

**The Toya-Usu UNESCO Global Geopark Master Plan**

(hereinafter: 'the Master Plan') provides information on the Toya-Usu UNESCO Global Geopark: its basic profile, viewpoints of the action plan, the roles of stakeholders, and future goals. It is intended that all stakeholders share the information provided herein.

**The Master Plan is valid for 2019 through 2028,** with the provision that the Toya-Usu UNESCO Global Geopark shall promptly revise the plan in accordance with any changes in circumstances and with feedback on activities.

# 01

## PROFILE OF THE TOYA-USU UNESCO GLOBAL GEOPARK

## 01-1 Profile of the Toya-Utsu UNESCO Global Geopark

The Toya-Utsu UNESCO Global Geopark (hereinafter: 'the UGGp') is on the Pacific Ocean in the southwestern part of Hokkaido Prefecture, Japan. The UGGp includes the whole area of the municipalities of Date, Toyoura, Sobetsu and Toyako. The UGGp measures 1,064 km<sup>2</sup>. With respect to climate, the UGGp is in a relatively warm part of Hokkaido, a subarctic island. Overlapping with Shikotsu-Toya National Park, the UGGp is blessed with magnificent seasonal landscapes and soothing hot springs. The Pacific Ocean to the south provides abundant marine resources; the fertile volcanic soil fosters fresh, delicious vegetables, fruits and livestock products. Such 'volcano's blessings' attract many visitors.

Yearly average temperature : 7.8 °C

Yearly average precipitation : 932 mm (Date)

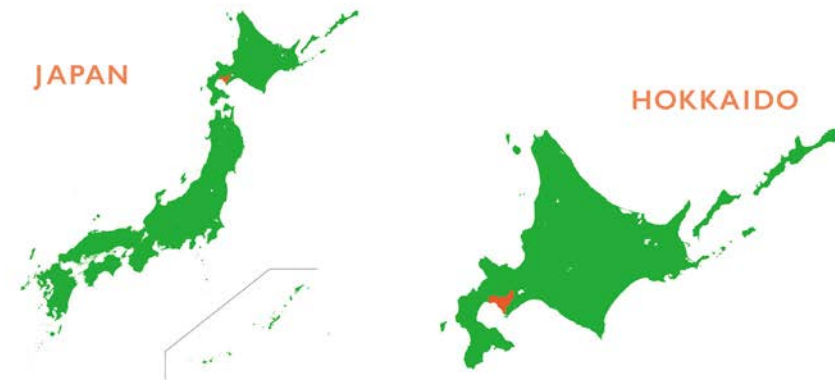
Yearly snow accumulation : 50 cm - 1 m

Municipalities :

Date, Toyoura, Sobetsu, Toyako

Industries :

tourism, agriculture (strawberries, apples, cherries, potatoes, beans/peas), fishery (scallops, flatfish, salmon)



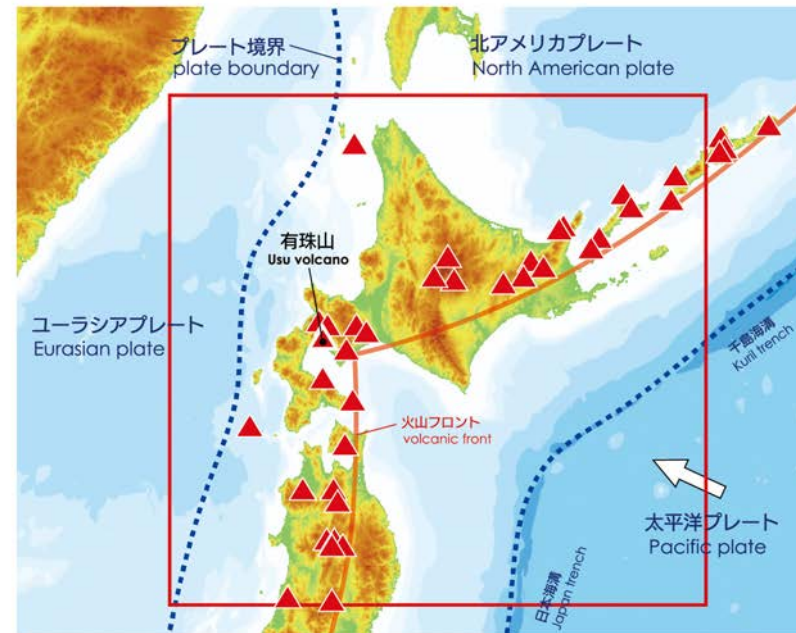
### - Volcanic Activity in the Environs of Today's Lake Toya and Mount Usu -

