

## 16. Local Phenomena of Tsunami (Part 1).

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The tsunami, that followed the big earthquake of December 21, 1946, attacked the western coast of the Kii-Peninsula and the southern coast of the Island of Shikoku, both being well known regions of frequent destructive tsunamis facing the Pacific Ocean. On this occasion, however, the waves were much smaller than those of the historical tsunamis of 1707, and 1854, in magnitude as well as in destruction wrought. Yet, 1496 houses were washed away by the present tsunami. As detailed descriptions of this tsunamis and the accompanied earthquake have been already published<sup>1)</sup>, it is not our intention to repeat them in this paper. But, as an addendum, this paper has been written based on the results of our leveling survey carried out in the districts which were of special interest in the study of tsunami.

As well known, the height and the velocity of tsunami wave are the important factors which determine the intensity of tsunami. Especially, the height is a large factor in the extent of the damage caused by the water. It, however, varies considerably with the geographical feature of the inundated area. Through the precise leveling, the fact has been well recognised in the last destructive tsunami of the northeast Japan of 1933. In a paper written by one of the writers<sup>2)</sup> referring to this tsunami, he has pointed out that the water did not increase its height as it advanced inland, even though it rushed in the narrow part of the V-shaped harbor. Good example which was found in the present tsunami is the Bay of Kure in the Kochi Prefecture, Fig. 1. The bay is of the V-shape with its mouth facing the direction of seismic origin and the depth in the bay grows larger with increasing distance from the shore. However, our survey has revealed that the height of the water did not increase at the head of this bay where the town of Kure was situated, but it rather decreased as the water proceeded inwards. At Kamata, 2 km. to the east of Kure and situated halfway between

1) *Spec. Bull. Earthq. Res. Inst.*, No. 5, April, 1947.

2) N. Nasu, *Bull. Earthq. Res., Inst., Suppl.* Vol. 1, March 1934.

the mouth of the bay and its head, the height of the tsunami was 3.0 m., Fig. 2, whereas on the coast of Kure it was 2.3 m., Fig. 3.

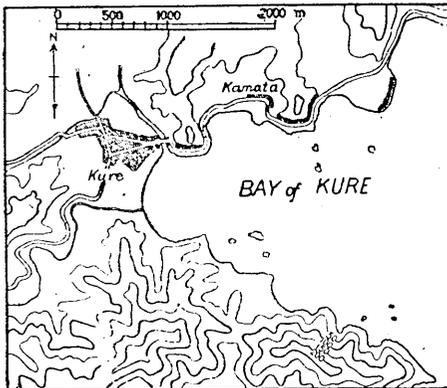


Fig. 1. Bay of Kure, Kochi Prefecture.

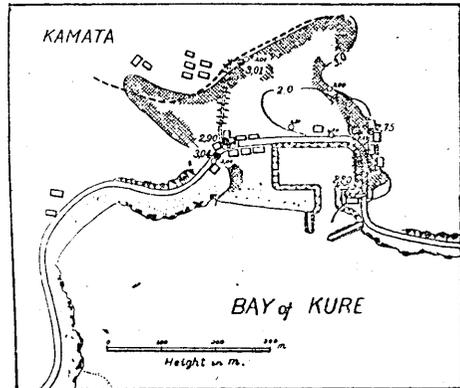


Fig. 2. Heights of tsunami at Kamata. (Dot indicates the point where the height of tsunami was measured. Boundary of invaded area is shown by lattice-shading.)

The waves invaded the town of Kure from the opposite side of the sea shore where a sand dune about 4 m. high existed. The water could not cross over it, but rushed up the river and flowed the low ground lying

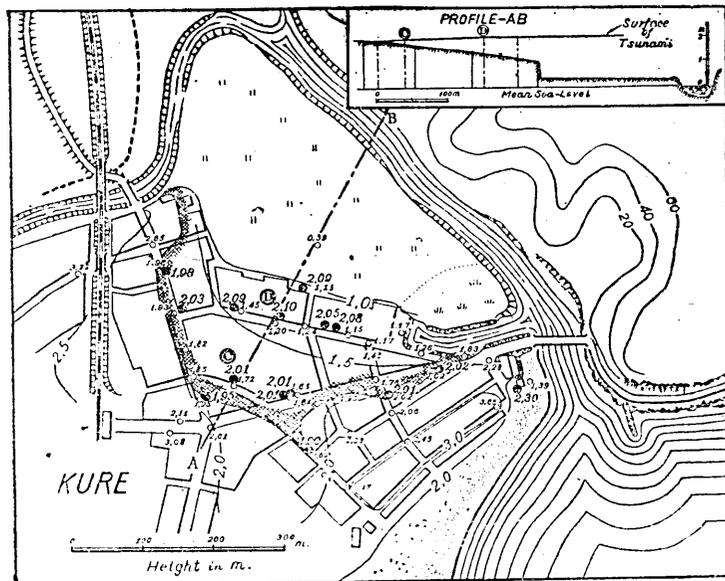


Fig. 3. Heights of tsunami at Kure, Kochi Prefecture. (Dot indicates the point at which the height of tsunami was measured. Boundary of invaded area is shown by lattice-shading.)



already been diminished before it reached the mouth of this bay. Perhaps, it was lower than 3 m. The wave, however, has been reported<sup>3)</sup> to be highest and 4.2 m. at Usa, 10 km. west of this bay, causing the severest damage on the coast of the Kochi Prefecture.

By the leveling survey of the heights of tsunami which was carried out along both coasts of the Urado strait, it has been found that there was a considerable change in height of water and further the height was rather increased on the shore which was attacked in front by the wave. The southern and western bay shores had several indentations and the water was heaped up to higher level than other places when it rushed in them. It is natural that the wave advances along a line of least resistance, that is, along the line joining the deepest points of the cross-sections of the strait. In this strait, however, the depth of the sea was larger at points near the southern and western shores than near the northern shore. Thus, the bulk of the water might advance along the former shores. Consequently the heights of tsunami on these shores were generally large as compared with those on the northern shore. After passing through this strait, the water spreaded over a wide area of the inner bay being so lessened in its height that its inrush could hardly be distinguished from coming-in of the ordinary tide or wind wave.

A civil-engineer who was in charge of the reconstruction work of this harbor told us that the form of the wave was that of a dome, higher at the middle part of the strait than at either bank and the wave-front was a steep wall of water. He could estimate the speed with which the wave passed through the narrowest part of this strait to be nearly 3 m. per second. He also told us that the wave was not single, but it was followed by a series of waves, of which the second one was the highest.

Although, both Kure and Tanesaki fortunately escaped from the havoc of the pretest tsunami, it should be mentioned that in 1707, these places were totally destroyed by the attack of the seismic sea waves. At the latter place, the water attained to a height of 28 m. This history must not be overlooked when we try to mitigate the damage which will be wrought by the next tsunami.

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3) S. Omote, *Spec. Bull. Earthq. Res. Inst.*, No. 5, April, 1947.