

# GUIDE-BOOK EXCURSION E-1,5

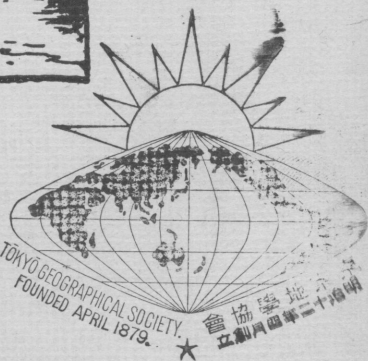
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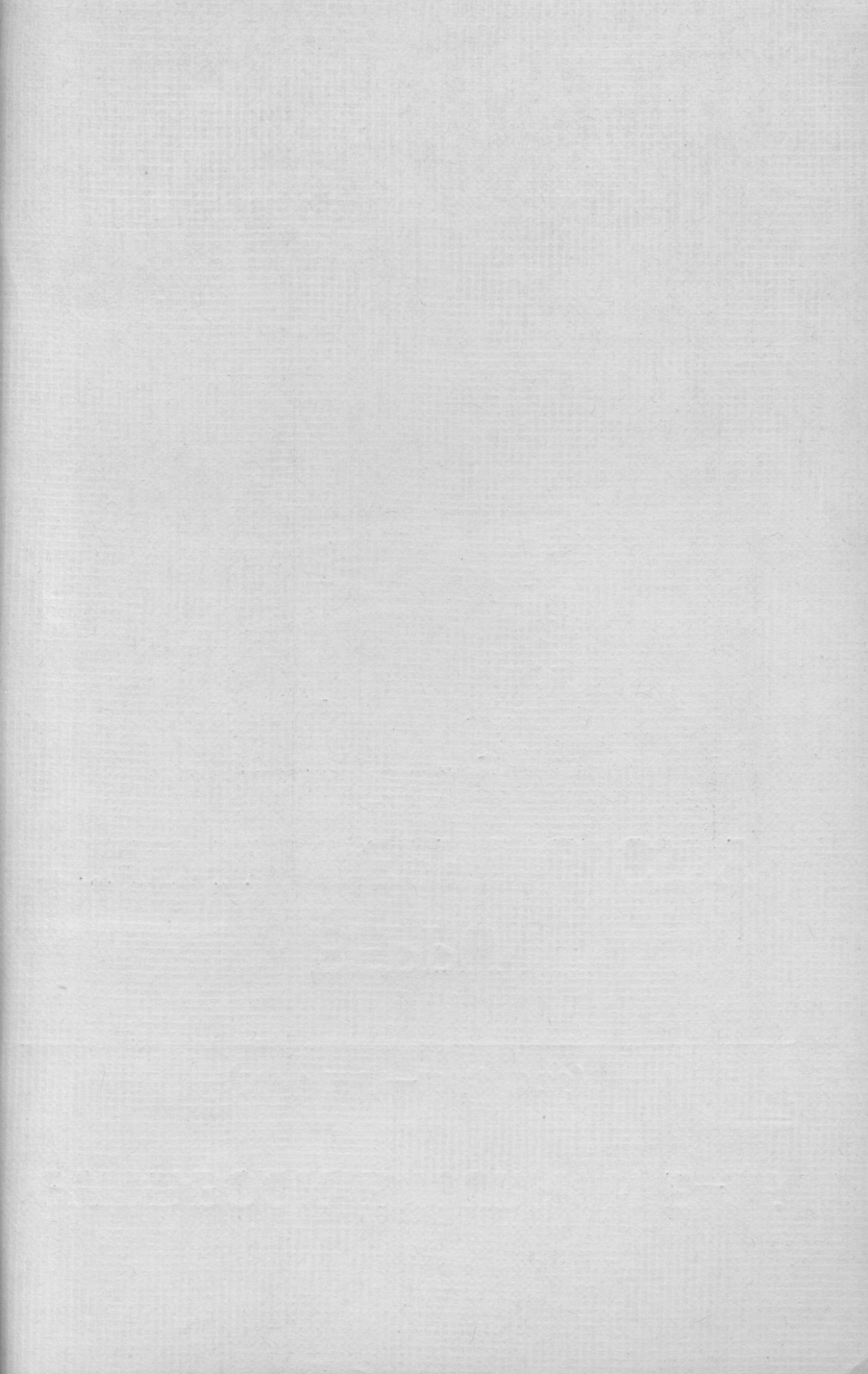
## BEPPU

## THE HOT-SPRING CITY



PAN-PACIFIC SCIENCE CONGRESS, 1926

JAPAN



Yufu-dake

Tsurumi-dake

Garan-yama  
Ōgi-yama

Myoban

Jissoji-yama.

Kannawa



Panoramic View of the Beppu City.

# BEPPU, THE HOT-SPRING CITY

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# BEPPU, THE HOT-SPRING CITY

BY FUJIO HONMA

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## I. GEOLOGY OF BEPPU AND ITS ENVIRONS.

The middle part of Kyūshū, which is covered by the volcanic ejecta of the mountains Unzen, Aso, Kujū, Yufu and Tsurumi, would have an altitude high enough to remain above water even if there were no such accumulations of ejecta. It is open to question whether this district is the southwestern extension of the lowland stretching from the Setouchi or Inland Sea. The concentration of volcanic activity is due to the fact that the Kirishima volcanic zone forming the inner zone of the arc of the Ryūkyū Islands meets here the Setouchi volcanic zone and a minor volcanic zone running southwest along the western side of Chūgoku (the southwestern end of the mainland of Japan).

