

Chapter IX. Earth-heat Phenomena at Saido.

57. Earth temperature. The orchard of Nishimoto (西本) behind the village of Saido (西道) at the N.W. coast of Sakura-jima has recently become a scene of a curious earth-heat development, the temperature of the ground having been remarkably raised and much scaring the people in the neighbourhood, who imagined this to be a forerunner of a possible volcanic eruption from the spot affected. The first perceptible symptom of the change was the dying of the peach trees in March, 1915, at the lowest part or N. end of the area, and the same effect gradually spread upwards or southwards; subsequently the *Quercus acuta*, *Quercus serrata*, *Eriobotrya japonica*, etc. also gradually died. The area in question, which is

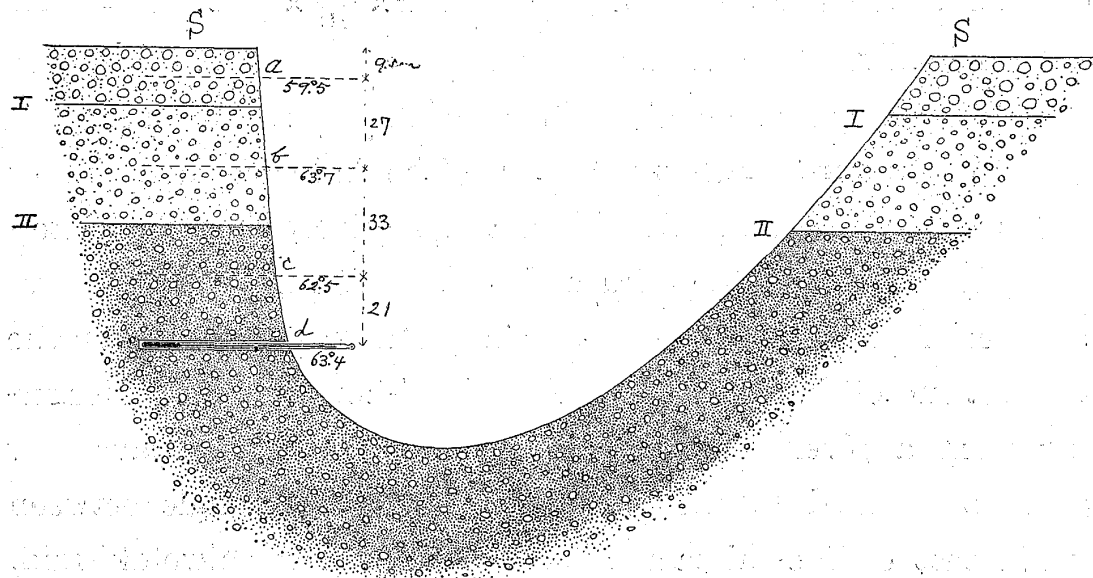


Fig. 130. Sectional diagram illustrating the accumulation of pumice and the measurement of the earth temperature at Saido.

S.....Surface. a, b, c, d.....Places of temperature measurement.

II.....New pumice accumulation. SI.....Coarse pumice. I II.....Finer pumice.

entirely pumiceous, probably to a depth of several metres, is on a gentle slope at the foot of a hill belonging to the outskirts of Kitadake, at a distance of about 600 m from the coast and at a height of 70–80 m above sea level. The surface accumulation of ejecta

due to the recent eruption was 36 cm, of which the upper layer, 9 cm thick, consisted of coarse pieces, and the lower layer, 27 cm thick, of fine pieces of pumice. The underlying portion was made up of fine old pumice pieces of dark colour. (See fig. 130.)

At the time of the present author's visit, on Oct. 1st, 1915, the heat area, marked out by a complete death of the trees and by a very slight issue of vapours from a few points, was nearly a circle, 156 metres in diameter, and, within it as well as in the neighbouring ravines and pathways leading up from the coast, there was perceived strongly a bad smell of gases like that of dilute chlorine mixed with benzine fumes, and exactly similar to what was experienced at the hill side above the village of Take, on the W. side of Sakura-jima, where in the previous spring an ox had been killed and several persons taken ill, probably from the suffocation due to the presence of carbonic acid. At this locality the gases seem to be firmly absorbed in the pumice, as was also the case in the vicinity of Hakamagoshi where the ash and pumice still preserved their bad smell in 1915.

