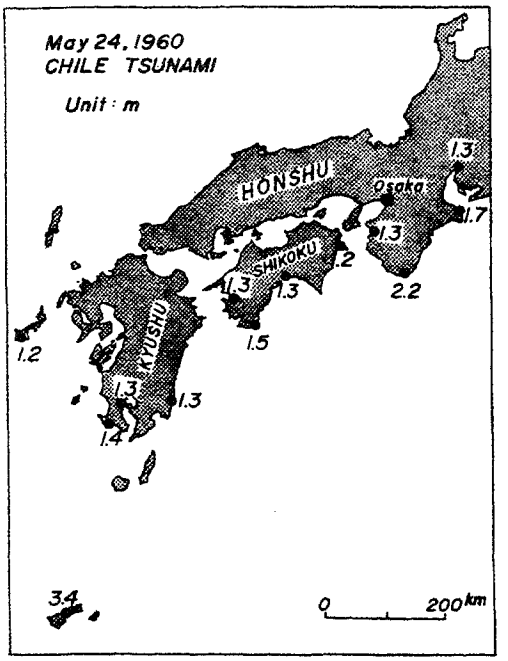

Fig. 8

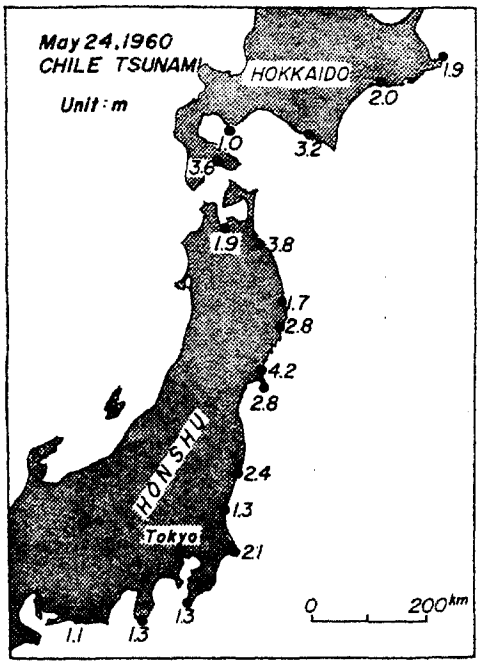

Fig. 7

Distribution of inundation Hights above mean sea level.

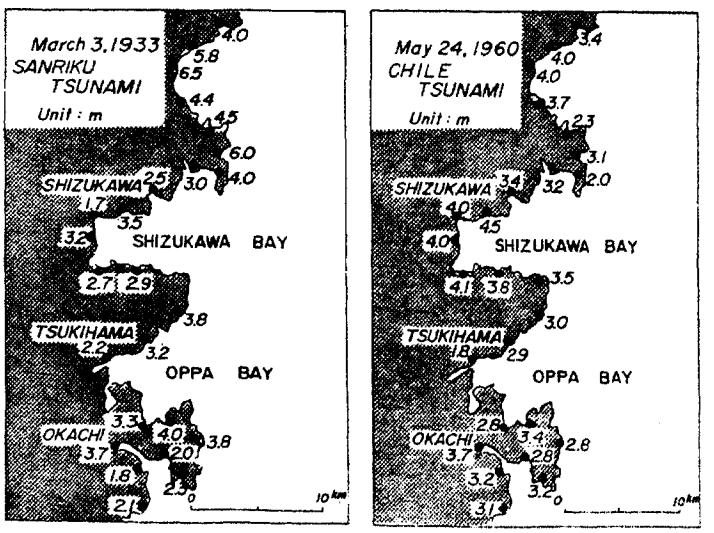

Fig. 9

Difference in the relative distributions of inundation heights in case of near and distant tsunamis.

Photo 1 Puerto Saavedra

Photo 2 Valdivia

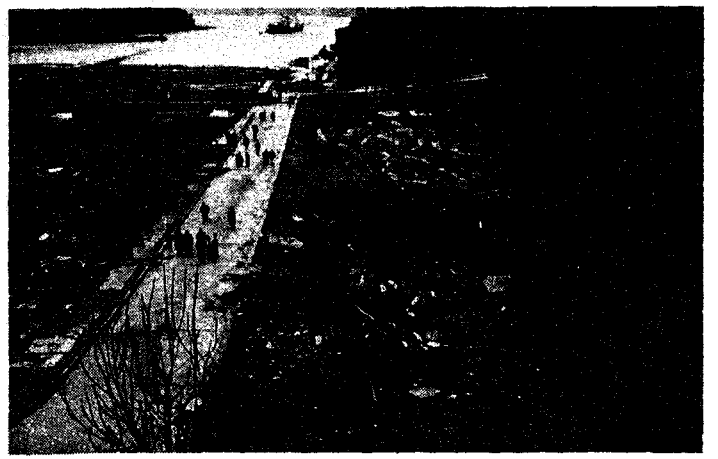

Photo 3 Corral

Photo 4 Ancud

Photo 5 Kisennuma (Courtesy Dr. Kamei)

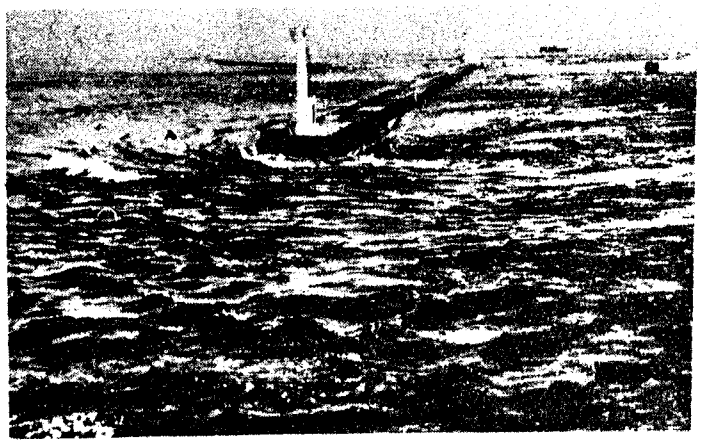

Photo 6 Onahama (Courtesy Mr. Sasaki)

Photo 7 Onagawa (Courtesy JOTI)

Photo 8 Kiritappu (Courtesy Yoshiori Iwata)