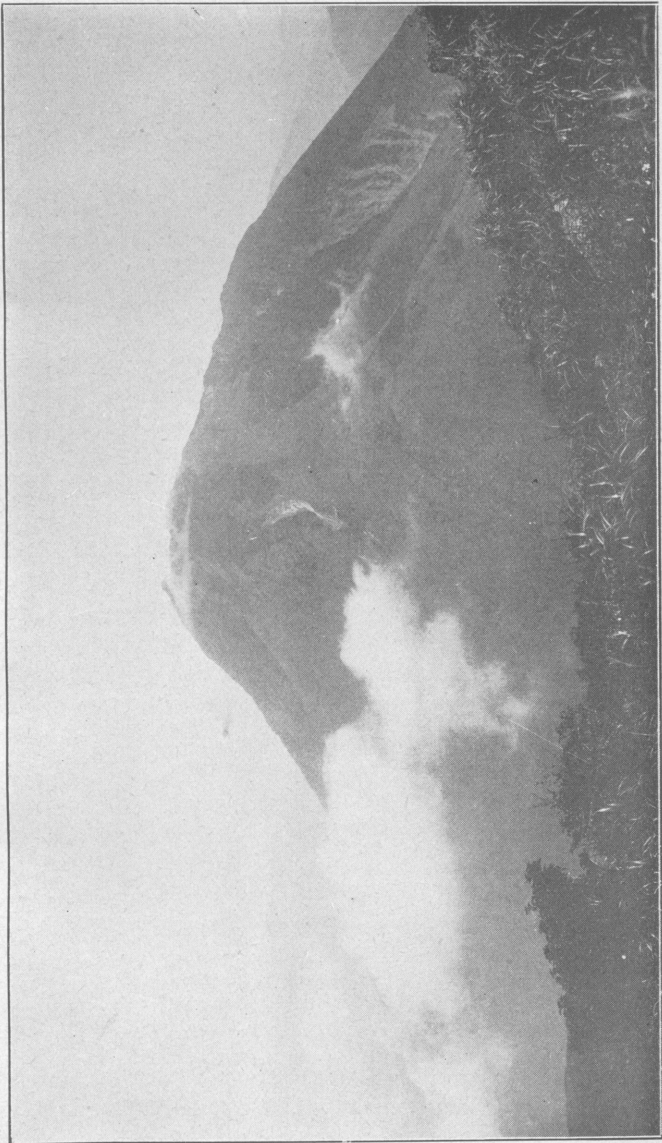
Yufu and Tsurumi are two volcanoes in the eastern part of this volcanic area. The after-action of their eruption still continues, vapour jets and hot-springs being scattered all over the adjacent district, which is now comprehensively known under the name of the Beppu Hot-Springs.

According to Prof. Tadaichi Matsumoto, who made a minute study of the volcanoes in Kyūshū, the old rock forming the basement

of this district is hardly visible about Beppu, but away toward the north of Mt. Yufu and Mt. Tsurumi, we find exposures of granite and mica-schist of the Ryōke series along the valleys at the foot of the mountains. Southwestward and southward of the city of Ōita there are rocks developing in a small trench, which Mr. Yehara has decided to be of "The Lower Cretaceous." Farther south we find an extensive development of the crystalline schists and Palaeozoics belonging to the outer zone of the arc of Southwest Japan.

The eruption of the volcanic rock over the basement dates from either the latter part of the Tertiary period or the beginning of the Quarternary period. The prophyrite exposed in the vicinity of Kwan-kaiji was first erupted, and over it we find agglomerates and lavas of hypersthene andesite. Further above there are agglomerates and lavas of two-pyroxene andesite constituting a mountain land which appears toward the south of Beppu basin as a *somma*, while north of the basin it assumes the form of a hilly land. The lava which appears to be the last eruption of these two-pyroxene andesites contains hornblende phenocrysts of long prismatic form measuring several millimeters. To all appearances these volcanic activities started in the bottom of the sea, because while evidence is lacking of their having ever happened on land, the volcanic ash layer about the mountain foot is often found to contain traces of fossilized diatom and to present beautiful stratification. Enveloping these volcanic ash layers there is found another andesite lava of younger growth, containing biotite. This younger andesite lava presents a totally different appearance from the rocks previously mentioned, evidencing in all probability a long cessation of volcanic activity at some intervening period. This biotite andesite extends west of this district toward Haneyama and adjacent areas, forming a wide plateau and marking an important epoch in the volcanic history of the northeastern part of Kyūshū. The eruption which followed this epoch produced hornblende andesite which now forms a plateau. Toward the end of the activity, the eruption resulted in the formation of the cones now known as Mts. Tsurumi and Yufu, which tower toward the WNW of the town of Beppu.

The mud lava forming the *somma* of the Aso volcano flowed after the eruption of the hornblende andesite. The essential coloured mineral contained in the mud lava consists of pyroxenes. It is extensively distributed toward the south in the vicinity of this



Mt. Yufu.



district, while in the north the distribution extends along the glens and valleys, and is exposed here and there all over the district.

During this volcanic activity there were two or three tectonic movements which brought about topographical changes. Of these the most significant was the movement rising southward along the fault running toward the center of Mt. Tsurumi after going WNW along the southern shore of Beppu Bay. Topographically this is indicated by a beautiful fault scarp, while geologically traces remain in the form of the straight demarkation characterizing the distribution of the pyroxene andesites and the grouping of many hot springs in this same direction. Though the formation of this fault dates earlier than the formation of Mt. Tsurumi, the probability of the rising of the land south of this fault even after the formation of Mt. Tsurumi is indicated vaguely by the marine terrace whose flat surface still remains at the height of 30 to 40 meters, consisting of volcanic ash, lapilli and mud.

Of the known volcanic explosions of this district, one took place on March 4th, 869 (20th of the 1st month [old calendar] in the 9th year of the Jōkan Era). It was the eruption of Mt. Tsurumi. The activity of the volcano continued for two months thereafter. The earthquake which shook the city of Beppu on September 1st, 1596, (the 9th of the 7th or intercalary month of the 1st year of Keichō, three days before the great earthquake of Fushimi near Kyōto) caused the sinking of the Bay of Ōita, but was not apparently accompanied by volcanic activity. In the Bay there was a small island called Uryū-jima, situated toward the north of Ōita City, which formed a sort of breakwater for the harbour of Ōita, a circumstance to which is due the importance of that city as a foreign trade port in ancient days. The isle measured  $2\frac{1}{2}$  miles from east to west, and  $1\frac{1}{2}$  miles from north to south; it lay about  $1\frac{1}{2}$  miles off the shore of Ōita. There were over 1,000 houses and 5,000 inhabitants. The isle sank, disappearing in the sea, as a result of the quake of Sept. 1st, 1596. Travellers going by steamer to Beppu will sight the city of Beppu off toward the right and Ōita to the left. The steamer then steers to the right around a shoal, the only remaining trace of the sunken isle of Uryū-jima.