There are many volcanoes in Japan. This geological feature relates to global-scale earth movements underneath the ground.

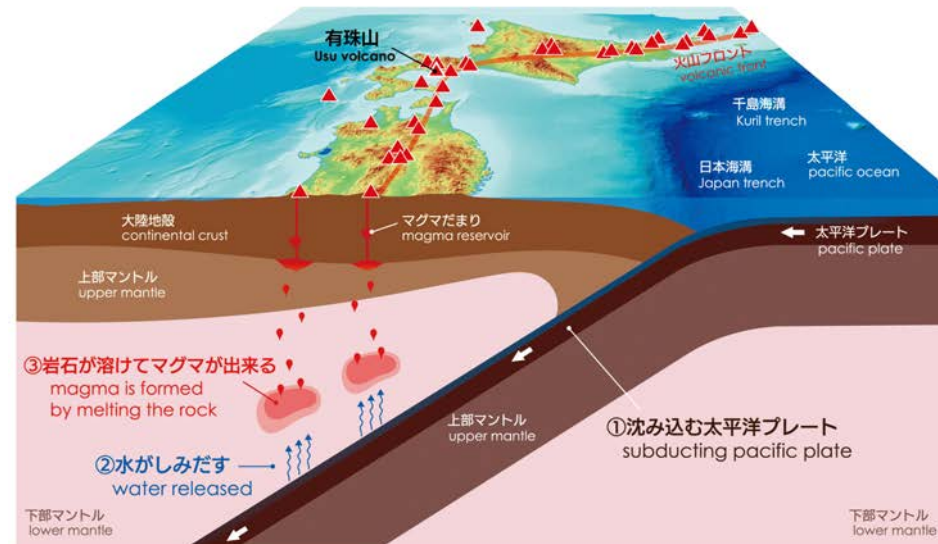
The earth's surface is covered by separate areas of bedrock called tectonic plates. Subducting oceanic plate releases water into the mantle at about a depth of 100 km. The water released into the mantle then decreases the melting point of the overlying rock (mantle). Following that, magma is formed by melting the rock. The magma rises to the surface and forms volcanoes.

Today, the Japanese archipelago is at the boundary of four plates. The Pacific Plate, which is under the Pacific Ocean, and the Philippine Sea Plate have been subducting under the crust of the Japanese archipelago, forming a trench along which earthquakes and tsunamis are likely to occur. Such subduction also generates large volumes of magma underground. The Toya caldera (Lake Toya) and Mount Usu have resulted from such subduction.

Lake Toya, the Nakajima islets and Mount Usu are the main features of the UGGp. Mount Usu has erupted several times. There is evidence of past volcanic eruptions farther from Lake Toya, such as in Toyoura and in the Otaki district of Date.



火山分布図 Location of active volcanoes



海溝でのマグマの発生 Magma genesis at subduction zone

### - Geological setting of the Toya-Usu UGGp -

The topography and natural features of the UGGp were mainly formed by a massive volcanic eruption some 110,000 years ago. The eruption discharged significant volumes of magma, or pyroclastic flow, from underground. The pyroclastic flow eventually covered the area tens meters in depth. Additionally, the volcano collapsed to form a large, flat-bottomed depression called caldera. As water flowed in, it became the lake we now call Lake Toya. Approximately 50,000 years ago, volcanic activity resumed at the centre of the lake, Nakajima crypto domes were formed

Lake Toya is Japan's third-largest caldera lake, after Lake Kussharo and Lake Shikotsu, both also in Hokkaido.



