

2. Hakone

Hakone is especially popular to the people because the major Pacific coast route, Tokaido, has been passing over it since the early ninth century, and the ancient government had set the major check point en route here. Today, Hakone is one of the most popular resort places, accessible within two hours from Tokyo, and is full of hot spas and historical remains.

Hakone is a caldera volcano consisting of old somma, young somma, seven central cones, a caldera lake "Ashinoko", and a barraco "Hayakawa". Its rather complex volcanic history was studied by the late Professor H. Kuno(1950, 1951, 1952). Figure 2-1 is after Kuno(1951). Studies have also been done by Professor Machida(1968, 1977).

The first volcanic activity of Hakone took place about 300,000 years ago and built an andesite strato-volcano of the Mt. Fuji shape, with an altitude of about 2,700m. An andesite parasitic volcano Kintokisan and a dacite parasitic volcano Makuyama were formed on the north-western and south-eastern flanks respectively. In the last stage of this activity, the top of the conical volcano collapsed or depressed and formed the first stage caldera. The caldera had been enlarged by the erosion during the quiescent period after its formation.

The young somma activity started about 130,000 years ago when it formed a 300m thick dacitic shield volcano filling the old caldera. Flat top hills Takanosuyama and Byobuyama at the east and south-east part of the caldera are young somma lavas. Then after a long quiescent period 75,000 to 50,000 years ago, a huge scale pumice eruption occurred three times. These caused Plinian air fall deposits and ignimbrite flows. Remnants of the pumice flow deposits are found at 50km east from the source near Yokohama City and also 25km south-west near Izunagaoka. The pumice eruption caused the caldera present today, with an oval shape measuring 12×7km.

The central cone activity took place 30000 years ago. There are Kozukayama, Daigatake, Kamiyama, 1325m peak, Komagatake, Kami-futago and Shimo-futago from north to south. Among them, Kamiyama is a strato-volcano and others are monogenic lava domes. Ejecta from Kami-futago has been dated at 4840 BP and it seems that this lava dome is