In conclusion, the presence of Mt. Tsurumi in the center gives one the false impression that the volcanic district of Beppu consists of a large caldera and a central cone, but in reality it does not. After the



eruption of pyroxene andesite, another eruption of hornblende andesite took place in a low plain, resulting in the formation of many volcanic cones of which Mt. Tsurumi is nothing but the most important one.

## II. HOT-SPRINGS AND "HELLS" IN BEPPU AND ITS ENVIRONS.

The famous hot-springs and *Jigoku* or "Hells," in Beppu and its environs constitute the post-volcanic activity of the two mountains of Yufu and Tsurumi. These hot-springs and "Hells" are found lying along the main fissure lines, and the temperatures of the hot water and vapour which gush from underground differ according to the location of each hot-spring and "Hell," the highest temperature so far known among them being more than 150°C.

The spas which form the Beppu Hot-Springs are divided into 10 different parts, viz., the city of Beppu (including Hamawaki), Kwankaiji, Hotta, Kannawa, Myōban, Shibaseki, Kamegawa, Shin-Beppu, Yufuin, and Tsukahara, all of which are scattered within a territory 100 kilometers square surrounding Mt. Tsurumi. The hot-springs are of several kinds, as is shown in the following table:

Spring	Location	Classification	Temperature	Sp. gr.	Total contents (gram in 1 kilo- gr. of water)
Furo-sen	Beppu	Iron carbonate	59°C	1.0009	0.8680
Reicho-sen	Beppu	Carbonated	65°C	1.0010	0.7450
Higashi- onsen	Hamawaki	Common salt	57°C	1.0030	3.3325
Kwankaiji- onsen	Kwankaiji	Iron carbonate	57°C	1.0004	Ca. 0.77
Shibu-no-yu	Kannawa	Acid vitriol	89°C	1.0011	Ca. 2.67
Jizō-no-yu	Myoban	Acid alum vitriol	91°C	1.0030	Ca. 2.50
Hijiri-yu	Shibaseki	Iron carbonate	69°C	—	Ca. 1.59
Shi-no-yu	Kamegawa	Common salt	57°C	—	Ca. 1.22

Overlooking the picturesque Inland Sea on the east, with the lovely form of Mt. Tsurumi on the west, the hot-springs of Beppu please visitors by their great natural beauty. Beppu is noted for its mild climate in winter, the mildest of all the spas of Japan. A table of temperatures (C) in Beppu follows.

	Max.	Min.	Average.
January . . . . .	10.1°	3.0°	7.1°
February . . . . .	10.9	3.4	8.3
March . . . . .	14.4	6.1	12.0
April . . . . .	19.2	7.7	15.2
May . . . . .	23.2	13.2	19.6
June . . . . .	26.2	19.3	23.3
July . . . . .	29.1	22.0	26.3
August . . . . .	28.4	22.6	27.2
September . . . . .	27.1	19.0	24.6
October . . . . .	23.5	13.3	20.9
November . . . . .	17.7	9.7	16.0
December . . . . .	12.1	3.9	10.0
Throughout the Year .	29.1	3.0	17.5

The most interesting features are the *Jigoku* or "Hells." In a volcanic country like Japan the so-called "Hells," which are fumaroles and solfataras with hot-springs, are common sights; but it is not often that so many of them are gathered together in one spot, all within easy access of each other. The "Hells" in Beppu are vents which send forth vapour, boiling water and mud. The boiling water and mud thus issuing from underground form small ponds, picturesque in aspect. The "Hells" are found in seven large groups, the names and qualities of which are explained in the following table:

<i>Jigoku</i> , or "Hells"	Materials of Emission	Colour of Water
Hachiman-J.	Vapour, hot water and mud bubbles.	Light blue, muddy.
Umi-J.	Vapour and hot water.	Greenish blue.
Bōzu-J.	Vapour and mud bubbles.	Milky, muddy.
Kōya-J.	Vapour and mud bubbles.	Indigo blue, muddy.
Kannawa-J.	Vapour and hot water.	Colourless.
Kamado-J.	Vapour and hot water.	Pale blue, milky.
Chinoike-J.	Vapour, hot water and mud bubbles.	Light blue, and vermillion in hue.