Repeated eruptions south of Lake Toya from 20,000 years ago formed Mount Usu. The eruptions during that period were characterized by lava flows. The magma was not very viscous, and the shape of the mountain was originally similar to Mount Fuji ('stratovolcano').

The summit area was collapsed 7,000 to 8,000 years ago\*, and debris avalanche flowed down southwest towards Uchiura Bay in the Pacific Ocean. Eventually, many large and small hummocks were formed at the foot of the mountain. Mount Usu had been in a dormant for thousands of years after that the collapse before erupting again in 1663, and it has erupted nine times since then. The nine most recent eruptions were characterised by high viscosity magma, which is occurred pyroclastic flows and formed new lava domes. Mount Usu has erupted every few decades from different craters.

\* There are various opinions regarding the dates. Discussions are under way.



### - People's Lives -

After the collapse 7,000 to 8,000 years ago, Mount Usu was quiescent for thousands of years. Springs in many places around Mount Usu have provided sources of water throughout the year. Rivers which run through the area have been home to salmon, which return every autumn. The complex terrain around the mountain that originated from the debris avalanche deposit and the reefs that formed from submarine volcanic activity have fostered marine creatures. The calm sea of Uchiura Bay and the reef have made a good fishing ground. This blessed environment has supported pleasant living. People started to settle in the area during the Jomon cultural period (roughly 10,000 years ago), and ethnic Japanese from Honshu, who were often called 'Wajin', began to migrate to the area in the Meiji period (the late 1800s).

The flat, cultivated lands around the volcano receive enough sunlight for various crops. Uchiura Bay is favourable for scallop farming and for other seafood. A hot spring source was discovered after the 1910 eruption, which has transformed the area to a major spa destination under the name of Toyako Onsen. The 1944 eruption created Mount Showa-Shinzan. The area was designated as Shikotsu-Toya National Park in 1949 and is a major international tourist destination.





## 01-2 Features of the Toya-Usu UNESCO Global Geopark

### - A Geoscience Heritage: The Ever-changing Earth -

In the UGGp area, the community zone is near geosites such as the Toya caldera, the Nakajima lava domes and cryptodomes and Mount Usu. This fact attests to the UGGp's status as a geological heritage of international value.

An enormous eruption occurred massive amounts of pyroclastic flows that buried the plains around the volcano to form the Toya caldera—now Lake Toya—and created a broad plateau of pyroclastic flow. This plateau became good farmland. Another eruption approximately 50,000 years ago formed the Nakajima islets, a group of more than 10 cryptodomes at the centre of the lake.

Mount Usu erupted four times in the 20th century alone. **In 1910**, it erupted at the northern foot of the mountain four days after a precursor earthquake, continued to explode for a couple of months, and eventually formed at least 45 new craters. In addition to, Mount Meiji-Shinzan was formed.

**From 1944 to 1945**, it erupted again at its eastern foot six months after a precursor earthquake. This time the magma uplifted farmland and residential areas to finally form a lava dome 407 m in elevation (now 398 m in elevation) above sea level. It was named Mount Showa-Shinzan.



**In 1977**, that mountain erupted 32 hours after a precursor earthquake. Initially, ash plumes were ejected to an altitude of 12,000 m, and the eruption continued until 1978. Earthquakes and ground

upheavals continued through 1982. Consequently, the mountain's summit was pushed up by magma to form Mount Usu-Shinzan.

In 2000, it erupted at its western foot four days after a precursor earthquake. Not only did it create more than 65 new craters at the foot of Mount Nishiyama and around Mount Konpira, but it also caused magma to push up roads and buildings, creating 'Mount 2000-Shinzan'.

The volcanic faults and mudflows that resulted from these eruptions repeatedly damaged infrastructure in surrounding communities. The land deformation and subsequent damages from the eruption are preserved as 'disaster remains', one of the geoscience heritages of the UGGp. Rare assets even in global terms, these sites speak to the importance of reducing disaster risks in the future.

