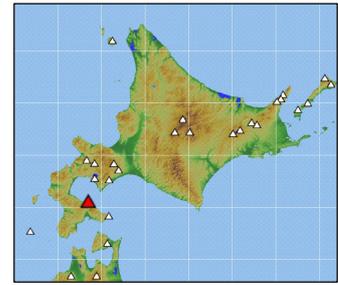


18. Hokkaido-Komagatake

Continuously Monitored by JMA

Latitude: 42°03'48" N, Longitude: 140°40'38" E, Elevation: 1,131 m
(Kengamine) (Elevation Point)



Overview of Hokkaido-Komagatake taken from south side on June 22, 2010. Courtesy of Chiaki Inaba.

Summary

The Hokkaido-Komagatake volcano is an andesite stratovolcano (The SiO₂ content is between 58.1 and 61.2 wt %) which became active over 100,000 years ago (Ganzawa et al., 2005). A conical stratovolcano was formed by Lava and pyroclastic material discharges until approximately 40,000 years ago. Three eruptive activity periods have been identified since then, with repeated collapses and explosive eruptions (Yoshimoto et al., 2008). At the summit there is a horseshoe-shaped crater with a diameter of approximately 2 km, surrounded by Kengamine to the west, Sawaradake to the north, and Umanose and Sumidamori to the south. Multiple small craters exist on the crater floor, and the 1942 eruption created a NW-SE fissure approximately 1.6 km long through the Showa 4-nen crater. The 1996 eruption created fissure vents approximately 200 m long to the south of the Showa 4-nen crater.

Photos



Fissure and craters taken from southwest side on June 30, 2006 by the Japan Meteorological Agency



Showa 4-nen Crater, taken from northwest side on June 30, 2006 by the Japan Meteorological Agency



Camera image at southeast of Shikabe Park on November 4, 2011 the Japan Meteorological Agency



Camera image at Akaigawa on October 20, 2011 y the Japan Meteorological Agency



Eruption on June 17, 1929, taken from Morimachi – Hiroki Nemoto (1930)



Eruption On October 25, 1998, taken from Nanae at southern foot of volcano
Courtesy of the Komagatake Disaster Prevention Committee



Showa 4-nen crater after eruption on September 28, 2000, taken from north side by the Japan Meteorological Agency

Topography around the Crater

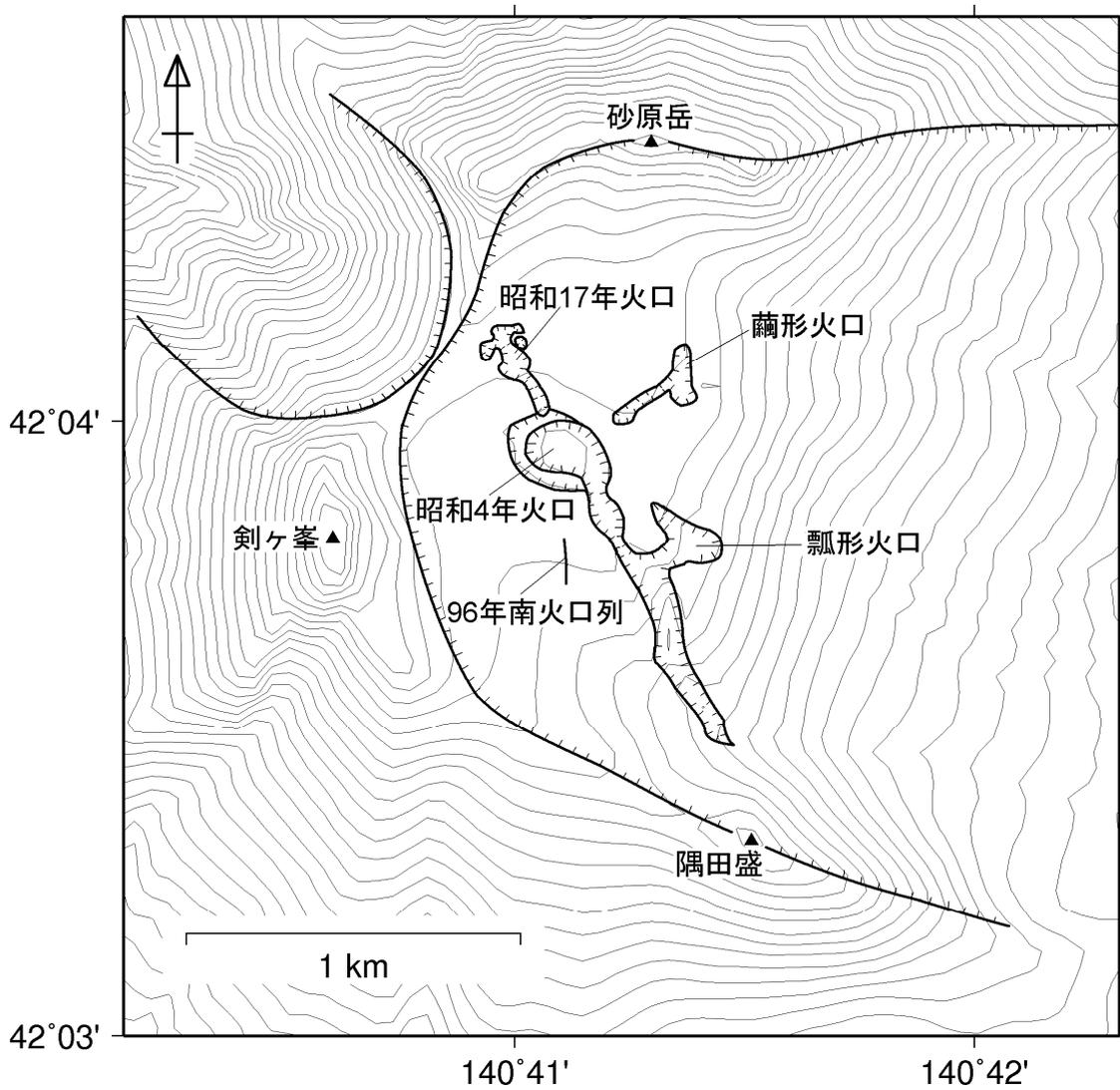


Figure 18-1 Detailed topography of the crater area.

Red Relief Image Map

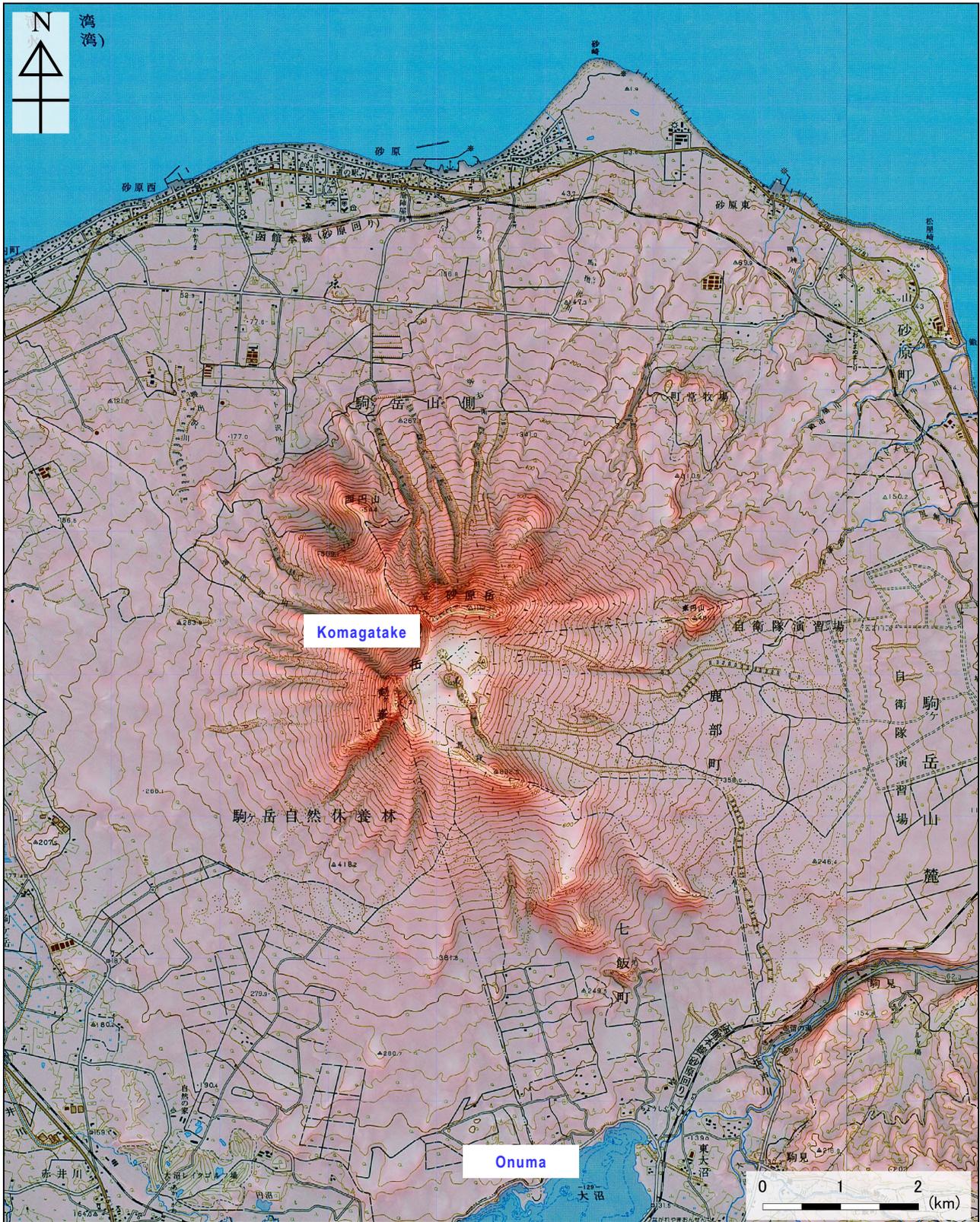


Figure 18-2 Topography of Hokkaido-Komagatake.

1:50,000 scale topographic maps (Onuma-Koen, Usujiri, Komagatake and Shikabe) and digital map 50 m grid (elevation) published by the Geospatial Information Authority of Japan were used.