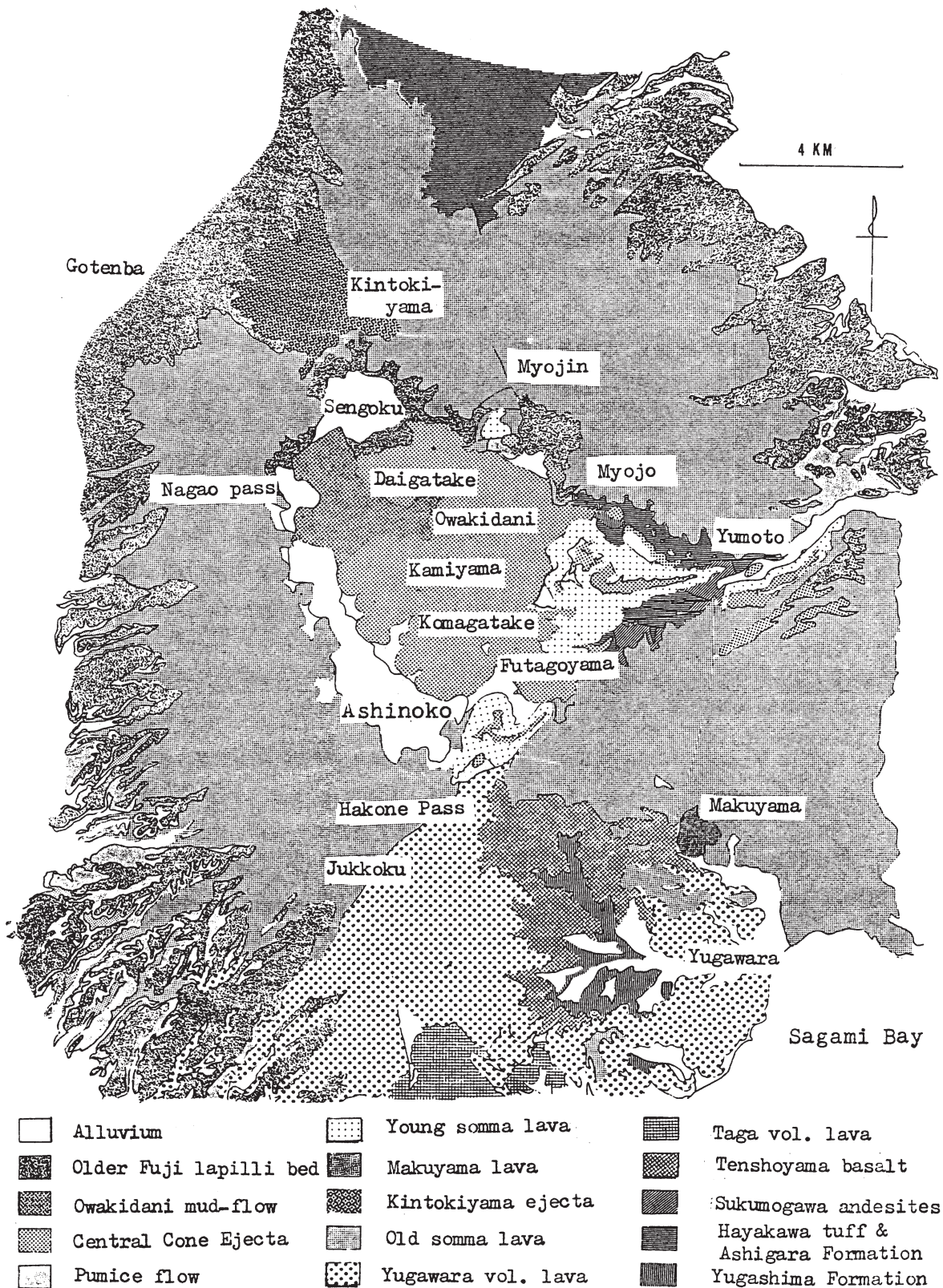


Figure 2 - 1 Geological Map of Hakone Volcano After Prof.H.Kuno(1950)

the youngest among the seven, and it appears that the northern ones are older. Kamiyama is the highest peak of Hakone with an altitude of 1438m above sea level, and this cone seems to have a history of repeated eruptions. The last magmatic eruption of Hakone took place on its flank as the lava spine Kanmuri-gatake and recent swarm earthquakes also occurred underneath this cone.

An explosion caused a mudflow on the north-west flank of Kamiyama dated at 3100 BP, and this mudflow dammed up the lake Ashinoko. Pyroclastic flow covering the mudflow has been dated at 2900 BP and this material turned out to be similar to the lava spine Kanmuri-gatake material. This lava spine is probably the last magmatic extrusion activity of Hakone, about 3,000 years ago.

Ashinoko is an elongated lake with a size of 6.5×1.5km, and area of 6.9km², maximum depth of 42m and water surface altitude of 723m. A 1,400m long water tunnel was dug in 300 years ago to give drainage on the western flank of Hakone, and is called Hakone-yosui.

Hakone occasionally causes swarm earthquakes. In 1786 AD about 100 earthquakes occurred in 2 days causing boulders to fall down from Futago-yama, damaging houses at Ashinoyu Hot Spa. In 1917, 242 earthquakes were felt in a day and two months later a fierce hot mudwater spring appeared at Owakidani. In 1934, there were felt swarm earthquakes and a landslide occurred at Owakidani. In 1952, there were felt swarm earthquakes and half a year later a great landslide occurred at Sounzan solfatara, causing 10 deaths and injuring 16 when a temple was washed away. In 1966 felt swarm earthquakes led to a sudden rise in hot spring temperatures about 10 months later. Changes of up to 20° C were observed. This evidence indicates that the swarm earthquakes were caused by thermal water ascending up from the depths under Kamiyama, and is probably related to the magmatic activity which occurs at these depths.

Seven natural hot springs have been known through history, and in the last 50 years boring wells have been drilled and new spas have been developed. Now there are 15 hot springs with a total of more than 220 wells yielding 18 tons/min, with an average spring temperature of 55° C.

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