Communities in the area accept the harsh reality of living under the risk of volcanos, receive abundant harvests from geological activity, and strive to live in harmony with the ever-changing earth into the distant future. This never fails to inspire visitors from around the world.



1910 eruption



1944-45 eruption



1977-78 eruption



2000 eruption

### - Successful Evacuation in the 1910 Eruption -

When Mount Usu erupted in 1910, Professor Omori Fusakichi of Tokyo Imperial University (the present University of Tokyo) and his team installed a pendulum seismograph on the erupting volcano. Their measurements were the world's first records of volcanic tremors of a mountain, and they significantly contributed to progress in volcanology and eruption forecast studies. Mr. Iida Seiichi, the chief of police in Muroran, persuaded local legislators to evacuate 15,000 residents from the site prior to the eruption. He made great use of knowledge learned from Professor Omori. This is believed to have been the world's first successful volcanic evacuation.



Prof. Omori Fusakichi

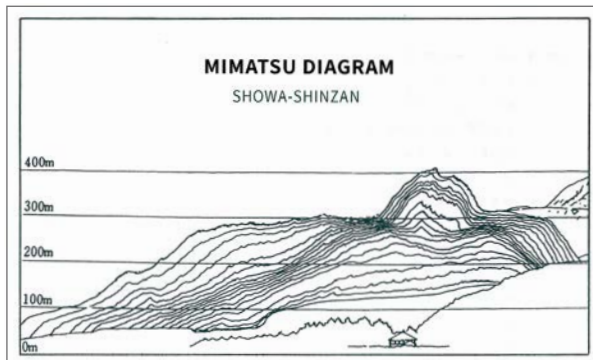


Iida Seiichi





Mimatsu Masao



Mimatsu Diagram

### - Mount Showa-Shinzan -

The eruption occurred from 1944 to 1945, causing the wheat fields and residential area east of Mount Usu to upheave, and eventually forming Mount Showa-Shinzan. Towards the end of World War II, volcanologists were unable to investigate the eruption process onsite because the Japanese army maintained a strict embargo on information. Instead, Mr. Mimatsu Masao, a local postmaster, recorded the number of earthquakes and drew a series of sketches of the rising ground while maintaining contacts with professional scientists. Mimatsu believed that this volcanic activity should not be ignored by history.

His sketches proved to be epochal data that revealed how a volcano develops. The data were compiled into what is named the Mimatsu Diagram, which gained great acclaim at the 1948 International Union of Geodesy and Geophysics in Oslo, Norway. Since then, the diagram has become well-known to geologists worldwide. The diagram is now presented in volcanology textbooks, and the original is preserved at the Mimatsu Masao Memorial Museum in Sobetsu.

Mimatsu later purchased Mount Showa-Shinzan to protect the rare lava dome and the whole formation from development and other human intervention. His action was based on the beliefs that Mount Showa-Shinzan is an ideal case study of a volcano and that it must remain undisturbed. Mount Showa-Shinzan was designated as a special natural

monument of Japan in 1957. Since its inscription on the list of Global Geoparks in 2009, the mountain has been one of the primary geosites of the UGGp.

Geological activity in the area has been scientifically recorded, and the sites that have resulted from volcanic activity have been preserved to retain their value and to be used for educational purposes. Those local efforts over the past 70 years are consistent with the Global Geoparks principle that such parks shall promote sustainable community development by balancing preservation against the utilisation of geological heritages. The collaborative efforts of scientists, residents, and governments to ensure life alongside the volcano still strongly reflect the spirit of Global Geoparks.