Geological Map

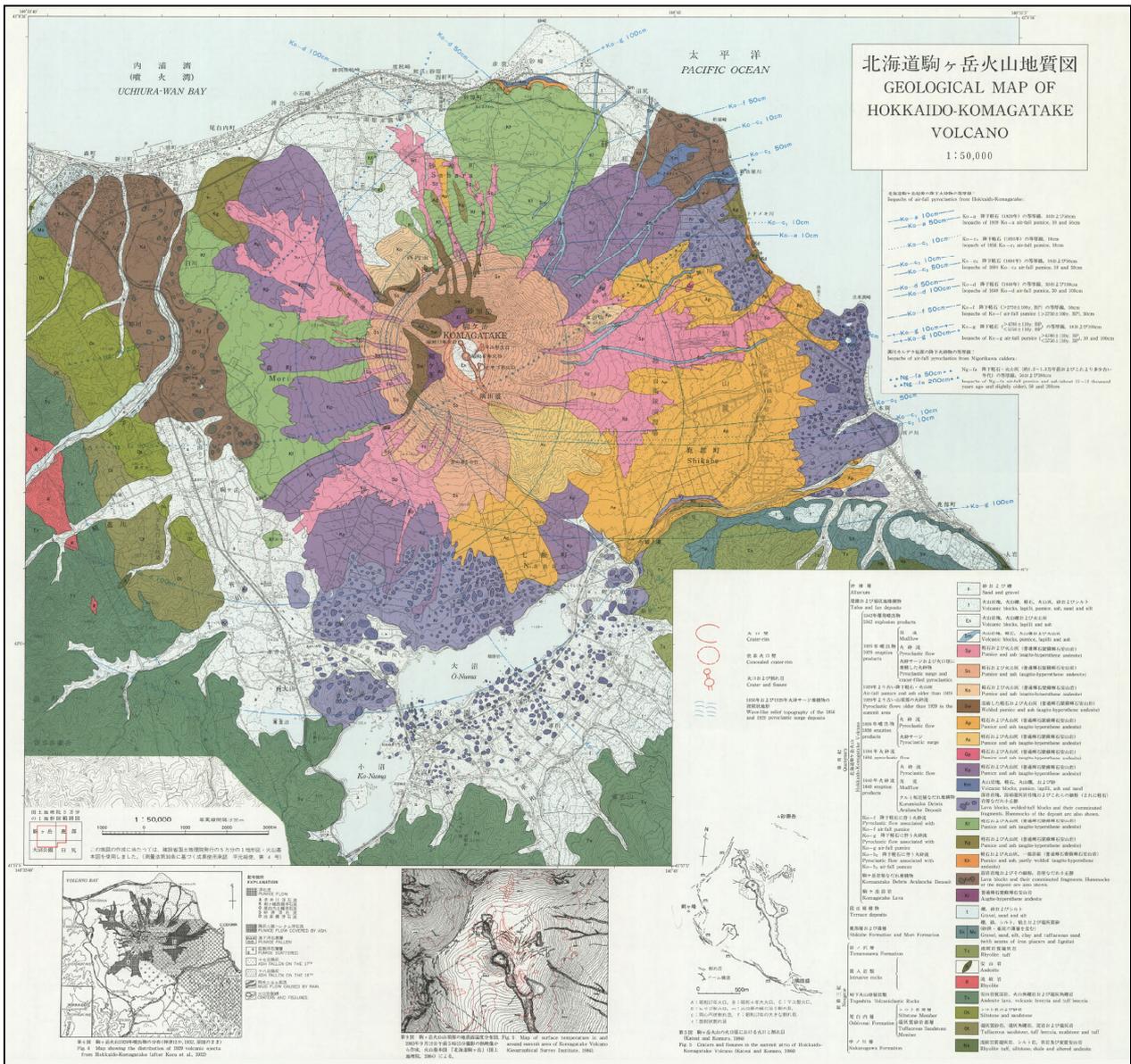


Figure 18-3 Geological map of Hokkaido-Komagatake (Katsui et al., 1989).

Chronology of Eruptions

Volcanic Activity in the Past 10,000 Years

Hokkaido-Komagatake resumed activity approximately 6,800 years ago, after a dormant period of over 6,000 years. In the approximately 500 years since approximately 6,800 and 6,300 years ago, 4 explosive eruptions occurred. The eruption approximately 6,800 years ago issued air-fall pumice and pyroclastic flow (Ko-g). The eruptions between approximately 6,500 and 6,300 years ago emitted 2 pyroclastic flows (P1 and P2). The eruption approximately 6,300 years ago ejected air-fall pumice and a pyroclastic flow (Ko-f). Then, after a dormant period of over 6,000 years, volcanic activity resumed during the Edo period (Katsui et al., 1989; Yoshimoto et al., 2008). The 1640 eruption started with sector collapse followed by a large plinian eruption. After the eruption, plinian eruptions occurred in 1694, 1856 and 1929.. Phreatic eruptions were then frequent, growing smaller in scale, leading up to the year 2000, one of which was a phreatomagmatic eruption in 1942 (Katsui et al., 1989; Ui et al., 1997a; Yoshimoto and Ui, 1998; Nakgawa et al., 2001; Takahashi et al., 2004).

Period	Area of Activity	Eruption Type	Main Phenomena / Volume of Magma
6.8ka	Summit?	Magmatic eruption	Ko-g eruption: Tephra fall, pyroclastic flow. Magma eruption volume = 1.2 km ³ DRE. (VEI 5)
6.5-6.3ka	Summit?	Magmatic eruption	P1, P2 eruptions: Pyroclastic flow. Magma eruption volume = 0.05 km ³ DRE. (VEI 4)
6.3ka	Summit?	Magmatic eruption	Ko-f eruption: Tephra fall, pyroclastic flow. Magma eruption volume = 0.3 km ³ DRE. (VEI 5)

* Volcanic periods, areas of activity, and eruption types taken from the Active Volcano Database of Japan, AIST (Kudo and Hoshizumi, 2006 onwards). All years are noted in Western date notation. "ka" within the table indicates "1000 years ago", with the year 2000 set as 0 ka.

A←→B: Eruption events taking place at some point between year A and year B

• Historical Activity

Year	Phenomenon	Activity Sequence, Damages, etc.
1640 (Kan'ei 17)	Large: (Debris avalanche) → magmatic eruption	July 31 large eruption: Strong volcanic rumbling, partial summit collapse at mid-day, producing debris avalanche which flowed into Onuma and Uchiura Bay, causing a tsunami which resulted in the drowning of over 700 people in coastal areas. Pyroclastic flow (blast) occurred at the same time as the collapse. After the collapse, strong emissions of pumice and volcanic ash occurred until August 2, as well as tephra fall and pyroclastic flow. Activity continued until late August. Dekimazaki was formed. The shapes of Onuma and Konuma became similar to the shapes they have today. Total ejecta: 2.9 km ³ . Magma eruption volume: 1.1 km ³ DRE. (VEI 5) Debris avalanche volume of 0.3 km ³ on the Onuma side, and 1.42 to 1.70 km ³ on the Shikabe side.
1694 (Genroku 7)	Large: Magmatic eruption	Large eruption on August 24: Eruption, accompanied by earthquakes and volcanic lightning, continued from the morning until August 26. Air-fall pumice and pyroclastic flow. Total ejecta: 0.36 km ³ . Magma eruption volume: 0.14 km ³ DRE. (VEI 4)
1765 (Meiwa 2)	Small eruption?	(Ancient legend).
1788 (Tenmei 8)	Volcanic plume	(Esashi local history).
1856 (Ansei 3)	Large: Magmatic eruption	September 23 large eruption: Rumbling. Earthquake swarm at the foot of the volcano from the early morning of September 25. Strong eruption began at approximately 9:00. Air-fall pumice killed 2, injured many, and burned down 17 houses in Shikabe and Honbetsu areas at eastern foot. Tomenoyu at southeastern foot struck by pyroclastic flow, killing 19 to 27. The eruption had largely stopped by the evening of the same day, but small eruptions occurred for approximately 1 month thereafter. Ansei crater formed. Total ejecta: 0.21 km ³ . Magma eruption volume: 0.08 km ³ DRE. (VEI 4)
1888 (Meiji 21)	Phreatic eruption	Small eruption (public notice, Hakodate Shimbun).
1905 (Meiji 38)	Phreatic eruption→ (lahar produced)	Rumbling on both August 17 and 18. Small eruption on August 19. New explosion crater (Meiji crater) opened at the south of Ansei crater. Eruption continued from August 21 to 23. Heavy rain in Oshidashinuma on August 22 caused secondary lahar, resulting in some damage to crops.
1919 (Taisho 8)	Phreatic eruption	Earthquake on June 16 (Hakodate weather station, 15:54), with rumbling. Small eruption on June 17. Several eruptions thereafter, until July 26.
1922 (Taisho 11)	Volcanic activity?	Slight anomalies in volcanic activity on May 22. (Details unknown)
1923 (Taisho 12)	Phreatic eruption	Sudden eruption at approximately 7:00 on February 27. Rumbling was heard in Sawara, and a small amount of ash fell at the western foot of the volcano. On March 15, at approximately 14:10, rumbling like distant thunder occurred, and a black volcanic plume.

Year	Phenomenon	Activity Sequence, Damages, etc.
1924 (Taisho 13)	Phreatic eruption	Occasional rumbling from approximately 8:00 on July 31. Small explosion and a black volcanic plume, reaching height of roughly 250 m, at approximately 8:30.
1929 (Showa 4)	Large: Magmatic eruption, (lahar produced)	An eruption began at approximately 0:30 on June 17 (Hakodate weather station recorded approximately 8 minutes of slight tremors, starting at 0:26). Tephra fall gradually increased, and at approximately 10:00 a large eruption occurred, accompanied by rumbling. At 11:00 the volcanic plume was 13,900 m tall. Pyroclastic flow began in the afternoon. 8 towns suffered damage due to volcanic blocks, air-fall pumice, pyroclastic flows, and volcanic gas, with over 1915 houses burned down, partially or completely destroyed, or buried. Major damage to mountain forest agricultural land. 2 deaths, 4 injuries, and 136 livestock killed. Activity subsided rapidly after 23:00 of the same day, returning to almost normal levels on June 19, and all activity stopped on June 21. Showa 4-nen crater, Mayugata crater, and Hisagogata craters were formed. Total ejecta: 0.34 km ³ . Magma eruption volume: 0.14 km ³ DRE. (VEI 4) Increase in volcanic smoke on September 6. Rumbling.
1934 (Showa 9)	Rumbling	Several incidences of rumbling from mid-day to the night of September 29.
1935 (Showa 10)	Rumbling and volcanic plume	Rumbling on October 14. Volcanic smoke increased on October 15.
1937 (Showa 12)	Phreatic eruption	Small eruptions on March 17 and 19. Showa 4-nen crater bottom blown off, leaving bucket-like shape.
1938 (Showa 13)	Earthquake and fume	Small earthquake swarms and fumarolic activity from February to April.
1939 (Showa 14)	Volcanic plume	Increase in volcanic smoke on April 5 and September 28.
1942 (Showa 17)	Moderate: Phreatic eruption → phreatomagmatic eruption → phreatic eruption (lahar production)	Pyroclastic surge → Tephra fall, lahar. On November 16, at approximately 8:00, an eruption began, accompanied by rumbling, and a volcanic plume that extended 8,000 m above sea level. A small pyroclastic surge also occurred. Volcanic lapilli and volcanic ash fell to the east-southeast, with 2 cm or more of deposits at Shikabe. A large crack, approximately 1.8 km in length, appeared in the summit crater floor. A small eruption also occurred on November 18. Lahar was formed at the summit crater floor crack from November 16 to 20. Total ejecta: 0.002 to 0.003 km ³ . (Small magma eruption volume)(VEI 2).
1943 (Showa 18)	Volcanic plume	Increase in volcanic smoke: 1,000 m above crater on January 30. 1,500 m above crater on April 16.
1947 (Showa 22)	Volcanic plume	Increase in volcanic smoke: 1,800 m above crater on February 14. 1,300 m above crater on November 9.
1949 (Showa 24)	Volcanic plume	Increase in volcanic smoke: 1,200 m above crater on April 26.
1954 (Showa 29)	Volcanic plume	Increase in volcanic smoke: 1,200 m above crater on April 3.
1967 (Showa 42)	Earthquake	Earthquake swarm: Earthquake swarm in Yokotsudake area, with an earthquake on December 9 with a seismic intensity of 1 in JMA scale in Hakodate and Onuma. December 16 earthquake with a seismic intensity of 2 in JMA scale in Shikabe and of 1 in Mori and Ono.
1969 (Showa 44) to 1971 (Showa 46)	Earthquake	Earthquake swarm: Earthquake swarm in Yokotsudake area from October, 1969, to May, 1971. On February 8 an earthquake with a seismic intensity of 3 in JMA scale occurred in Hakodate. On May 17, 1971, an earthquake with a seismic intensity of 2 in JMA scale struck Hakodate. ²⁸
1979 (Showa 54)	Volcanic plume	No volcanic plume was observed by visual observation from the Mori weather station after January 21 (until March, 1996, eruption).
1983 (Showa 58)	Earthquake and heat	Earthquake swarm consisting of 22 earthquakes during a short time on June 13. Underground temperature at Hisagogata crater rose slightly in October.