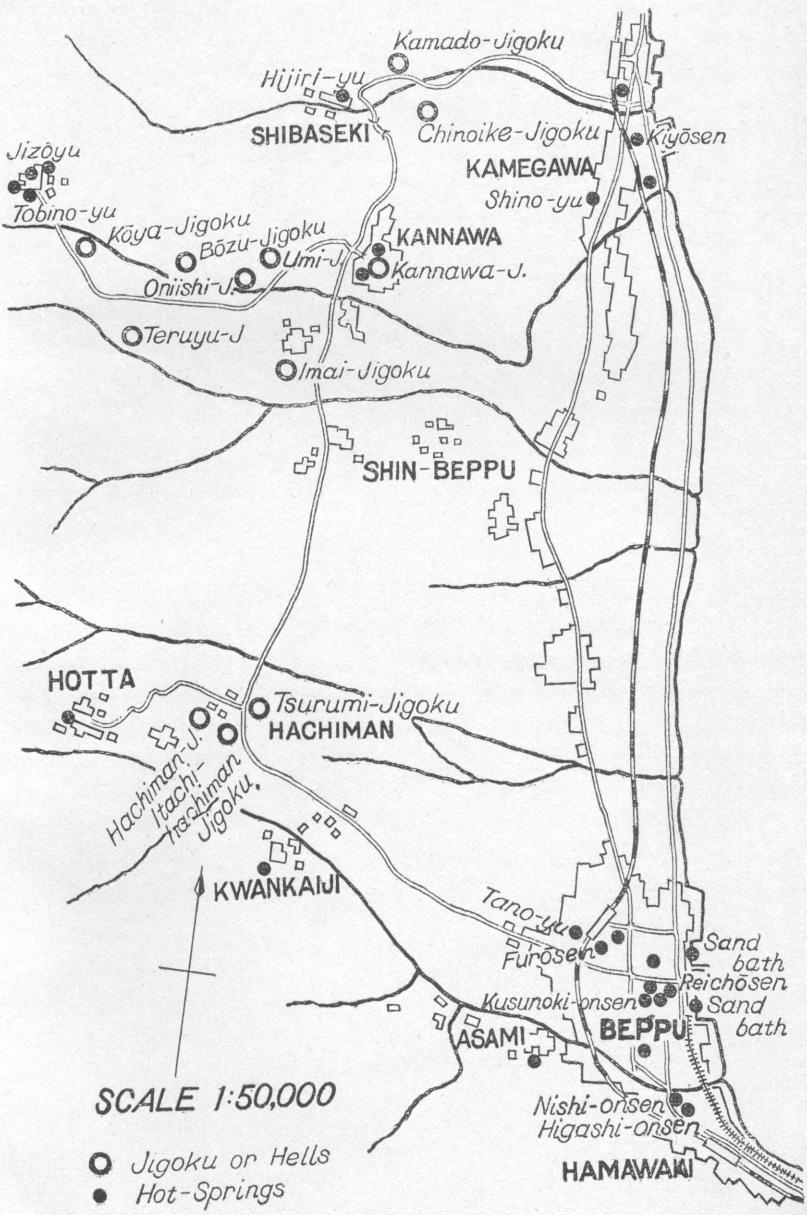
Such hot-springs as Hamawaki, Beppu, Kwankaiji, Hachiman, and Hotta lie in a line facing WNW in the southern corner of the hot-spring district of Beppu, while the hot-springs of Kampu, Kōya, Myōban and the "Hells" of Umi-Jigoku and Bōzu-Jigoku exist in the northern corner of the district, lying in a line facing either east or west. Others, including the hot-springs of Kamekawa, Shibaseki, and the "Hells" of Kamado and Chinoike are located in the northern corner of the district, also lying in a line facing either east or west.

#### a. Hot-Springs in the City of Beppu.

The city of Beppu has a permanent population of 40,000, and is said to be visited by some 2,000,000 bathers every year. The city is situated at the western corner of the Inland Sea. It faces the picturesque bay and enjoys a mild climate. From ancient days Beppu has been popular as a hot-spring resort, and at present the city is equipped with every convenience for comfortable living. The city is also provided with convenient traffic facilities.

The city of Beppu is divided into two parts, the southern and northern, by the River Asami, which runs through the city. The northern section is called Beppu Proper, and the southern, Hamawaki. In these two sections which comprise the city of Beppu, there are innumerable vents from which hot-spring water gushes. In former times hot water could be taken by digging underground four or five meters, but now this can no longer be done. The present-day hot spring wells are dug to the extent of from 40 to 60 meters and hot water is brought to the surface through pipes. In the days gone by even on the elevated land to the west of the railway, spring water used to gush out of vents, but today this is no longer observed except at a spot near the sea which lies to the east of the railway. Pumps have not been used, however, for drawing hot water from underground.

There are 1,300 hot-spring vents in the city of Beppu, of which some 800 are used for bathing purposes and tapped at numberless places, while about 400 are put to domestic uses such as kitchen and washing purposes. The rest of them are unused because of the small



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- *Jigoku or Hells*
- *Hot-Springs*



quantity of water they produce. The total quantity of hot-spring water in the city of Beppu amounts to some 10,000 liters a minute. This represents a quantity of some 550 liters of hot-spring water a day to every resident and visitor in the city. From this fact the large quantity of spring water in Beppu may well be gauged.

Public bathing houses are maintained by the municipality, and are, therefore, open either free or for a moderate charge. Every inn and hotel in Beppu has hot-spring wells of its own, from which hot water is sent to each bathtub for the comfort of guests, while some residents of the city have one or more wells for their private use.

The vents in Beppu are so scattered throughout the city that the whole city appears to be built over numerous big bathtubs. Hence the other name of Beppu is *Sen-pu* or "The Hot-Spring City." Here the municipal and public organizations maintain 66 common baths and 4 beach sand-baths. There are more than 2,500 common baths and 33 sand-baths in tubs and 16 hot waterfalls.

The following table shows the principal bathing establishments maintained by the municipality.

Hot-Spring	Location	Classification	Temperature	Equipment
Furo-sen	Beppu	Iron carbonate	59°C	Bath, hot waterfall
Reicho-sen	Beppu	Carbonated	65°C	Bath, sand-bath, vapour-bath
Takegawara-onsen	Beppu	Carbonated	67°C	
Kusunoki-onsen	Beppu	Iron carbonate	51°C	Bath
Ta-no-yu	Beppu	Carbonated	51°C	Bath
Yanagi-yu	Beppu	Carbonated	48°C	Bath
Higashi-onsen	Hamawaki	Common salt	57°C	Bath
Nishi-onsen	Hamawaki	Iron carbonate	57°C	Bath

Results of chemical analyses of the hot-springs in the city of Beppu are given in the following table:

Hot-Spring	Furo-sen	Reichō-sen	Takegawara- onsen	Higashi-onsen
Location	Beppu	Beppu	Beppu	Hamawaki
Classification	Iron carbonate	Carbonated	Carbonated	Common salt
Temperature	59°C	65°C	67°C	57°C
Specific gravity	1.0009	1.0010	1.0009	1.0030
Total contents (gram in 1 kilo- gram of water)	0.8680	0.7450	0.9056	3.3325
Cl	0.1149	0.1419	0.1775	1.4449
SO <sub>3</sub>	0.0860	0.0320	0.0529	0.1381
SiO <sub>2</sub>	0.1680	0.1800	0.1235	0.1560
CO <sub>2</sub>	0.6240	1.4720	1.3325	0.6260
K <sub>2</sub> O	0.0071	0.0208	0.0065	0.0712
Na <sub>2</sub> O	0.1486	0.0620	0.1611	0.2022
CaO	0.1160	0.1215	0.0904	0.2210
MgO	0.0440	0.0645	0.0476	0.1260
Fe <sub>2</sub> O <sub>3</sub> + Al <sub>2</sub> O <sub>3</sub>	0.1720	0.0010	0.0232	0.0029

Along the seashore at Beppu there are many vents from which hot-spring water gushes. At low tide after the seashore has been washed by the flow, hot-spring vapours may be seen issuing from the sandy beach. During the warm season, that is, from spring to autumn, tents are put up on the seashore, where bathers bury themselves in the sand to warm their bodies with the hot-spring water. This bathing in the sand on the beach is called *Suna-yu* or "Sand-bath." This natural sand-bath is peculiar to the seashore at Beppu, and may be seen nowhere else.

