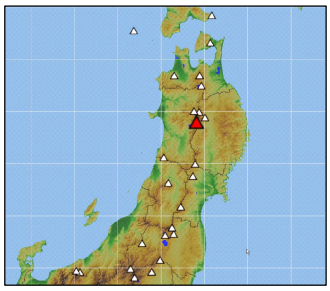
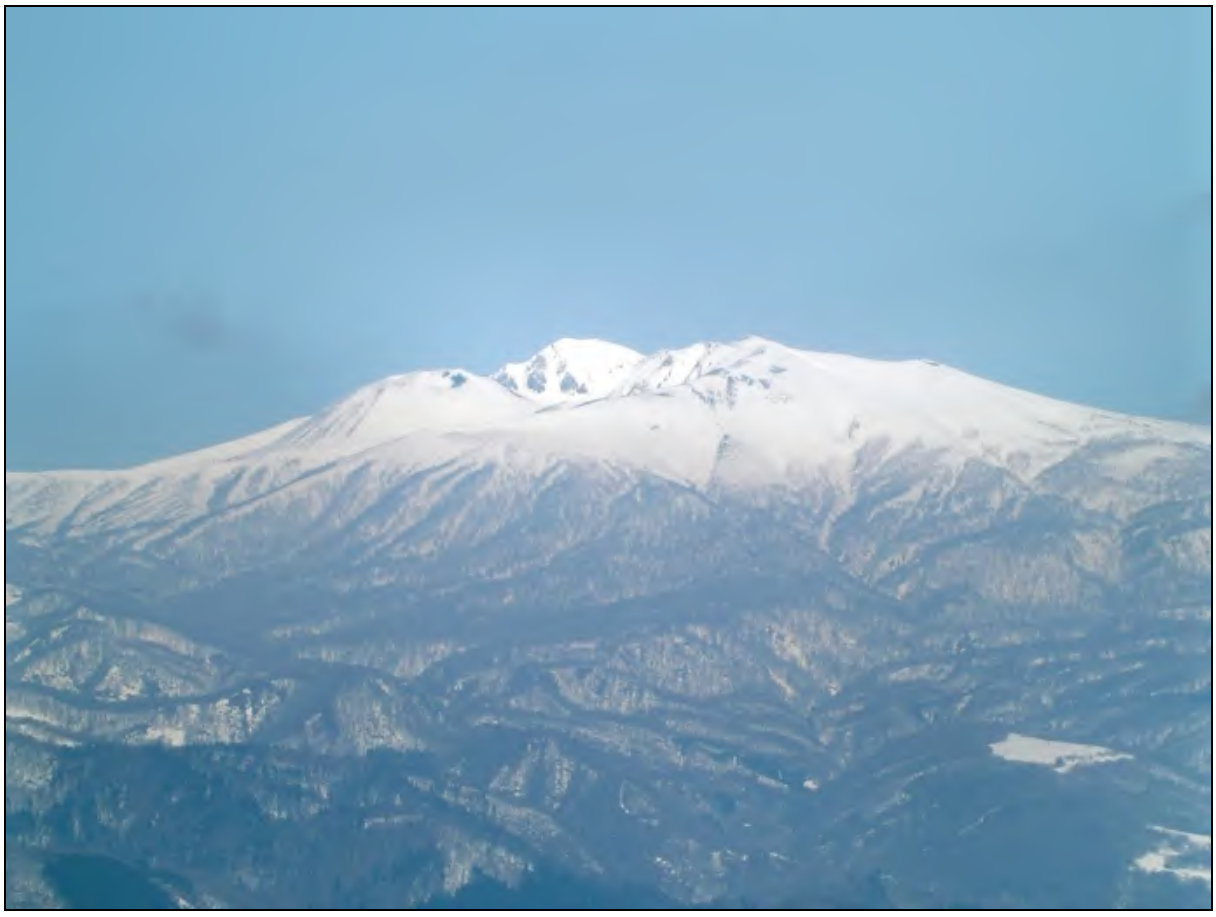
28. Akita-Komagatake



Continuously Monitored by JMA

Latitude: 39°45'40" N, Longitude: 140°47'58" E, Elevation: 1,637 m
(Onamedake)
(Triangulation Point - Komagatake)



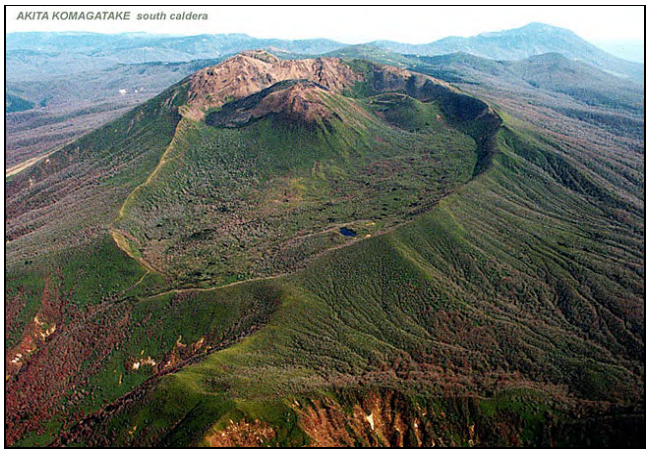
Overview of Akita-Komagatake taken from the southeast side on April 9, 2010 by the Japan Meteorological Agency.