Year	Phenomenon	Activity Sequence, Damages, etc.
1987 (Showa 62)	Heat activity	Temperature at Showa 17 crater stopped falling, and began rising.
1989 (Heisei 1)	Earthquakes, volcanic tremors	Earthquake swarm on December 30 in Sawara area, approximately 5 km north of Komagatake. 20 earthquakes at Nishiyama (old A point). Maximum magnitude of M3.4, ale seismic intensity of 3 in JMA scale at Mori, and of 1 at Muroran. Tremors believed to be volcanic tremors measured over a wide range (Hokkaido University).
1990 (Heisei 2)	Earthquakes, volcanic tremors	Earthquakes on April 3 and 6. Earthquake swarm consisting of 49 earthquakes during a short period of time at the western foot of the volcano (old A point) on April 7. Low-frequency earthquake and volcanic tremor also observed on April 7 (Hokkaido University).
1996 (Heisei 8)	Small: Phreatic eruption	5 earthquakes before March 5 eruption. Small eruption on March 5: Tephra fall. Approximately 6 minutes of volcanic tremors were observed, starting at approximately 18:10. 1996 main crater formed inside Showa 4-nen crater. Roughly 200m long 1996 south crater chain formed on south of Showa 4-nen crater. Total ejecta: 120,000 tons. (VEI 1) Volcanic smoke increased on March 9, with volcanic plume extending 1,000 m above crater.
1998 (Heisei 10)	Fumarolic activity, heat activity	A new fumarole was confirmed in middle of northwest wall of Meiji crater on May 14 (first since immediately after March, 1996, eruption). A new fumarole was confirmed near Mayugata crater. No evidence of ejecta found for either.
		Slight increase in ground temperature and growth of geothermal area at west of 1996 south crater chain from July 30 to July 31.
	Small: Phreatic eruption	Small eruption on October 25: Tephra fall. Approximately 6 minutes of volcanic tremors were observed, starting at 9:12. Immediately after the eruption, a volcanic plume extended to a height of 1,200 m. Small amount of tephra fall over approximately 10 km area to east-southeast. 1998 crater formed inside Showa 4-nen crater. Total ejecta: 50,000 tons. (VEI 1)
1999 (Heisei 11)	Volcanic tremors	Tremors on March 1. Approximately 1 minute of volcanic tremors were observed. No surface phenomena anomalies.
2000 (Heisei 12)	Volcanic tremors	Approximately 1 minute of volcanic tremors were observed on March 12. No surface phenomena anomalies.
	Fume	July 19 to 21 Showa 4-nen crater fumarole grew in both volume and strength compared to spring field observations (for both main 1996 and 1998 craters).

Year	Phenomenon	Activity Sequence, Damages, etc.
2000 (Heisei 12)	Fume	From August 7 to 9 the amount of volcanic smoke from the Showa 4-nen crater rose above normal, with the volcanic plume reaching a maximum height of 400m above the crater (white on August 9). No colored volcanic plume, volcanic earthquakes, or volcanic tremors were observed. Special field observation carried out in the morning of August 9 found no anomalies in the crater area.
	Earthquake	Large earthquake on August 11 at 22:47. seismic intensity of 3 in JMA scale at Uwadaicho, Mori, and of 1 at Kaminoyu, Yakumo. Hypocenter located in Uchiura Bay, approximately 10km north-northwest of Komagatake. M3.4.
	Small: Phreatic eruption	Small eruption on September 4. Approximately 10 minutes of volcanic tremors were observed, starting at 22:14. Volcanic plume conditions immediately following the eruption could not be confirmed, because the eruption occurred at night, but at 5:00 on September 5 a white volcanic plume extended 500m above the crater. Volcanic ash was distributed to the northwest, and a small amount of ash fell over an area approximately 11km from the Showa 4-nen crater. Crater floor volcanic ash and lapilli deposits were up to 40 cm deep, and many volcanic blocks the size of soccer balls and some blocks 1 m or more in diameter were ejected (Geological Survey of Hokkaido, More weather station). Total ejecta: 100,000 tons. (VEI 1)
	Phreatic eruption	Very small eruption on September 12. Approximately 3 minutes of volcanic tremors were observed, starting at 22:12. A white volcanic plume rose 700 m above the crater. Surveys found no evidence of anomalies such as tephra fall or surface phenomena (at a later date a small amount of tephra fall was confirmed around the crater by the Mori weather station).
	Phreatic eruption	Small eruption on September 28. Approximately 8 minutes of volcanic tremors were observed, starting at 13:56. Volcanic plume conditions immediately following the eruption could not be confirmed because of clouds, but a small amount of ash fell over an area approximately 10 km from the Showa 4-nen crater, such as in the Higashionuma area at the southeast foot of the volcano. Near the crater, the volcanic ash was approximately 2 cm deep.
	Phreatic eruption	Very small eruption on October 24: Approximately 3 minutes of volcanic tremors were observed, starting at 0:01. Volcanic plume activity increased after small tremors were observed, reaching a height of 2,000 m above the crater (volume and color unknown). According to surveys and studies by organizations in the area, no tephra fall was observed at the foot of the volcano. Aerial observation found no new ejecta in the crater area, but on the afternoon of the 24 th , studies by the Mori weather station and Geological Survey of Hokkaido, etc. confirmed a small amount of new volcanic ash in the crater floor Umanose area.
	Small: Phreatic eruption	Small eruption on October 28: Approximately 9 minutes of volcanic tremors were observed, starting at 2:43. A volcanic plume rose 2,000 m or more above the crater (volume and color unknown). Volcanic ash was distributed around Shikabe and to the east, and a small amount of ash fell in the Iwato, Minamikayabe area, approximately 17km from the Showa 4-nen crater. On October 29, according to a study by Hokkaido University, volcanic blocks up to approximately 4.5 m across were ejected, as well as surge deposits. Total ejecta: 30,000 tons. (VEI 1)
	Volcanic tremors	On November 1, 3 small tremors occurred, so small that they were only recorded at the special summit observation point. Their durations were approximately 30 seconds each.
	Volcanic tremors	Approximately 2 minutes of volcanic tremors were observed on November 4. There were also other similar small waveforms. During the same times, the Hokkaido University general observation well observed tilt-changes. No surface phenomena anomalies were observed.
	Volcanic tremors	On November 5 a small tremor occurred. It was so small that it was only recorded at the special summit observation point. Its duration was approximately 30 seconds.
	Phreatic eruption	Small eruption on November 8. Approximately 9 minutes of volcanic tremors were observed, starting at 7:38. When the eruption occurred, a volcanic plume rose 2,000 m or more above the crater (volume and color unknown). Volcanic ash was distributed to the east and east-southeast, and a small amount of ash fell near the tephra fall fishing port, approximately 12 km from the Showa 4-nen crater.

Year	Phenomenon	Activity Sequence, Damages, etc.
2001 (Heisei 13)	Tremors, crustal deformation	Approximately 1 minute of volcanic tremors were observed beginning at 13:29 on January 17. Due to clouds, it is not known whether a volcanic plume was emitted. The tiltmeter at the western foot of the volcano (old A point) observed a shift from falling to rising at the same time as the volcanic tremors.
2002 (Heisei 14)	Earthquake	On February 19 earthquakes occurred relatively deep below the eastern foot of Komagatake, including a magnitude 3 earthquake. In addition, there was a slight increase in seismic activity from February to March.

* Reference documents have been appended with reference to the Active Volcano Database of Japan, AIST (Kudo and Hoshizumi, 2006 onwards) for volcanic periods, areas of activity, eruption types, and eruption events.

Whole Rock Chemical Composition

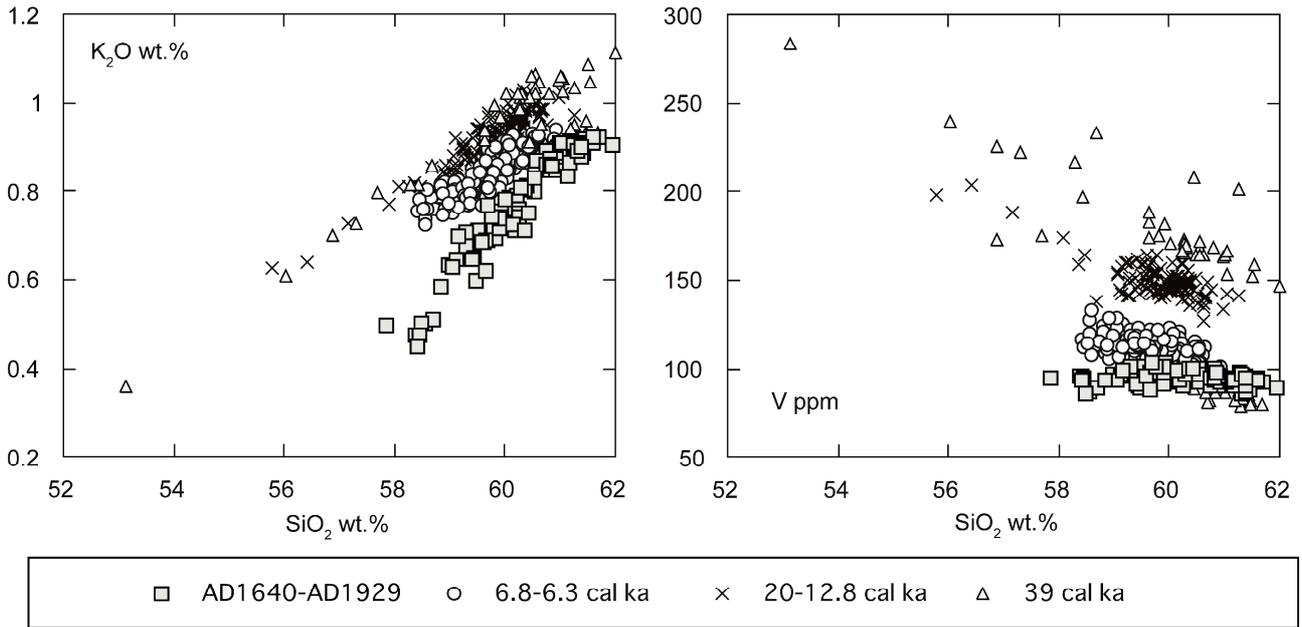


Figure 18-4 Whole rock chemical composition Harker diagram (after Yoshimoto et al., 2008).