#### b. Spas outside the City of Beppu.

The "Eight Spas of Beppu" is an old name. It includes eight principal spas, viz., Beppu Proper, Hamawaki, Kwankaiji, Hotta, Myōban, Kannawa, Shibaseki, and Kamegawa. Of these, Hamawaki, Beppu, Kwankaiji and Hotta are situated in the southern corner of the Beppu hot-spring district, all facing WSW. In addition to the foregoing eight, another spa has been established, the Shin-Beppu, or "New Beppu." This spa has no spring, but is supplied with spring water from the hot-spring of Umi-Jigoku, hot water being

sent there through pipes. There are two other spas at the foot of Mt. Yufu and Mt. Tsurumi respectively, but they are exceedingly far from the city of Beppu.

The Kwankaiji Hot-Spring:—Some three kilometers to the west of the city of Beppu, there is the Kwankaiji hot-spring at the foot of Mt. Kwankaiji. It is a noted hot-spring spa, commanding beautiful scenery. The chemical composition of the hot-spring water at this spa as determined by analyses is given in the following table:

Classification . . . . .	Iron carbonate
Temperature . . . . .	57°C
Sp. gr. . . . .	1.0004
Total contents (gram in 1 kilogr. of water) . . . . .	Ca. 0.77
Cl . . . . .	0.0732
SO <sub>3</sub> . . . . .	0.0346
SiO <sub>2</sub> . . . . .	0.0936
CO <sub>2</sub> . . . . .	0.5933
K <sub>2</sub> O . . . . .	0.0062
Na <sub>2</sub> O . . . . .	0.0536
CaO . . . . .	0.0818
MgO . . . . .	0.0357
Fe <sub>2</sub> O <sub>3</sub> + Al <sub>2</sub> O . . . . .	0.0590

At this spa, the natural hot water is served to guests instead of tea. Tradition has it that drinking an excessive quantity of this natural hot water has a good effect upon persons suffering from venereal disease.

The Hotta Hot-Spring:—The Hotta hot-spring spa lies some six kilometers to the west of the city of Beppu on an elevation at the southeastern foot of Mt. Tsurumi. It is a sulphur spring, and has a temperature of 36°C.

The Myōban Hot-Spring:—This hot-spring is situated at the northeastern foot of Mt. Tsurumi some eight kilometers to the north-west of the city of Beppu. It comprises four principal hot-springs, including the Jizō-no-yu, Kami-no-yu, Tsuru-no-yu, and Tobi-no-yu. The nature of the spring is acid alum vitriol; an analysis of its water is given in the following table. The mud deposits of the spring are spread on the ground and when dried by the sunshine form salts which present a yellow hue due to their sulphuric contents. The salts thus made are called *Yu-no-hana*, signifying "Blossoms of the Spring." These salts are sold in the city. Visitors to the spring take them home for use in preparing their own baths.



## Chemical Composition of the Waters of Various Hot-Springs.

Location	Myoban	Kannawa	Kannawa	Shibaseki	Kamegawa
Name of spring	Jizo-no-yu	Shibu-no-yu	Umi-Jigoku	Hijiri-yu	Shi-no-yu
Classification	Acid alum vitriol	Acid vitriol	Acid vitriol	Iron carbonate	Common salt
Temperature	91°C	89°C	90.5°C	69°C	57°C
Sp. gravity	1.0030	1.0011	1.0029	—	—
Total contents (gram in 1 kilogram of water)	Ca. 2.52	Ca. 2.67	Ca. 3.51	Ca. 1.59	Ca. 1.22
NaCl	—	0.0923	1.3238	0.3632	0.6780
Na <sub>2</sub> SO <sub>4</sub>	0.1480	0.8009	0.9362	0.4301	0.0040
NaHCO <sub>3</sub>	—	—	—	0.2311	0.0930
NH <sub>4</sub> Cl	—	—	0.0046	—	—
K <sub>2</sub> SO <sub>4</sub>	0.0830	0.2514	0.3910	0.0060	0.0840
Ca Cl <sub>2</sub>	—	0.1820	0.2344	0.2000	—
CaSO <sub>4</sub>	0.1460	—	—	—	0.1230
MgCl <sub>2</sub>	—	0.0635	0.1245	0.0681	—
Mg(HCO <sub>3</sub> ) <sub>2</sub>	—	—	—	0.0108	0.0510
Fe Cl <sub>3</sub>	—	0.0456	—	—	—
Fe <sub>2</sub> (SO <sub>4</sub> ) <sub>3</sub>	0.3150	—	—	—	—
Al Cl <sub>3</sub>	—	0.1528	—	—	—
Al <sub>2</sub> (SO <sub>4</sub> ) <sub>3</sub>	0.8630	—	0.0498	—	—
Fe SO <sub>4</sub>	0.1590	—	0.0351	—	—
Fe(HCO <sub>3</sub> ) <sub>2</sub>	—	—	—	0.2207	0.0070
HCl	—	0.7910	0.2214	—	—
H <sub>2</sub> SO <sub>4</sub>	1.9870	—	—	—	—
HBO <sub>2</sub>	—	—	0.0141	—	—
H <sub>2</sub> SiO <sub>3</sub>	0.4608	0.3751	0.4805	—	0.2557
Al <sub>2</sub> O <sub>3</sub>	—	—	—	0.0014	—
CO <sub>2</sub>	—	—	—	0.0153	0.0310

The Kannawa Hot-Spring:—This hot-spring is situated some seven kilometers to the NNW of Beppu. Located on elevated land some 1,500 meters above sea level, this spa commands a beautiful

view of the surrounding districts. Large quantities of hot-spring water characterize this spa. Every household in this locality uses the vapour for its cooking oven. Among the noted springs in this spa are the Shibu-no-yu, Shin-no-yu, and Netsu-no-yu. Of these, the Shibu-no-yu is the most noted, its spring-water being acid vitriol. The chemical composition of its waters is given in the foregoing table. The Shin-no-yu is a sulphur spring, and the Netsu-no-yu a carbonated spring. The Kannawa spa is equipped with vapour baths and hot waterfall baths in addition to ordinary hot water baths. The vapour bath is famous in Beppu, and is said to have originated with Ippen-shōnin, an ancient Buddhist monk.