On making with a thermometer the determinations of the earth-temperature at different points it was found out that the hottest portion was a small circle about 20 m in diameter, situated excentrically near the upper boundary of the heat area. (See fig. 131.) The method of the observation was as follows:—the thermometer was inserted in a small hole made with a stick vertically or obliquely at the bottom, or horizontally at the side, of an excavation (fig. 130); care was taken to prevent the free ingress of the external air into the hole, by stopping the mouth with small pumice pieces; this last precaution being necessary to insure the accuracy of the result. During the temperature measurements, from 10 a.m. to 3 p.m. (Oct. 1st), the weather

was calm and fair, but sultry, the air temperature being 28° to 29°C. After 3 p.m. there was a precipitation of rain, accompanied by lightnings. The earth-temperatures determined at different points in the hottest portion, at depths varying from a few cm up to about 1 metre, were as follows :—

Earth Temperature measured in the Hottest Area.

Size of Excavation.	Depth where the temperature measurement was made.	Earth Temperature.	Remarks.
Length Breadth Depth 90×60×90 cm.	(Measured near the surface.)	64.6° C	{ Slightly steaming from bottom. { Air temperature=28.0° C.
	"	62.5	
	(Measured at bottom.)	61.5	
150×90×120.	9 cm.	59.5	{ In the new coarse pumice layer. { (Air insulation imperfect.)
	36	63.7	In the layer of new fine pumice
	69	62.5	{ In the older layer of black fine { pumice.
	90	63.4	Do.
(Small excavation.)	45	61.0	In the new pumice layer.
(Small hole ; (Depth = 60 cm.)	20	54.5	{ The hole was made vertically { with a stick.
	15	53.5	Repeated after half an hour.
(Small hole.)	(Oblique depth =9 cm.)	57.5	The hole was made with a stick obliquely at the base of a tree. (Air insulation imperfect.)
30×45×30	15	49.0	(Air insulation imperfect.)

The several excavations utilized in the temperature measurements had been dug several weeks previously. This fact, however, does not affect the accuracy of the result, as the heated gases must have been diffused within the limit of small dimensions almost uniformly through the mass of the pumice layers. To this last mentioned characteristic of the ground is probably to be attributed the approximate constancy of the temperature at varying depths,

at least till about 1 m below the surface ; there being, so far as these observations are concerned, no increase of temperature at the bottom of the excavations. It is of course not to be assumed that the temperature remained unchanged to a great depth, say, of over several metres.

The maximum earth temperature in the hottest portion was thus $64^{\circ}.6$ C, while that in the immediate neighbourhood at a distance of 16 m sidewise to the west of the hottest portion was $47^{\circ}.8$ C at $1\frac{1}{2}$ feet depth. At a point $2\frac{1}{2}$ m within the upper (or southern) margin of the heat area, where there was a strong bad smell, the