Period - Cumulative Magma Volume

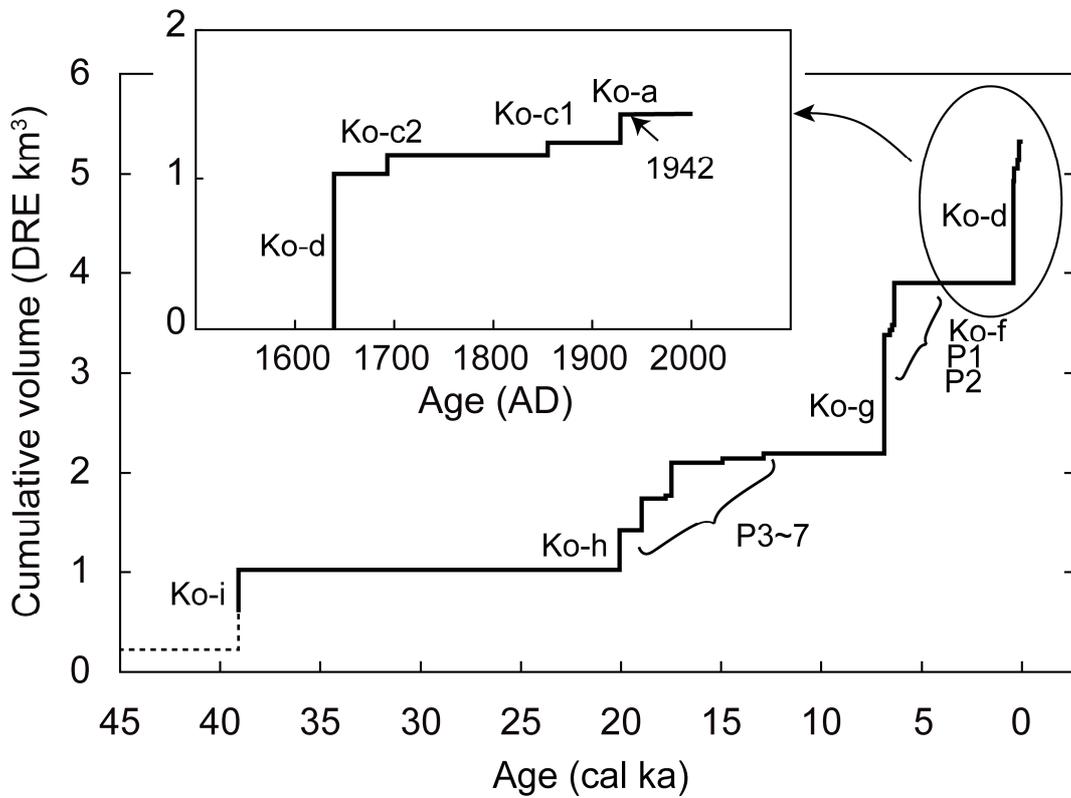
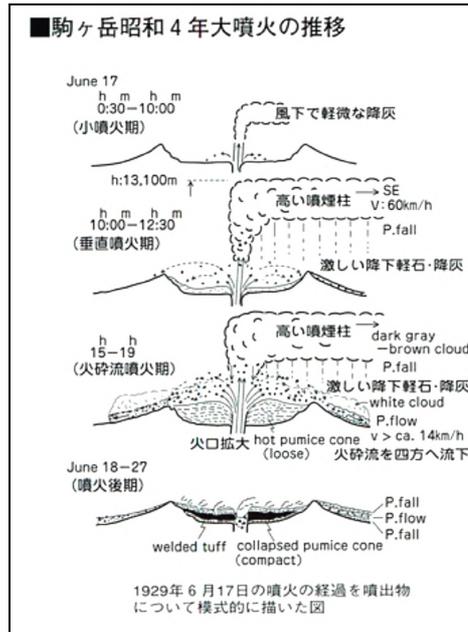
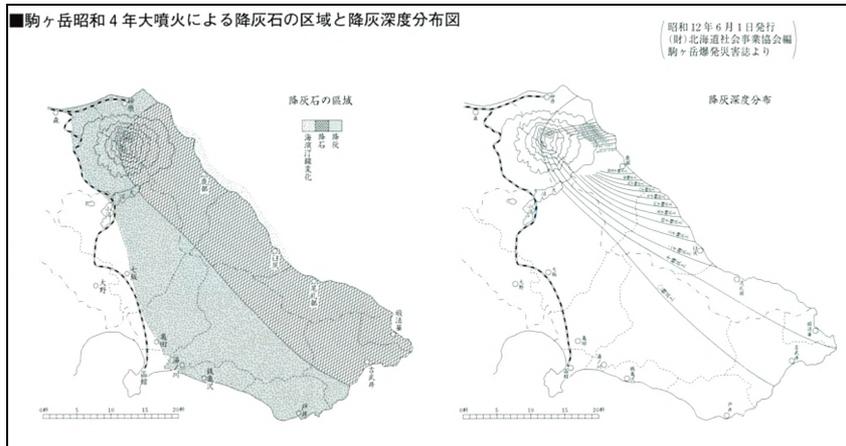


Figure 18-5 Step diagram of Komagatake Volcano (Yoshimoto et al., 2008).

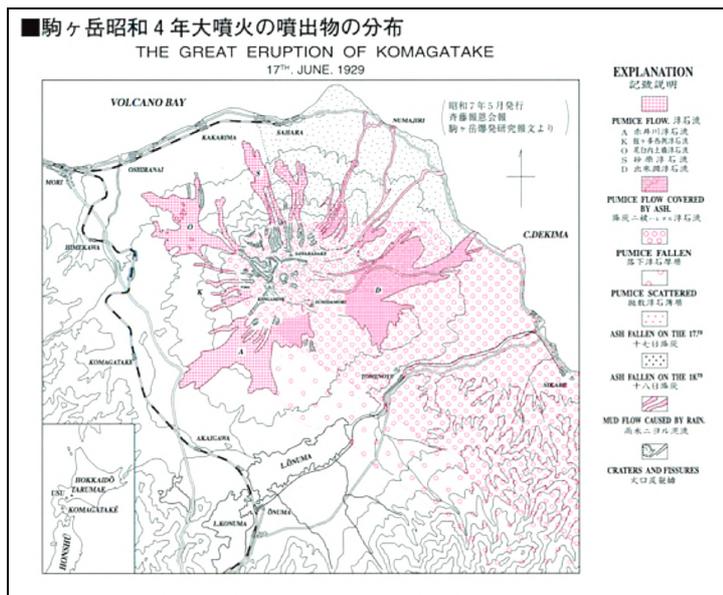
Main Volcanic Activities



(Katsui et al., 1975)



(Hokkaido Shakaijigyo, 1937)



(Kozu et al., 1932)

Figure 18-6 Chronology of the 1929 eruption and distribution of the ejecta (Komagatake Volcano Disaster Committee, 1998).



Figure 18-7 Changes in topography of Komagatake crater floor.
New craters (I to III) are shown in red on pre-1929 eruption topographical map (Atami and Kishigami, 1931)

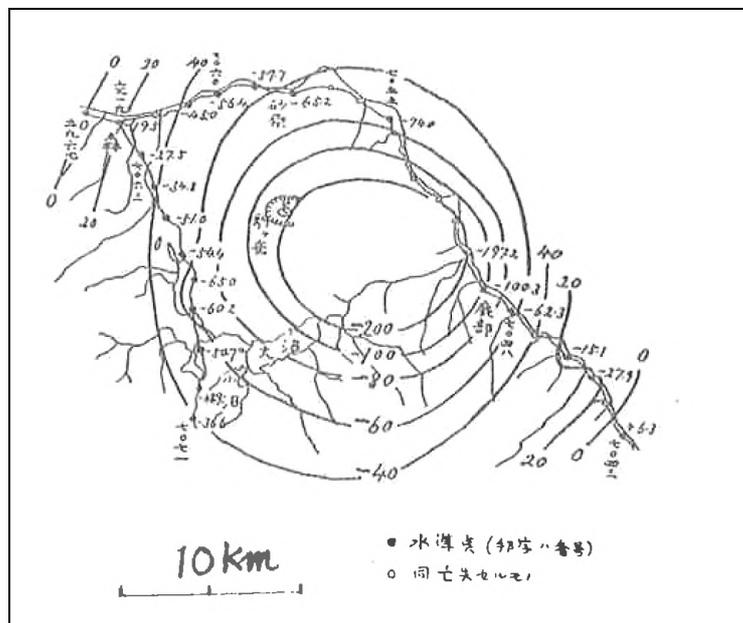


Figure 18-8 Distribution of vertical deformation from 1904 to 1934 (unit: mm) (Nakamura, 1935).

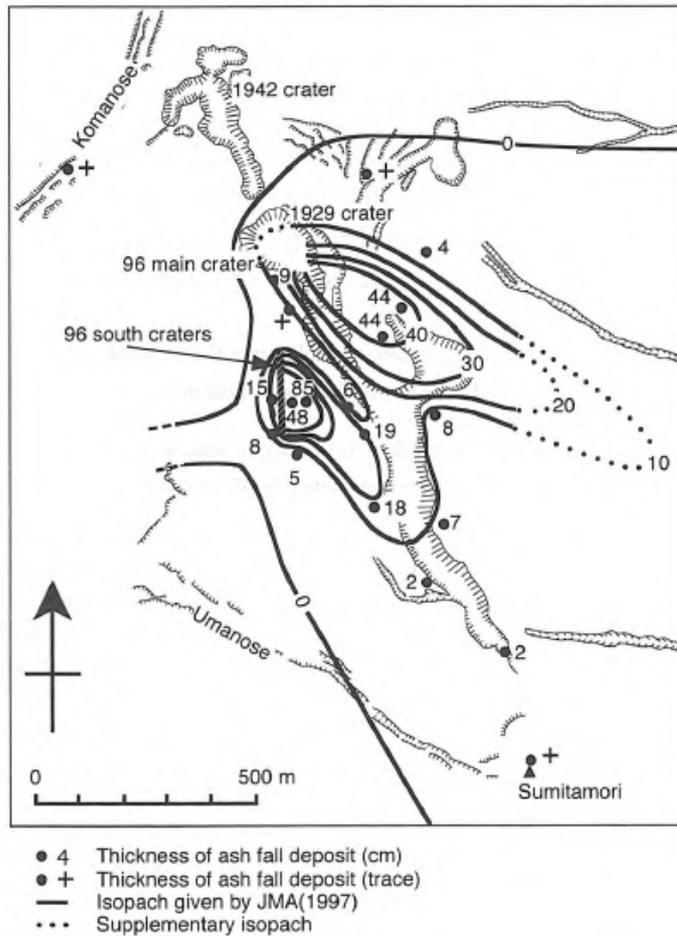


Figure 18-9 Distribution of ash fall from 1996 eruption near crater (Ui et al., 1997a).

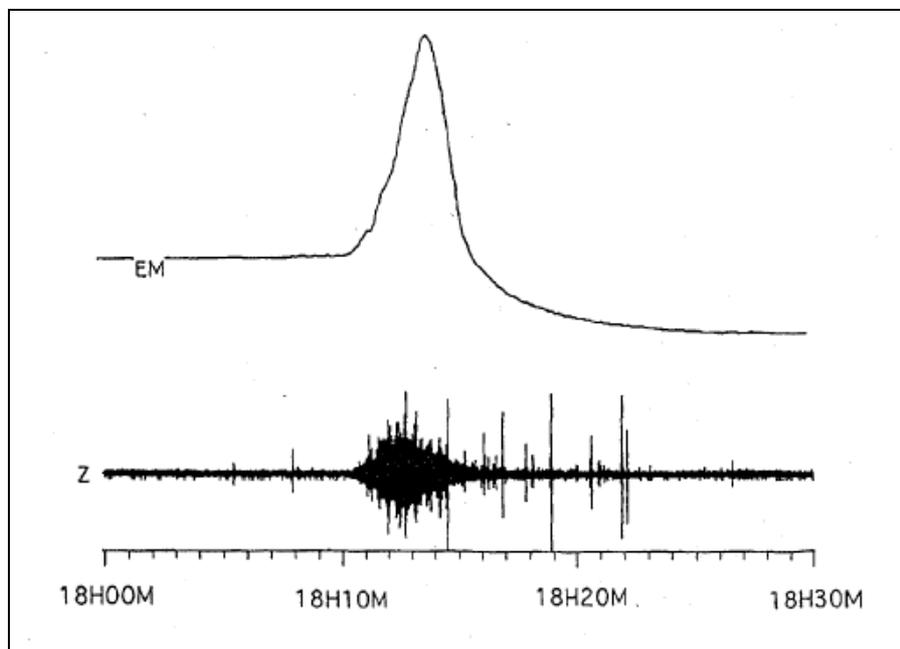


Figure 18-10 Extensometer and short-period seismometer records from 1996 eruption. (Usu Volcano Observatory, Hokkaido University, 1996)

The seismometer recorded long-period pulse variations in volcanic tremors and earthquake swarms at the same time as the small eruption, characterized by extensometer (N131°E direction) measurements of 1.6×10^{-8} of expansion and 0.5×10^{-8} of permanent contraction strain.