The Shibaseki Hot-Spring:—Some eight kilometers to the NNW of Beppu, there is the Shibaseki hot-spring, almost buried among hills and valleys. Hot-springs are found in the vicinity along the bed of the River Shibaseki. The spa there is equipped with hot waterfall baths as well as hot water baths. The best known spring in this locality is the Hijiriyu, a feature of the hot-spring being that cold water from the nearby river is taken into the bathtubs to moderate the temperature of the hot-spring water. The spring belongs to the iron carbonate group; results of chemical analyses of its waters are given in the foregoing table.

The Kamegawa Hot-Spring:—Kamegawa lies some eight kilometers to the north of Beppu, and can be reached from the Kamegawa railway station. Hot-springs there are found along the sea-shore, the most noted being the Shi-no-yu and the Kiyō-sen. Both are common salt springs. In addition to the foregoing springs, Kamegawa has natural sand-baths along the beach. The chemical composition of the spring water there is explained in the foregoing table.

### c. The *Jigoku* or "hells."

The Hachiman-Jigoku or "Hells" in Hachiman:—The Hachiman-Jigoku or "Hells" are located some four kilometers to the west of the city of Beppu. They are divided into three sections, those of Itaji-Hachiman, Tsurumi, and Hachiman. Of these, the "Hell" at Itaji-Hachiman is a geyser, and intermittently throws up hot water. The force whereby the gushing water is sent upward, is different according to different seasons. It is weakest in April, and strongest during the rainy season in June, when it sometimes sends the

water soaring up toward the sky to the extent of 40 meters. This "Hell," like the one at Tsurumi, has been excavated by human hands. The latter is a pond which emits fierce vapour. The "Hell" at Hachiman is natural. It forms a small pit which contains boiling mud. It emits vapour thus creating mud bubbles.

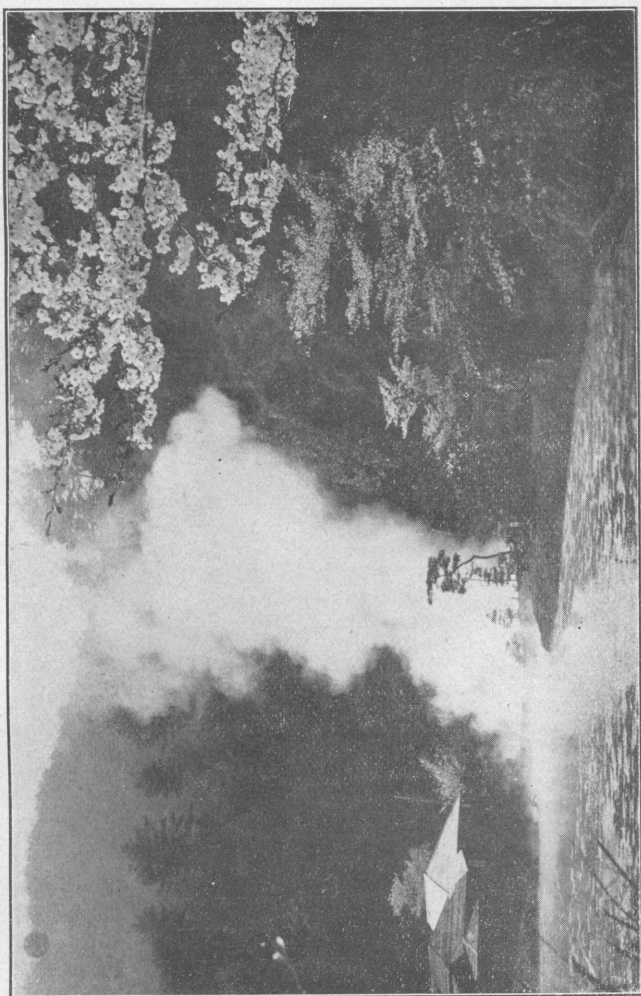
The Umi-Jigoku or "Sea Hell":—A number of "Hells" are found between the hot-springs of Myōban and Kannawa, clearly indicating the existence of a fissure line between the two localities. To the north of the "Sea Hell" Proper, there is the "Human Hell." This "Hell," like the one at Hachiman, forms several small pits, emitting mud bubbles.

The "Sea Hell" is composed of two ponds. One of them is a boiling water pond some 150 meters square, while the other is 3,000 meters square, forming a lake which has hot-springs at several different spots. The smaller pond contains boiling greenish blue water, and emits white vapour, presenting a very picturesque sight. It is to be noted that the spa at Shin-Beppu draws its supply of hot water from the hot-springs of the "Sea Hell."

The Bōzu-Jigoku or "Priests' Hell", and the Kōya-Jigoku or "Hell of the Dyeing Pot":—About one kilometer to the west of the "Sea Hell," is situated the "Priests' Hell." This "Hell" forms a pit, and boils mud by the power of its vapour. The "Hell of the Dyeing Pot" is situated at a spot about half a kilometer from the "Priests' Hell." This "Hell" contains blue boiling water, giving the impression of a dyeing pot: hence its name.

The Kannawa-Jigoku or "Hell" at Kannawa:—Kannawa has been a popular spa since ancient times. The Kannawa "Hell" is in the center of the town of the same name, and emits vapour, causing fierce noises. The vapour emitted is now transmitted through a Buddhist image, from the head of which it is allowed to issue. By human work the natural sight of the vapour emission has been made impossible.