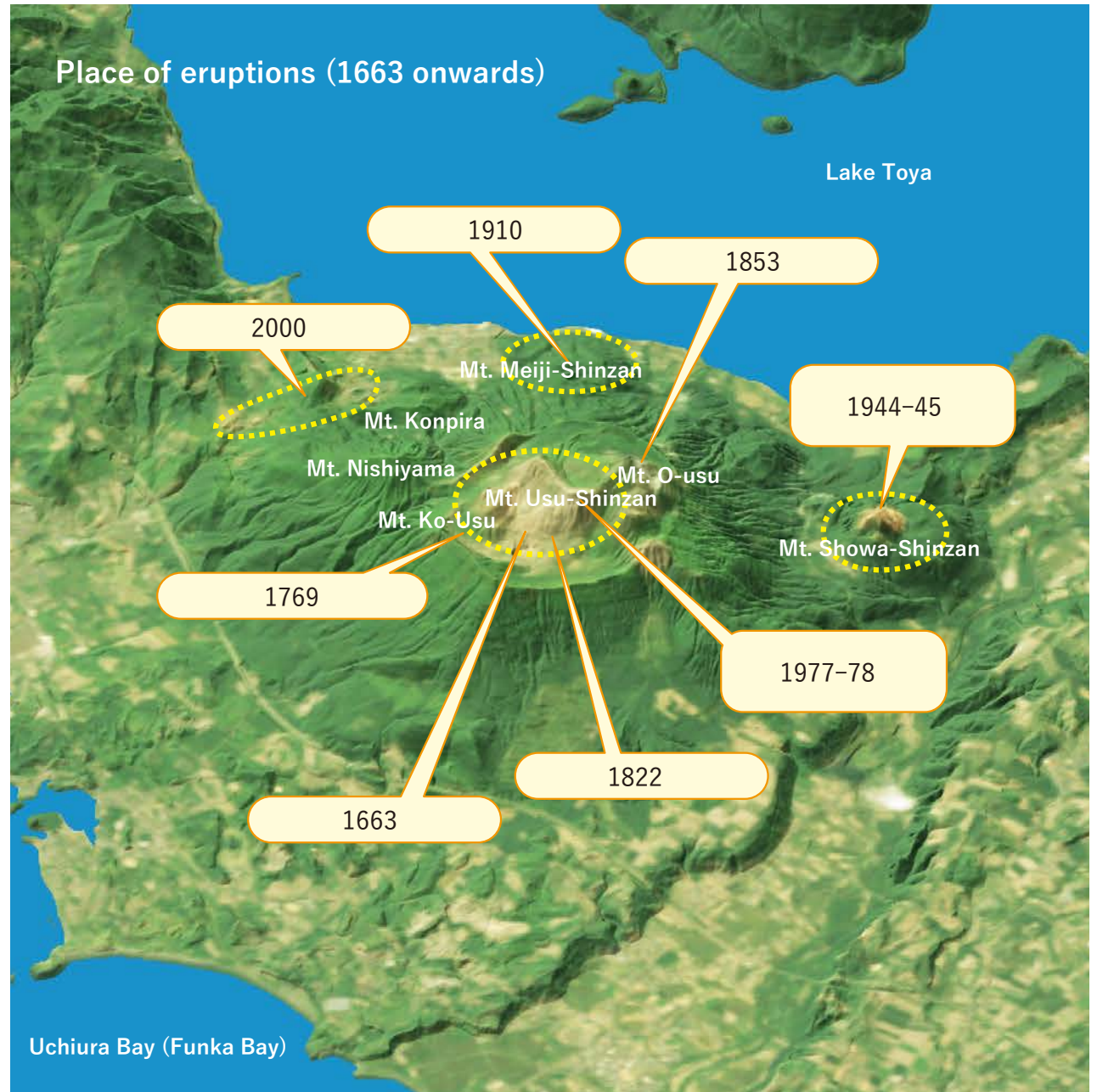
## 01-3 Various Heritages

### - Natural Heritages -

Forests cover one-third of the UGGp. Lake Toya, Mount Usu and their environs also comprise Shikotsu-Toya National Park. Natural assets here are unique in terms of volcanic topography and geology, which consist of caldera lakes, plateaus of pyroclastic flow, lava domes and cryptodomes, craters, hummocks, hollow coves and coasts. Mount Usu is near the sea, a setting that has given it unique vegetation of seaside and alpine plants.