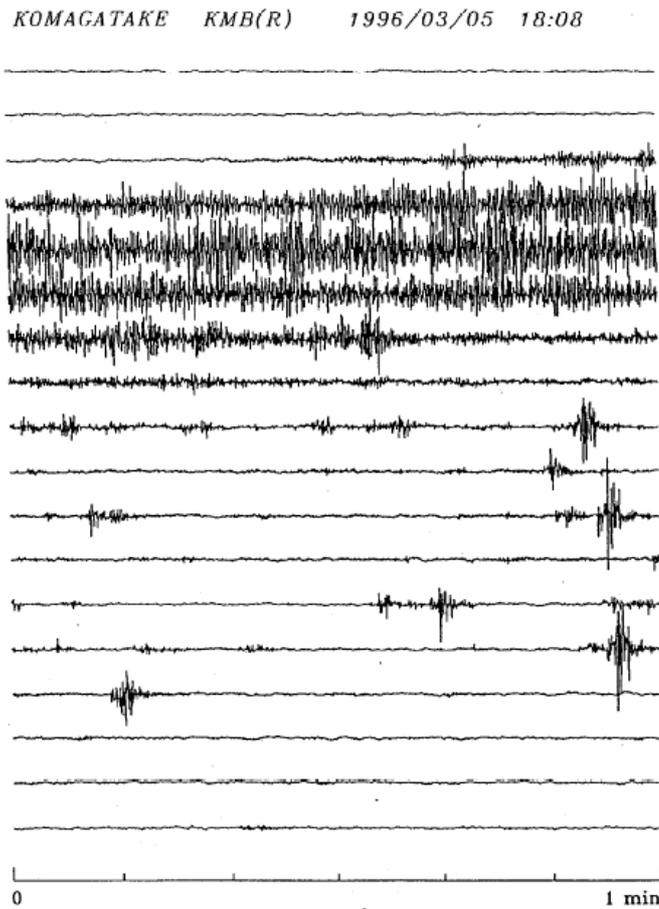


Figure 18-11 1996 eruption tremors and earthquake swarms (Hokkaido University School of Science Usu Volcano Observatory, 1996).

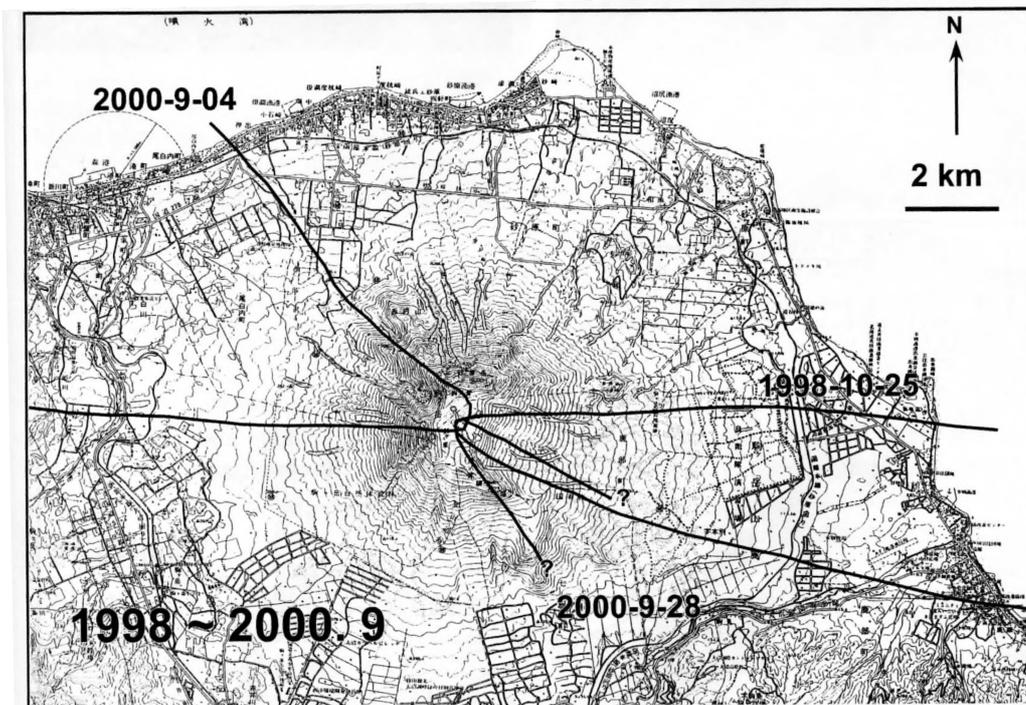


Figure 18-12 Distribution of ash fall from 3 eruptions, from 1998 to September, 2000 (Nakagawa et al., 2001).

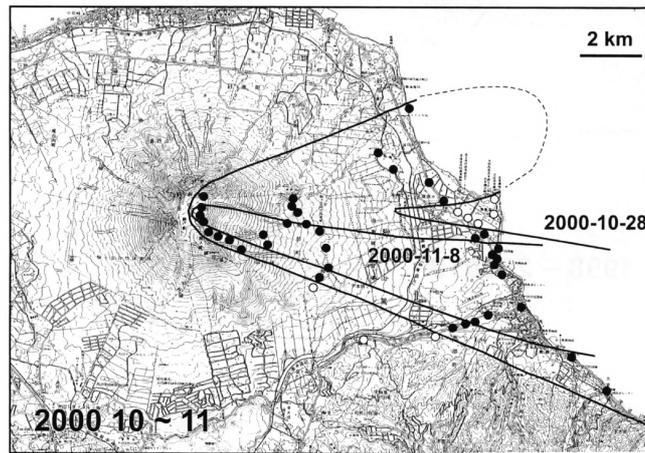


Figure 18-13 Distribution of ash fall from October 28, 2000, and November 8, 2000, eruptions (Nakagawa et al., 2001).

Precursory Phenomena

One week before the 1929 magmatic eruption localized felt-earthquakes and unfelt-earthquakes occurred. In the case of the recent phreatic eruption, there was slight summit crater floor inflation for approximately 10 years before the eruption, and an increase in small earthquakes in shallow areas directly below the crater floor immediately preceding the eruption. Also, volcanic plume activity increased several months before the eruption.

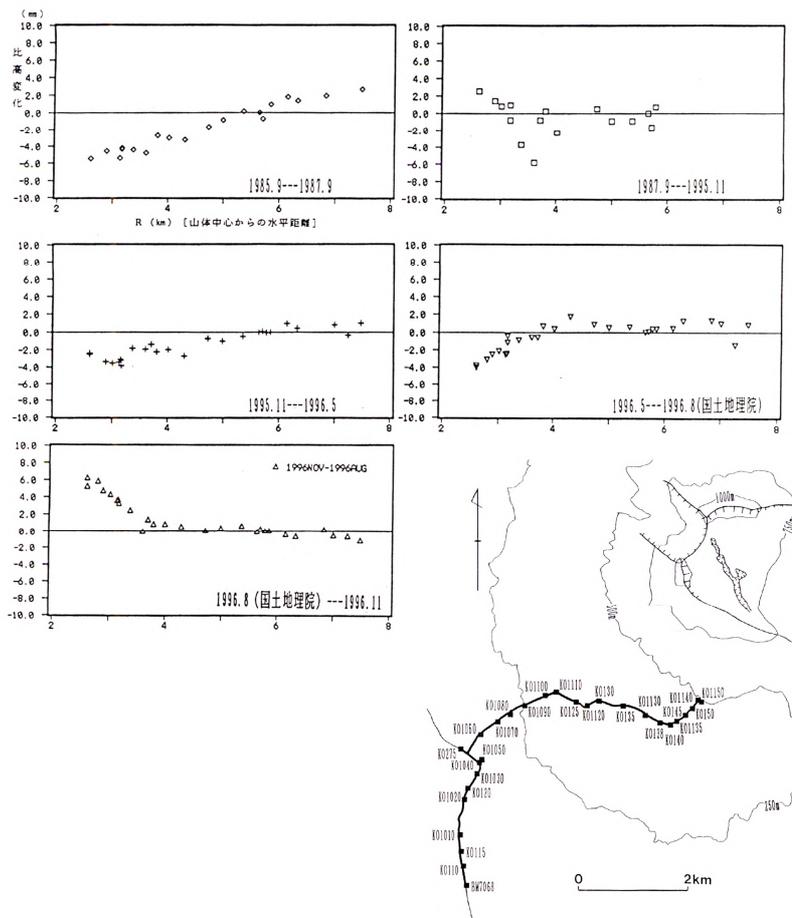


Figure 18-14 Results of precise leveling observation of southwest foot of the volcano (Usu Volcano Observatory, Hokkaido University, 1996).

Top: Change in relative height (1985 to 1996) Bottom right: Leveling route diagram

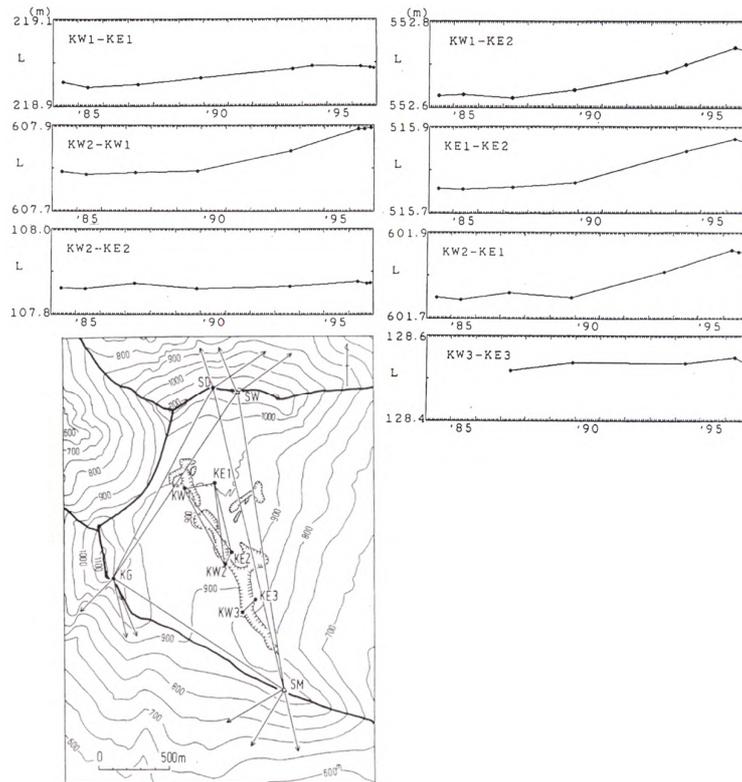


Figure 18-15 Results of distance measurement observation of summit (Usu Volcano Observatory, Hokkaido University, 1996).
 Top: Change in distance (1984 to 1996) Bottom right: Distance diagram

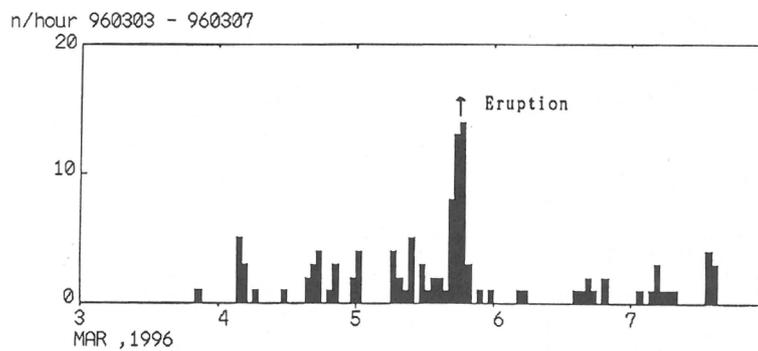


Figure 18-16 Number of small earthquakes observed directly before March 5, 1996, eruption. (Usu Volcano Observatory, Hokkaido University, 1997)

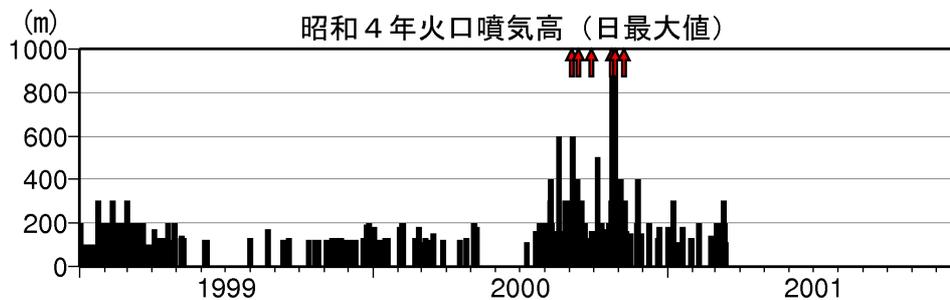


Figure 18-17 Changes in height of volcanic plume from Showa 4-nen crater observed before eruptive activity from September, 2000 (Red arrow: eruption).