The Kamado-Jigoku or "Oven Hell":—Some two kilometers to the northeast of the Kannawa "Hell," there is the "Hell of the Cooking Oven" among the valleys. Before reaching the "Hell" one crosses an upland. Out of a large depression surrounded by huge stones, which resembles an oven, vapour of high temperature issues.



Umi Jigoku.



The Chinoike-Jigoku or "Blood Pond Hell":—This "Hell" can be reached by descending the valleys east of the "Hell of the Cooking Oven" to a level land. The hot-spring water in the "Blood Pond Hell" is light blue as it gushes out, but when the water comes in contact with the air, its colour changes to light vermilion, due to the oxidation of the iron contained in the water. The red ferric oxide forms a deposit at the bottom of the "Hell" which resembles blood. The water boils and emits vapour. *Chi-no-ike* means a "Pond of Blood" in Japanese.

Recently, mud-baths have been prepared by utilizing the mud of the "Blood Pond" in a manner similar to that of the maul baths in the West.

### III. GUIDE TO THE HOT-SPRINGS AND "HELLS."

What are worth visiting in Beppu are the Furō-sen, Reichō-sen and other public bathing establishments, and the natural sand-baths on the seashore at low tide. For visiting the "Hells" and spas, visitors are advised to take an automobile. Leaving Beppu in an automobile, and going about one kilometer toward the west, the Beppu Geophysical Institute of Kyōto Imperial University is reached. Here research work on the Beppu hot-springs is being conducted by Assistant Professor Suzuki under the direction of Professor Shida, along the lines of geology, physics and chemistry. The equipment of the Institute includes Wiechert's seismograph and another seismograph of Professor Shida's own invention capable of recording seismic vibrations 20,000 times magnified. Daily meteorological observations are also being made there. The Institute was opened in 1924.

By going further westward the Hachiman-Jigoku or "Hells" in Hachiman are reached. They are situated about four kilometers to the west of Beppu. Of the three "Hells" grouped at this spot, one is a geyser, another a fierce fumarole, both excavated by human power, and the other is interesting for its natural mud bubbles. All are of interest to visitors.

The automobile then goes northward. The Beppu hot-spring district lies in a territory extending from the foot of Mt. Tsurumi to the seashore, forming an inclined plain, topographically called a "fan." From Beppu to the "Hells" in Hachiman, the automobile runs over the southwestern corner of the fan. From the "Hells" in

Hachiman, the car traverses a gently inclined plain to the north. This is called the Ishigaki Plain.

While the car is running over this plain, Mt. Tsurumi may be seen in full view. Toward the northeastern foot of the mountain there is another elevation called Mt. Ōgi with its skirts extending in a northeastern direction. Although the fine characteristics of the mountain have apparently been lost, it is clear that it was once a beautiful conical volcanic mountain. The summit of the fan-shaped plain at Ishigaki is close to the northern part of the crater of Mt. Tsurumi. It is a famous ancient battlefield, where in A.D. 1600 Ōtomo-Yoshimune, a powerful feudal lord, engaged in battle against his rival Kuroda-Yoshitaka, and was killed.

Passing over the plain and still going northward, the automobile arrives at the northern end of the Beppu Hot-Spring district and enters a mountainous section. The first thing to be seen here is the Umi-Jigoku or "Sea Hell," a large pond from which a great quantity of hot water is gushing. The water is greenish blue like the water of the sea. Hence the name of the "Sea Hell." Going on to the west, the Bōzu-Jigoku or "Priests' Hell" and the Kōya-Jigoku or "Hell of the Dyeing Pot" are visited. Here interesting mud bubbles can be seen. If a fire is built on the bank of the mud pond of the Bōzu-Jigoku, the vapour issuing from the surface of the water seems to attain greater thickness in colour.

The automobile then turns eastward for a distance of two kilometers to reach the Kannawa hot-spring and "Hell." Two kilometers farther on to the northeast the Kamado-Jigoku or "Hell of the Cooking-Oven" is reached. From the big "Cooking-Oven," vapour of a high temperature soars up to heaven. If one approaches the vapour with a burning match, the white vapour increases several fold in visibility. It is a curious and interesting phenomenon.

On a plain situated below the valleys lying to the east of the Kannawa hot-spring, the Chinoike-Jigoku or "Blood Pond Hell" is located. The water is tinted vermilion, due to the deposition of ferric oxide at the bottom of the "Hell"; hence the name of *Chi-no-ike* or "Pond of Blood." Leaving this "Hell," the automobile runs over a smooth road along the seashore of Kamegawa for a distance of six kilometers before returning to Beppu.

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## BOTANICAL NOTES ON THE BEPPU DISTRICT

BY KWAN KŌRIBA AND ZENTARŌ TASHIRO

The vegetation in the Beppu district has been extremely modified since prehistoric times, partly by the volcanic action of Mt. Tsurumi, and partly by human agency. Though this district lies in a warm-temperate region, where evergreen oaks and others should predominate, yet such an association can scarcely be seen, except at shrines and temples, where it has been to some extent preserved.

For instance, at Yusuhara, 8 km. southeast of Beppu, there is a grove surrounding a shrine, in which *Pasania cuspidata*, *Quercus gilba*, *Cinnamomum Camphor*, *Ilex Oldhami*, *Prunus macrophylla*, *Myroxylon japonica*, and other trees grow luxuriantly. The largest camphor tree there has a circumference of about 20 m. Another example, which indicates the mild climate of this vicinity, is a *Cycas*-tree about 600 years old in the grounds of the Shookuji temple, 12 km. north of Beppu. It has a height of 5 m. and its 25 branches cover an area measuring 8×9 m. The circumference of the main trunk measures 3.3 m. These two trees are now preserved by the Government as national relicts. About 18 km. east of the temple, there is still another natural relict at Karijuku, in the village of Nagae. It is a tract where *Iris Rossi* grows abundantly and in late spring adorns the hillsides with attractive flowers.

In the hot-spring region, among other trees and shrubs are to be noticed: *Quercus glauca*, *Elaeocarpus elliptica*, *Myroxylon japonica*, *Symplocos lucida*, and some species of *Deutzia*. *Arundo bifaria* growing along the river banks, *Woodwardia radicans* var. *orientalis* on the steep slopes, and *Ligularia Tussilaginea* on rocks are also remarkable.