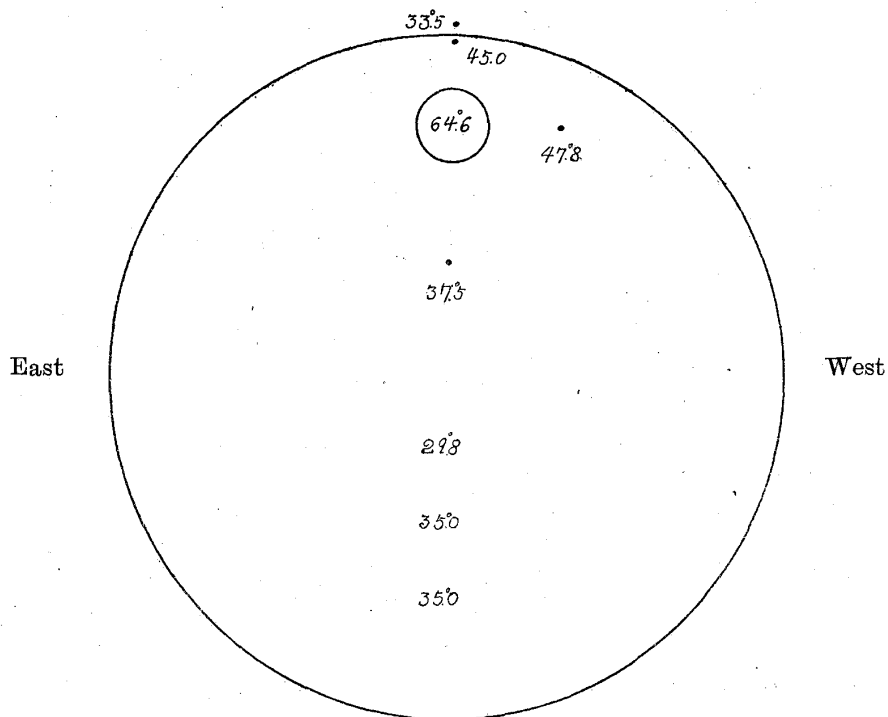


Fig. 131. Plan showing the Variation of the Earth Temperature in the Saido Heat-Area (large circle), on Oct. 1st, 1915. The small circle marks the spot of specially high soil temperature. The upper part of the figure corresponds to the higher slope.

earth-temperature was $45^{\circ}.0$ C ; but at a distance of 2 m outside the same boundary line, where there was no bad smell and where the trees were green, the temperature 2 feet below the surface fell abruptly to $33^{\circ}.5$ C. 25 metres to the N. of the hottest portion,

the temperature was $37^{\circ}.5$ C at $1\frac{1}{2}$ feet depth. In the lower and more level part, within the heat area, the temperatures at three different places, measured $\frac{1}{2}$, $2\frac{1}{3}$, and $1\frac{3}{4}$ feet below the surface, were respectively $29^{\circ}.8$, $35^{\circ}.0$, and $35^{\circ}.0$ C.

Thus it seems that the high earth-temperature existed, on Oct. 1st, 1915, only within small "hottest portion," near the upper edge of the "heat area," wherein the trees were dead, while the rest of the space in question has practically regained its normal earth-temperature. The emanation of the warm gases injurious to the plant life had probably been commenced at the lowest end and gradually extended upwards.

As the heat area has extended upwards only about 7 metres since June (1915), when Mr. J. Sasamoto, of the Kagoshima High School, examined the locality, it is to be supposed that the heat increase and gas emanation attained their maximum activity during the first three months of March, April, and May, and also possibly already in February (1915). The interesting question of the time variation of the maximum earth-temperature in the heat area is unfortunately impossible to consider in detail, as the previous temperature determinations by different investigators were not carried on with sufficient attention. Mr. N. Maeda, of the Kagoshima Meteorological Observatory, found on July 18th, 1915, the maximum earth-temperature within the same hottest part to be $55^{\circ}.0$ C at the bottom of a pit about 5 feet in depth, while that obtained by Professor A. Imamura on August 13th, was about $49^{\circ}\frac{1}{2}$ C at the depth of 2 feet and under the air temperature of $31^{\circ}.6$ C. All these results are too low, due to the want of precaution for sufficiently preventing the external air from affecting the thermometer bulb, which was simply buried or inserted in a vertical position into the pumice mass previously dug.

58. Heat phenomena and volcanic activity. The development of earth-heat in the vicinity of Saido is by no means abnormal. As mentioned in Number 1 of the present Volume, the sea beach of the village, where still exists a mineral spring, is called Yunosaki ("hot-spring cape") and is a likely place for the production of a new hot spring or an emanation of gases consequent to a powerful volcanic eruption in Sakura-jima. In fact, the appearance of the heat area may be taken to have been simultaneous with the 2nd stage outflow of the eastern lavas; both being the effects of, or stress-relievings afforded to, an accumulation of the volcanic tension under the mountain consequent to the almost complete cessation of the explosions about that time. Taken in this view, the phenomenon under question, which is evidently approaching to its close, is one of the residual activities of the great recent eruption, and not a preliminary to a new one*.

Temporary fumaroles at the coast of Ushine. According to the account of Mr. H. Oi, Chief Engineer of Kagoshima Prefecture, there was also a manifestation of increase in soil temperature in a small ravine at the coast of Ushine, some distance from the eastern end of the "contact line" or junction of the Sakura-jima lava and the former coast of Ōsumi; there having been a slight issue of steam, such that on April 6th, 1915, the ground, when dug, had a temperature too hot to allow one's hand to be put in. This fact was apparently related to the production of the heat region in the vicinity of Saido.

* According to Professor A. Imamura's measurements, repeated with care in Aug. 25-28, 1916, the highest earth temperature within the district in question was 63°.0 C, met with at the depth of 1.28 m. It thus seems that the maximum earth temperature did not much vary during the 11 months subsequent to the present writer's examination in Oct. 1915.