Recent Volcanic Activity
 - Activity Chronograms

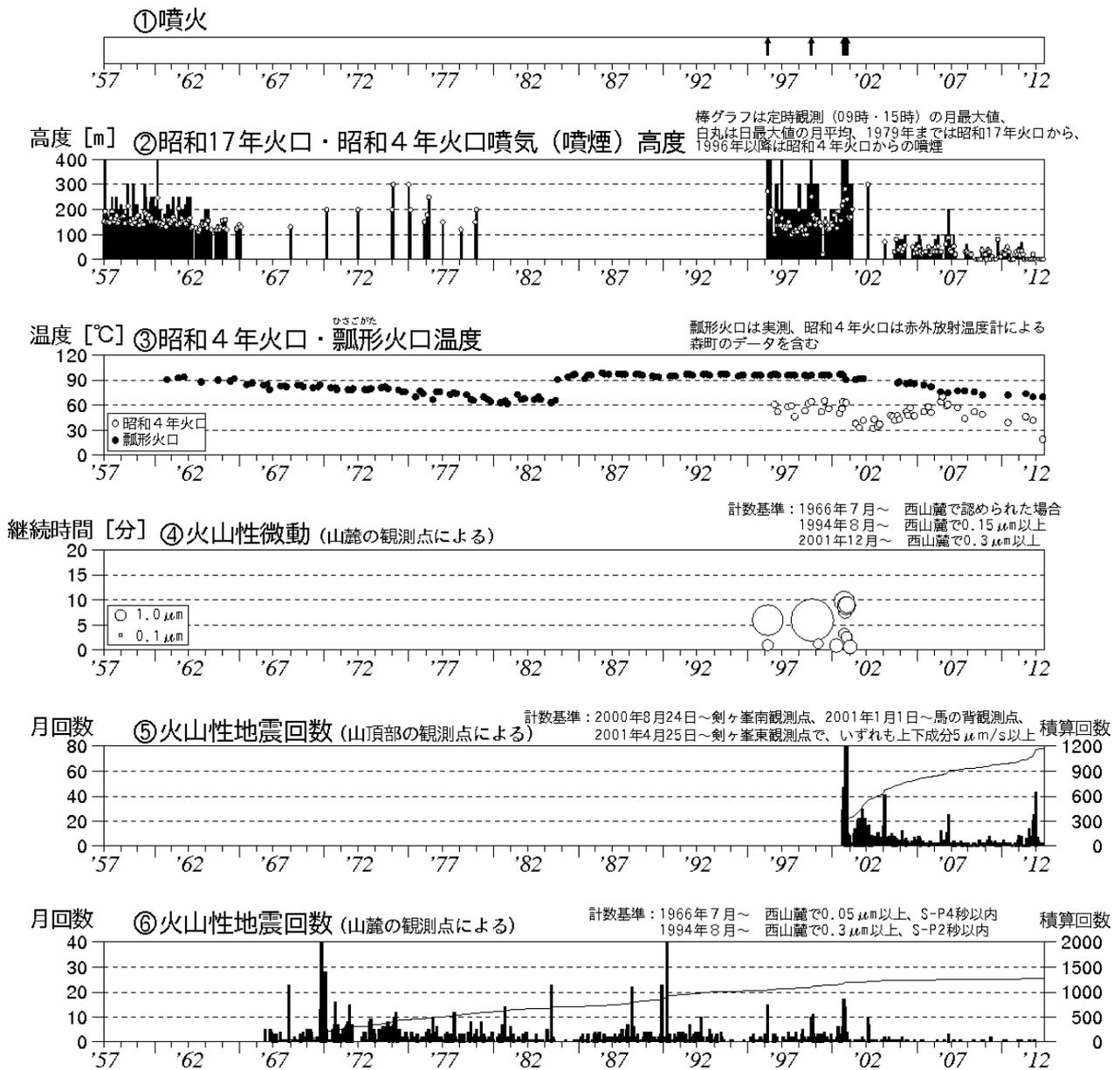


Figure 18-18 Volcanic activity (1957 to June, 2012).

- ① Eruptions
- ② Showa 17 crater and Showa 4-nen crater eruption (volcanic plume) heights
- ③ Showa 4-nen crater and Hisagogata crater temperatures
- ④ Volcanic tremors (observed by observation point at foot of volcano)
- ⑤ Number of volcanic earthquakes (observed by observation point at summit of volcano)
- ⑥ Number of volcanic earthquakes (observed by observation point at foot of volcano)

▪ Volcanic Earthquake Epicenter Distribution

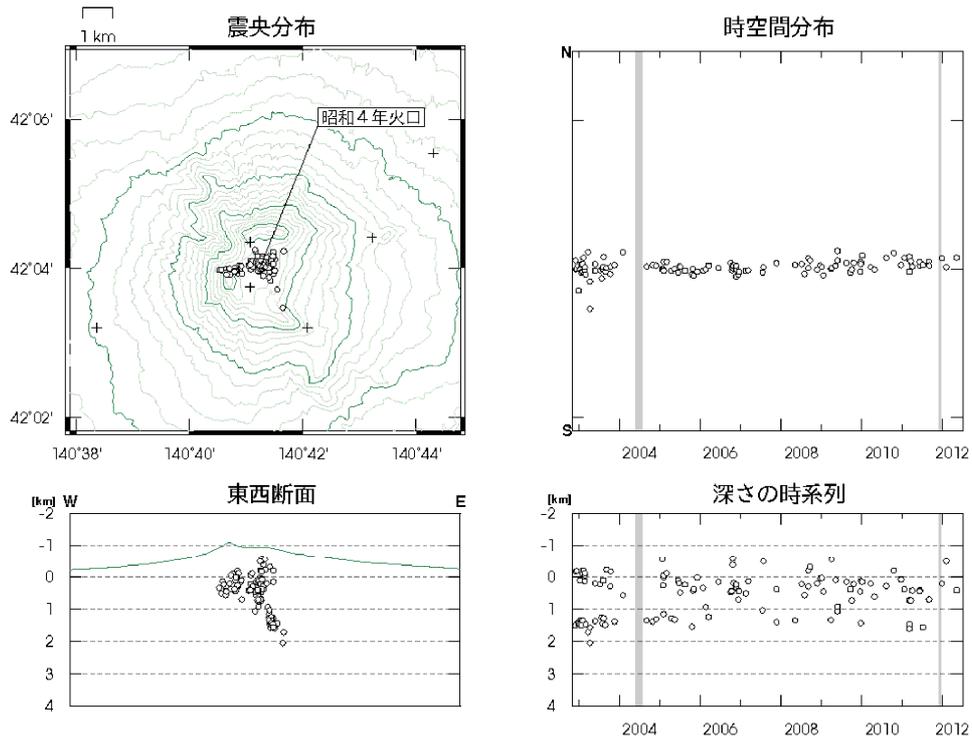


Figure 18-19 Distribution of volcanic earthquakes (November, 2002, to June 30, 2012).

+ symbols indicate observation points

① Epicenter distribution, ② Space-time plot, ③ E-W cross-section, ④ Depth time series

▪ Seismic activity

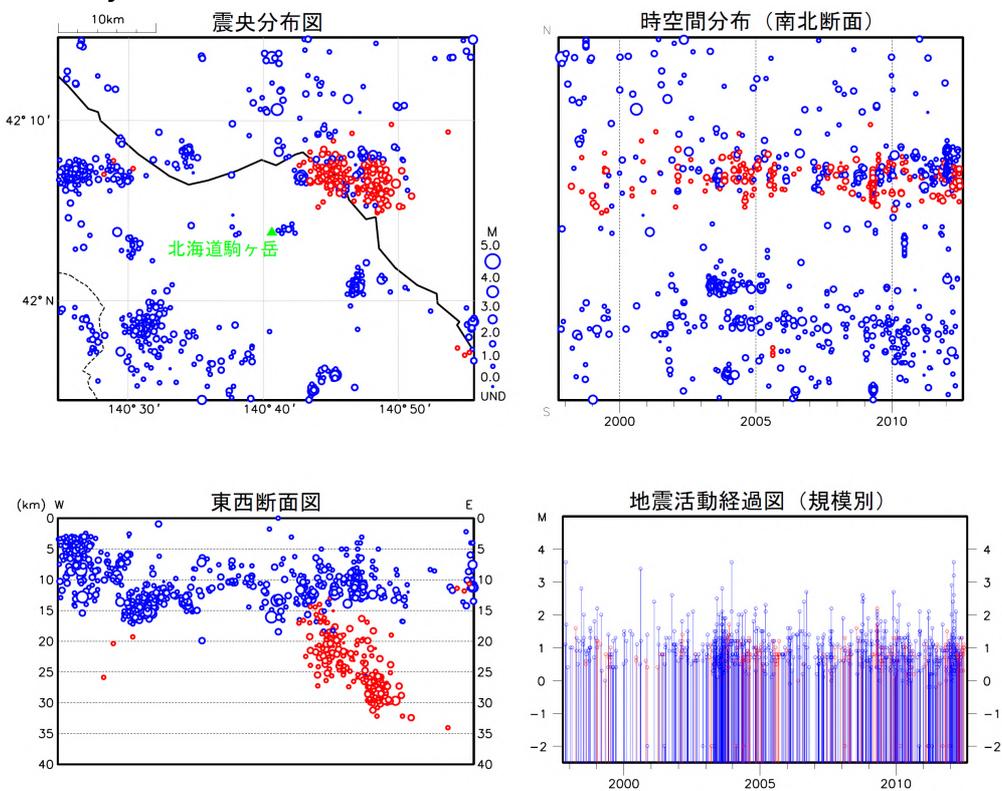


Figure 18-20 Activity of shallow VT earthquakes (blue circles) and deep low-frequency earthquakes (red circles) observed by a regional seismometer network (October 1, 1997, to June 30, 2012). Epicenter distribution (upper left), space-time plot (N-S cross-section) (upper right), E-W cross-section (lower left) and magnitude-time diagram (lower right).