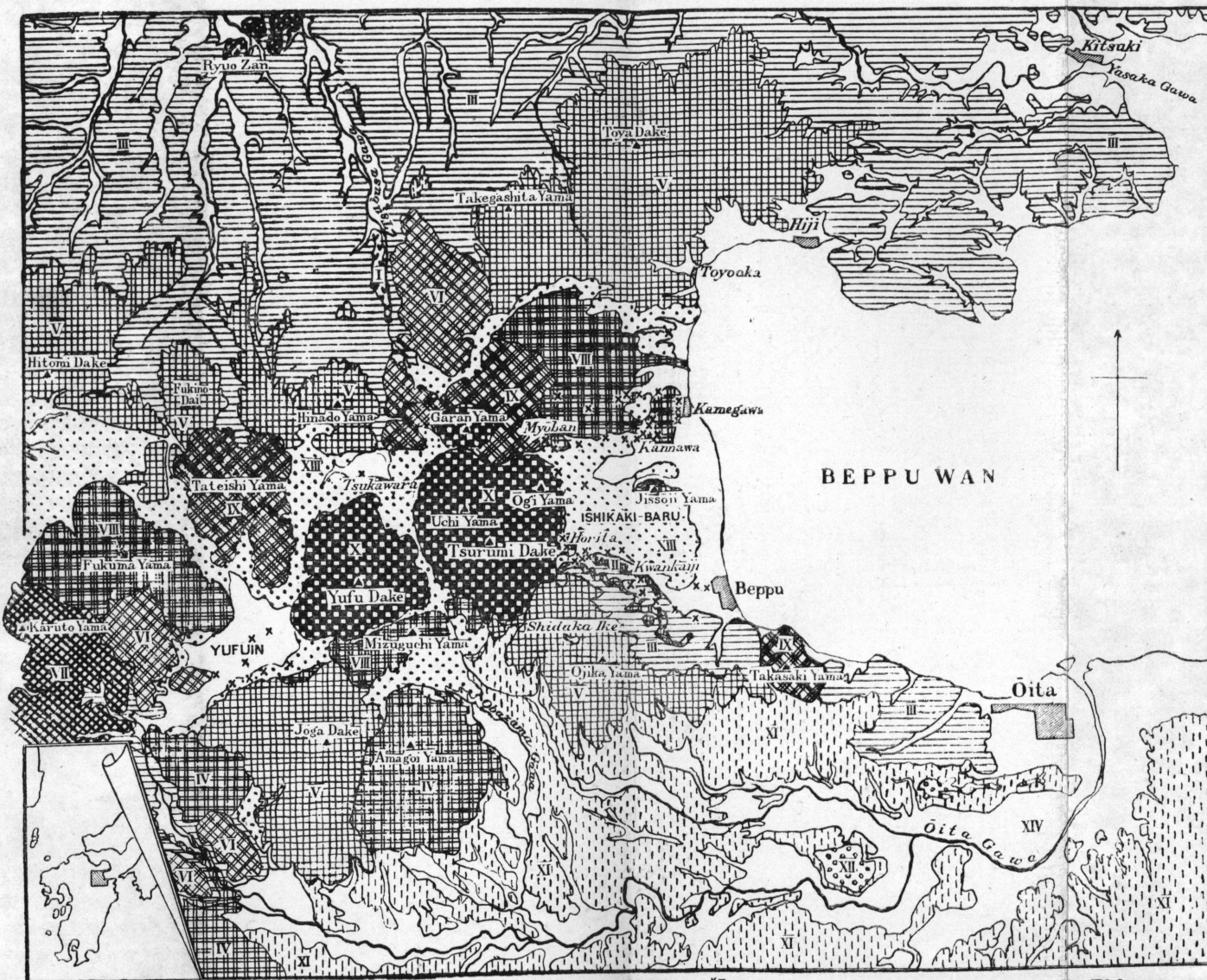
A feature of special interest in connection with the hot springs is the occurrence of some southern plants. *Pteris vittata*, *Dryopteris gongylodes*, *Lycopodium cernuum*, *Fimbristylis ferruginea*, and *Wedelia calendulacea*, all of which are known to be distributed southward from South Kyūshū, are found here, but only near the hot springs or along the streams flowing from them. The fact that these plants produce spores or easily dispersible fruits, implies that they were carried from the south, probably by the wind, and are able to flourish here only in the warm places.


















Mt. Tsurumi (1,375 m.) and Mt. Yufu (1,584 m.) stand immediately west of Beppu. The vegetation of the former is still very young, but the latter, especially its western side, being free from the eruptive damage of the former, has well developed forests and meadows. Besides such common plants as *Miscanthus sinensis*, *Festuca ovina*, *Arundinaria variegata* var. *Tanakae* and two species of *Lespedeza*, there occur some plants proper to Kyūshū, such as *Achillea ptarmicoides* var. *brevidens*, *Artemisia vulgaris* var. *kiusiana*, *Saussurea kiusianum*, *Pedicularis refracta*, *Cnidium longeradiatum* and *Rhododendron kiusianum*, the last mentioned being well-known for its charming flowers. There are also floral elements common to Korea and Manchuria, but absent or rarely found in Honshū and Shikoku, such as *Symplocos paniculata*, *Viola xanthopetala*, *Iris Rossi*, and others, implying the intimate relation of Kyūshū with continental Asia in past geological periods.

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# GEOLOGIC MAP OF THE ENVIRONS OF BEPPU



-  Quartz Diorite
-  Propylite
-  Basal Pyroclastics
-  Hypersthene Andesite
-  Two Pyroxene Andesite
-  Augite Hornblende Andesite Glass
-  Biotite Hornblende Andesite
-  Older Pyroxene-bearing Hornblende Andesite
-  Pyroxene-bearing Hornblende Andesite
-  Younger Pyroxene-bearing Hornblende Andesite
-  Aso Lava
-  Pleistocene Gravel
-  Fan and Detritus
-  Recent Deposit
-  Hot-spring

0 1 2 3 4 5 Km.

By T. Matsumoto

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