As new craters were formed by each eruption, the vegetation succession at each place proceeded at different speeds. Some sites are relatively bare or have only short, herbaceous plants after an eruption; other sites have grown into forest in the more than a century that has passed since an eruption. We can see birds and other animals adapting to these changing environments: Woodpeckers feed on insects inside trees that died in eruptions, and bank swallows create holes in which to nest at precipices of soft hummocks.





### - Cultural Heritages -

Along the coast are many archaeological sites from the Jomon culture through the modern Ainu culture (circa, 14,000-300 BCE). After the sector collapse of Mount Usu, the area remained stable and tranquil until 1663, when the mountain erupted again. People were blessed with abundant marine and land resources for thousands of years. Two archaeological sites—the Irie Takasago Shell Midden and the Kitakogane Shell Midden—attest to the lifestyle of the time. These sites are part of the ‘Jomon Archaeological Sites in Hokkaido and Northern Tohoku’, which aims for inscription on the list of UNESCO World Cultural Heritages. The coast of Uchiura (Funka) Bay is a notable shell midden cluster in Japan. The remains of communities, shell middens, and ritual places from the Jomon to the Ainu cultural periods suggest that rich natural blessings of the area have supported people’s survival and prosperity over a long time, not to mention today. At the Kitakogane Shell Midden, which is another shell midden in the UGGp area, a number of tools made from lava have been excavated, showing the relationship between the Jomon culture and volcanos

### - Intangible Heritages -

Many place names in the UGGp originate from expressions of the Ainu, an indigenous people of Hokkaido. These names suggest an Ainu perspective on nature. Ainu in the Rebunge and Abuta districts annually host prayer rituals called *Kamuinomi* (prayers to the gods) and *Icharupa* (prayers to ancestors). Traditional Japanese customs were brought by migrants from the main island of Japan during or after the end of the Edo shogunate (the mid-19th century). Some of these customs, such as the *shishimai* (lion dance), *dashi* (float) parades, and Japanese drumming, are featured at local events and festivals.





### - Disaster Risk Reduction Culture, a Unique Intangible Heritage -

The UGGp area has faced many disasters and has successfully managed to avoid severe damage. We must emphasise that this is because the residents know Mount Usu well, are aware of how to prevent the loss of life from eruptions, and understand how to respond to events. We refer to the residents' awareness of eruptions and commitment to eruption risk-reduction activities as a 'disaster risk reduction culture', which is a significant intangible heritage of the UGGp.

For example, the 2000 eruption brought serious damage to the whole area, but there were no casualties because local governments and volcanologists worked together to evacuate all the residents prior to the eruption. This would not have been possible without prompt responses by the government and academic experts, as well as appropriate actions by the residents to mitigate damage. Towards building readiness for future eruptions of Mount Usu, the Toya-Usu Volcano Meister certification was launched in 2008. As of today, more than 50 Volcano Meisters are actively committed to promoting this culture of disaster risk reduction.



# 01-4 Policies for Sustainable Development

The UGGp is proud of its the volcano’s blessings. The spectacular scenery of the magnificent caldera lake, the steaming lava domes and cryptodomes, and the jagged craters, as well as hot springs that comfort visitors, are all gifts of the earth. Our community development focuses on the culture of disaster risk reduction. To remain mindful of disasters, we maintain the traces of past eruptions ( ‘disaster remains’) and organise unique educational opportunities that help us to be prepared for possible future disasters.

The ‘disaster risk reduction culture’ and ‘volcano’s blessings’ have laid a foundation for sustainable development policies of the Toya-Usu UGGp. See the following statements.

(1) The Toya-Usu UNESCO Global Geopark will achieve sustainable communities by reducing disaster damage through a culture of DISASTER RISK REDUCTION and by increasing the local value of VOLCANO’S BLESSINGS.

(2) The Toya-Usu UNESCO Global Geopark will contribute to global society regarding geological hazard mitigation by promoting our DISASTER RISK REDUCTION CULTURE. Well aware of the threats of the volcano and prepared for the coming disasters, the Toya-Usu UNESCO Global Geopark will contribute to the global popularity of geotourism through VOLCANO’S BLESSINGS and will achieve a sustainable global community through the Global Geoparks Network.