Interior Structure

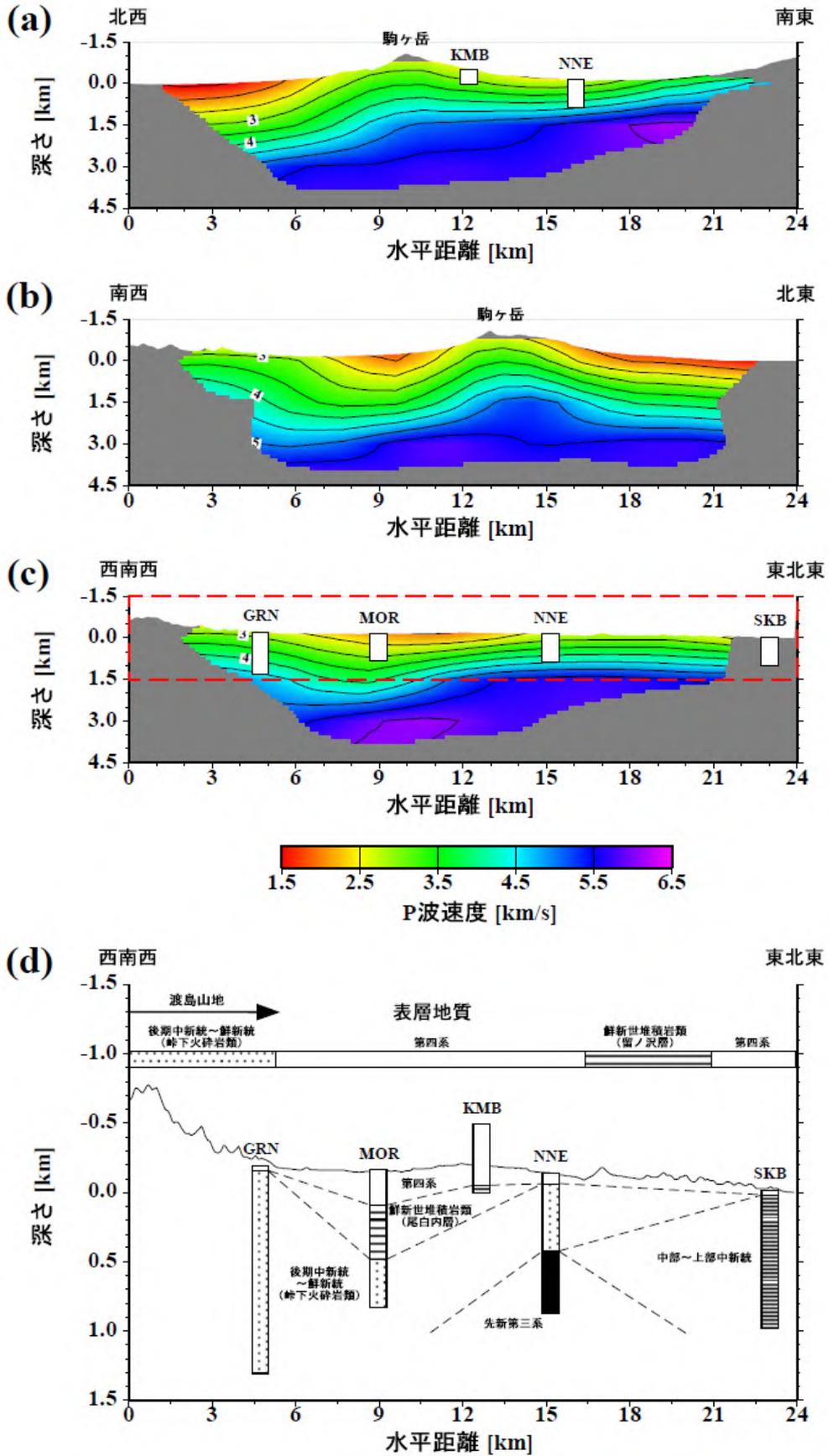


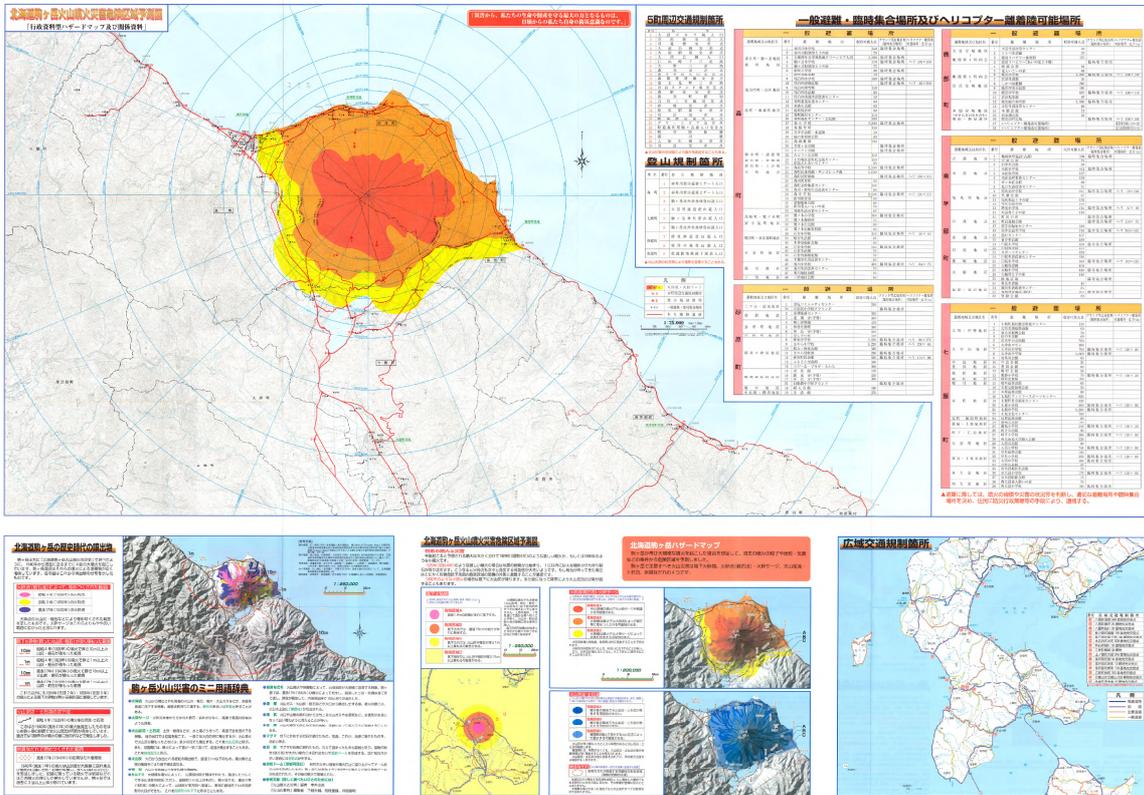
Figure 18-21 Velocity structure model determined through analysis of artificial earthquake exploration data (Onizawa et al., 2009).

Information on Disaster Prevention

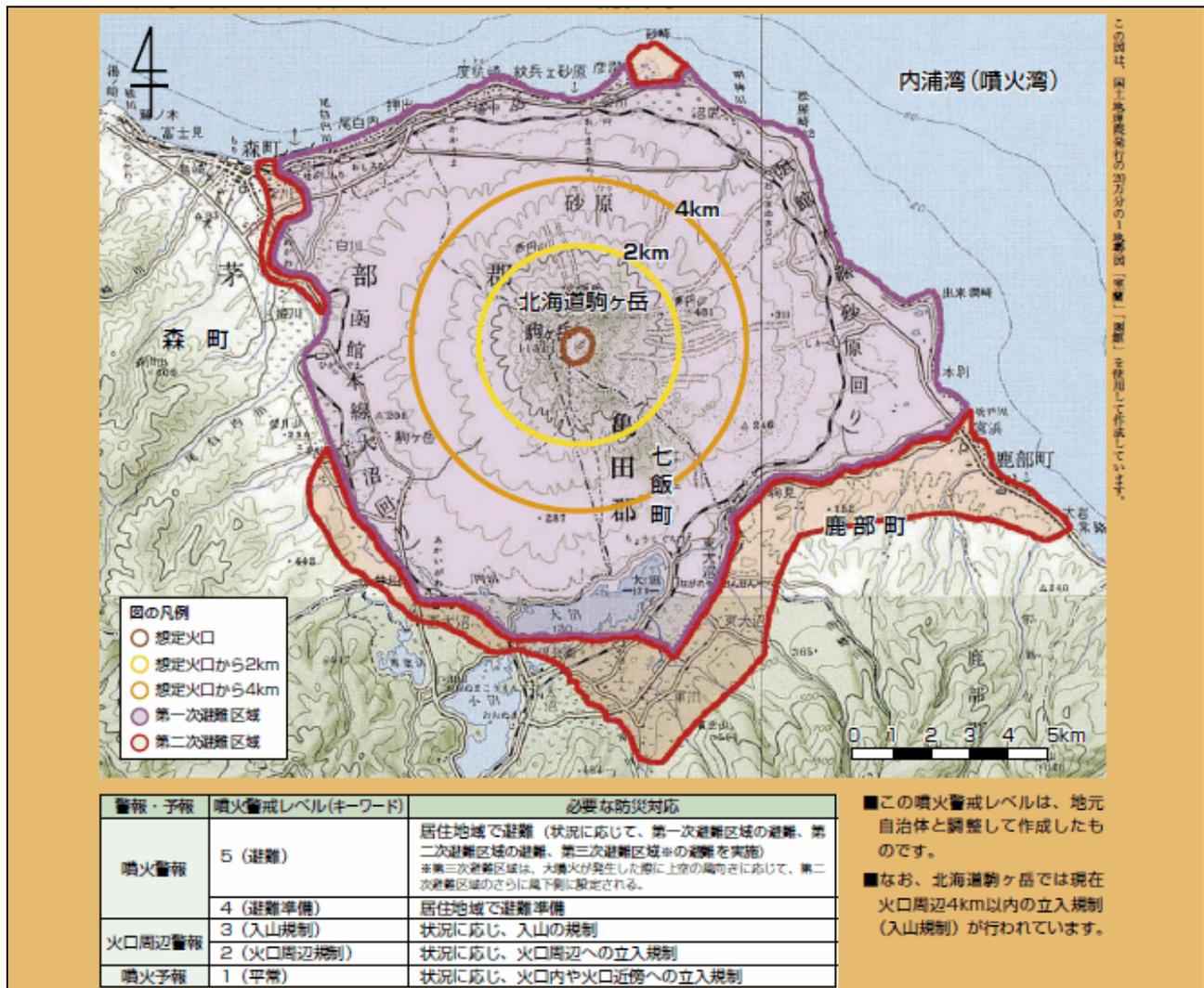
① Hazard Map

Komagatake Volcano Disaster Prevention Handbook - March, 2010 - Komagatake Volcano Disaster Committee

http://www.town.hokkaido-mori.lg.jp/sections/bosai/komagatake/post_8.html



② Volcanic Alert Levels (Used since December 1, 2007)



Volcanic Alert Levels for the Hokkaido Komagatake Volcano (Valid as of December 1, 2007)

Warning and Forecast	Target Area	Levels & Keywords	Expected Volcanic Activity	Actions to be Taken by Residents and Climbers	Expected Phenomena and Previous Cases
Eruption Warning	Residential areas and areas closer to the crater	5 Evacuate	Eruption or imminent eruption causing significant damage to residential areas	Evacuate from the danger zone	<ul style="list-style-type: none"> ● Large eruption with pyroclastic flow reaching residential areas and deposits of large amounts of pumice and volcanic ash over a wide area. Showa 4 Eruption (1929) Past Example June 17, 1929, approximately 10:00 to 24:00: Large eruption with deposits of large amounts of pumice and volcanic ash over a wide area, and pyroclastic flow reaching the foot of the volcano (up to 8km from the crater). ● Imminent large eruption due to prominent crustal deformation, etc. Past Examples No observed examples
		4 Prepare to evacuate	Forecast of eruption causing significant damage to residential areas (increased probability).	Those within the alert area should prepare for evacuation. Those requiring protection in the event of a disaster must be evacuated.	<ul style="list-style-type: none"> ● Small, long duration eruption or small intermittent interruption, or forecast of large eruption as a result of increase in volcanic tremors. Showa 4 Eruption (1929) Past Example June 17, 1929 (early morning): Intermittent small eruptions.
Crater Area Warning	Non-residential areas near the volcano	3 Do not approach the volcano	Eruption or prediction of eruption causing significant damage to areas near residential areas (entering area is life threatening).	Residents can go about daily activities as normal. When necessary, evacuation preparations should be performed for those requiring protection in the event of a disaster. Access restrictions for dangerous areas, including mountain climbing and mountain access prohibitions, etc.	<ul style="list-style-type: none"> ● Small eruption scattering volcanic blocks in and around the summit crater floor. Showa 4 Eruption (1929) Past Example June 17, 1929, approximately 00:30: First small eruption. Other Past Examples September to November, 2000: Small eruption scattering volcanic blocks in and around the summit crater floor. October 25, 1998: Small eruption scattering volcanic blocks in and around the summit crater floor. March 5, 1996: Small eruption scattering volcanic blocks in and around the summit crater floor. ● Small eruption imminent due to increased volcanic tremor, earthquake, and heat activity. Past Examples July 19 to July 21, 2000; August 7 to August 9, 2000: Increased volcanic plume activity.
	Crater area	2 Do not approach the crater	Eruption or prediction of eruption affecting area around crater (entering area is life threatening).	Residents can go about daily activities as normal. Access to crater area restricted, etc.	<ul style="list-style-type: none"> ● Small eruption forecast as a result of increase in seismic activity and thermal activity, etc. Past Examples April 3 and April 6 to April 7, 1990: Volcanic tremors and many volcanic earthquakes. June 13, 1983: Continuous earthquakes.
Eruption Forecast	Inside the crater	1 Normal	Little or no volcanic activity. Volcanic ash may be emitted within the crater as a result of volcanic activity (entering area is life threatening).	Access to interior of and area around crater restricted as necessary, etc.	<ul style="list-style-type: none"> ● Little or no volcanic activity. Possibility of emissions which may affect summit crater interior and nearby area.

Note 1) The volcanic blocks mentioned in this table refer mainly to blocks large enough that their trajectories are not affected by wind.

Note 2) Large eruptions refer to eruptions with volcanic plumes extending 10,000m or more, with pyroclastic flows reaching residential areas, and depositing large amounts of pumice and volcanic ash over a wide area.

Note 3) Small eruptions refer to eruptions with volcanic plumes extending several hundred meters, scattering volcanic blocks on the floor of the summit crater.

Social Circumstances

① Populations

- Mori Town population: 17,784 (as of October 31, 2011)
- Shikabe Town population: 4,507 (as of October 31, 2011)
- Nanae Town population: 28,930 (as of October 31, 2011)
- Hakodate Minamikayabe population: 6,189 (as of October 31, 2011)

② National Parks, Quasi-National Parks, Number of Climbers

- Onuma Quasi-National Park - Mori Town
Number of sightseers per year: Approx. 762,000
(Number of entering sightseers, from 2010 Hokkaido-wide municipal study)
- Onuma Quasi-National Park - Shikabe Town
Number of sightseers per year: Approx. 190,000
(Number of entering sightseers, from 2010 Hokkaido-wide municipal study)
- Onuma Quasi-National Park - Nanae Town
Number of sightseers per year: Approx. 1,579,000
(Number of entering sightseers, from 2010 Hokkaido-wide municipal study)
- Onuma Quasi-National Park - Hakodate Minamikayabe
Number of sightseers per year: Approx. 148,245
(Number of entering sightseers, from 2010 Hokkaido-wide municipal study)
- Onuma Quasi-National Park - Hokkaido-Komagatake
Number of mountain-climbers per year: 9,607
(Komagatake Disaster Prevention Committee, Period: June 1, 2011 to October 23, 2011)

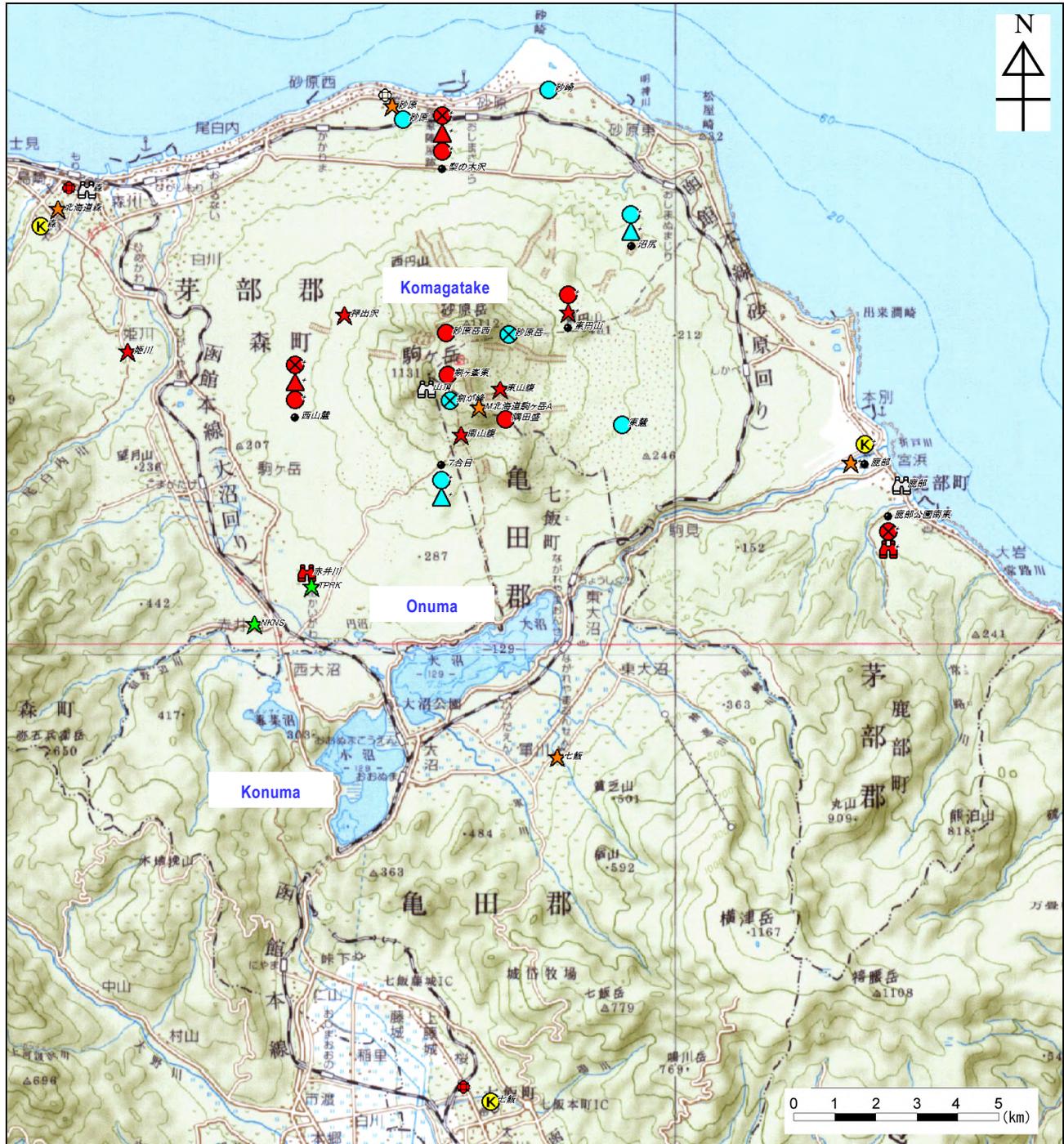
③ Facilities

- Mori Town
Mori Folk Museum
- Hakodate Minamikayabe branch office
Hakodate Jomon Culture Center

Monitoring Network

Wide Area

* Monitoring sites with multiple observation instruments are indicated by small black dots, and other symbols indicate types of monitoring.



1:200,000 scale regional maps (Muroran and Hakodate) published by the Geospatial Information Authority of Japan were used.

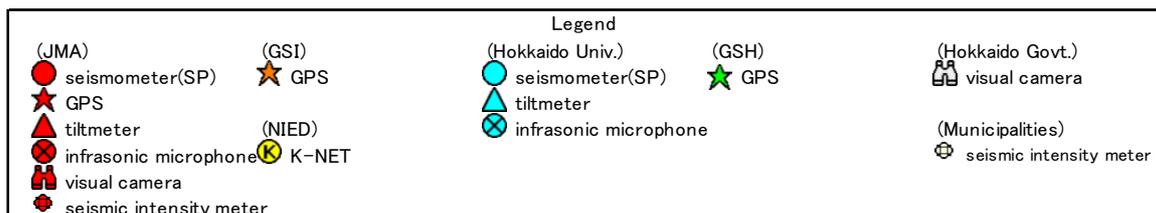
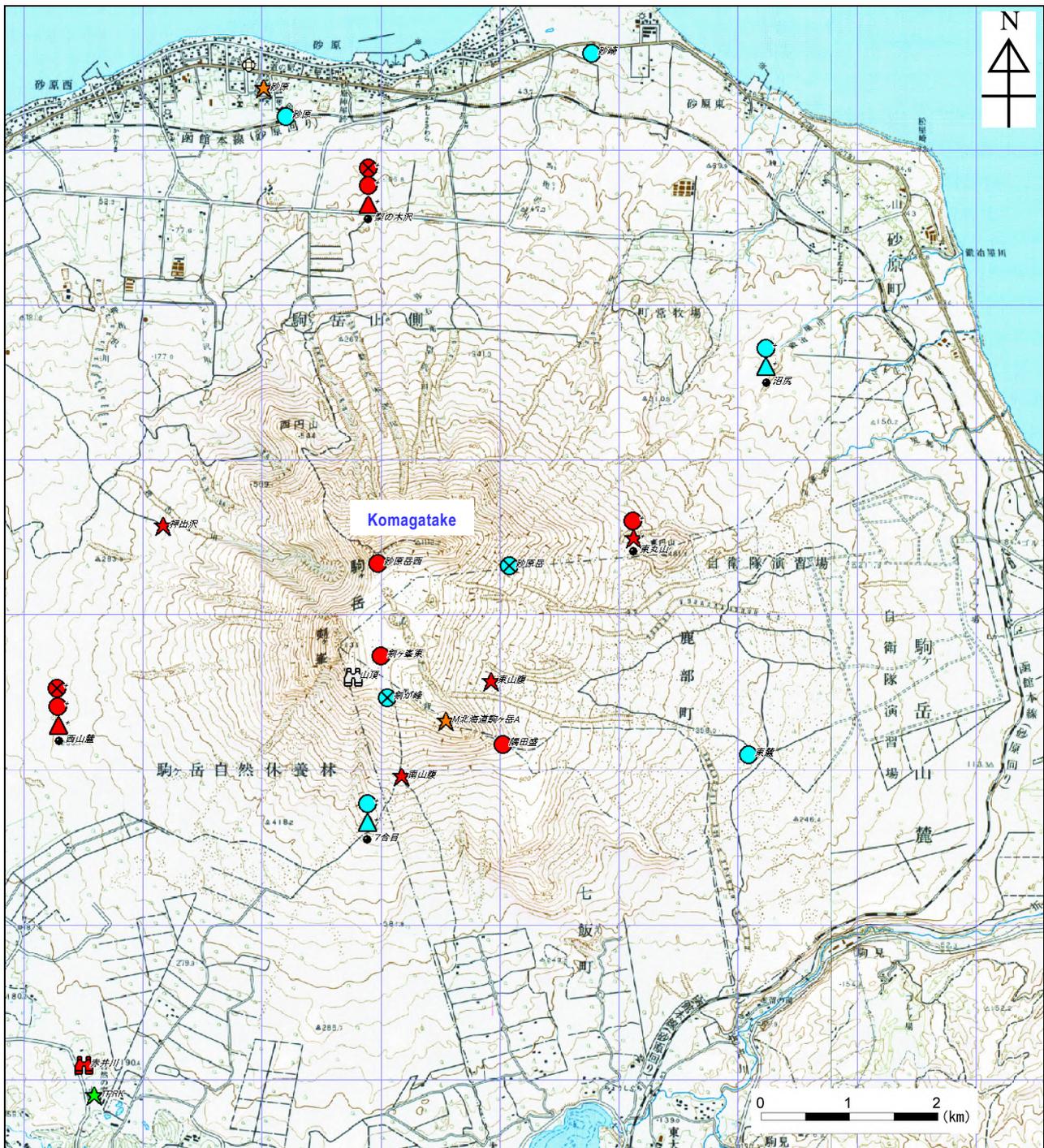


Figure 18-22 Regional monitoring network.

In and Around the Summit

* Monitoring sites with multiple observation instruments are indicated by small black dots, and other symbols indicate types of monitoring.



1:50,000 scale topographic maps (Komagatake and Shikabe) published by the Geospatial Information Authority of Japan were used.

Legend				
(JMA)	(GSI)	(Hokkaido Univ.)	(GSH)	(Hokkaido Govt.)
● seismometer(SP)	★ GPS	● seismometer(SP)	★ GPS	📷 visual camera
★ GPS	(NIED)	▲ tiltmeter		(Municipalities)
▲ tiltmeter	Ⓚ K-NET	⊗ infrasonic microphone		⊗ seismic intensity meter
⊗ infrasonic microphone				
📷 visual camera				
● seismic intensity meter				

Figure 18-23 Local monitoring network.

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(Nakagawa, M., Takarada, S., and Yoshimoto, M.)