Summary

Akita-Komagatake is a basalt-andesite stratovolcano with two calderas. The northern caldera (1.2 km x 1.0 km) located on the northeast side of the summit and the southern caldera (3 km x 2 km) located on the southwest side of the summit. Deposits of pyroclastic flows and volcanic ash issued during the caldera forming eruptions are distributed at the foot of the volcano and to the east of the volcano. The northern caldera is almost completely buried by lava and pyroclastic cones such as Onamedake (the highest peak), with lava flowing down from the northern rim of the caldera to the northwest. Odake is a peak located on the western rim of the junction between the northern and southern calderas. Inside the southern caldera are the Medake, Odake, and Minamidake pyroclastic cones, and the caldera floor is covered with lava flows, some of which flowed to the west from the southwestern rim of the caldera.

Fumaroles from sulfur deposits had been observed inside the northern caldera until the early 20th century. Many hot springs are located at the foot of the volcano. Although the main phreatic activity was known in recorded history, small, repeated strombolian explosions and lava flows occurred in 1970 and 1971. The SiO_2 content is between 48.6 and 70.8 wt %.

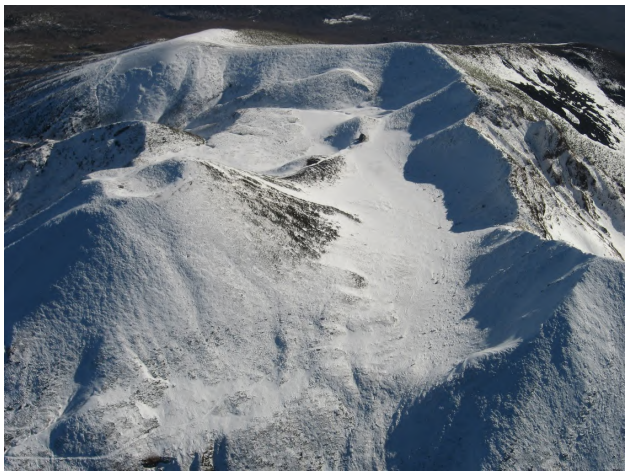
Photos



Southern Caldera and Central Cone Medake. Taken on October 23, 1997. Courtesy of T. Chiba.

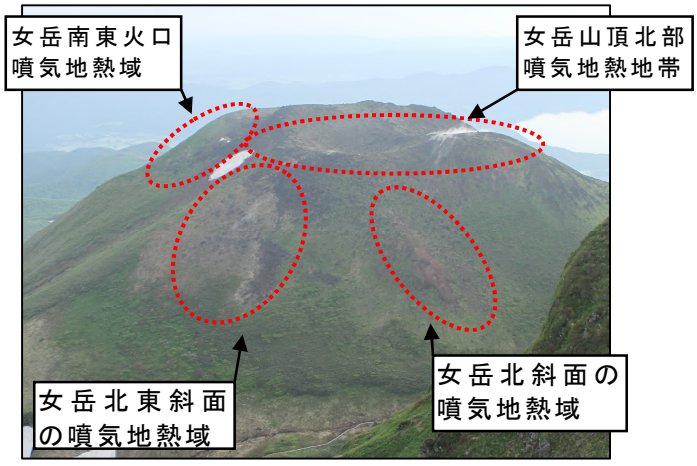
Medake. Taken from the southwestern sideon October 23, 1997. Courtesy of T. Chiba.

Southern Caldera and Medake. Taken from the southwestern side on April 9, 2010 by the Japan Meteorological Agency.



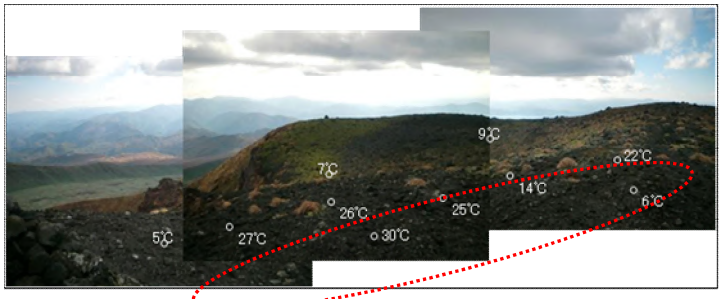
Northern Caldera and Central Cone Onamedake. Taken from the western side on November 2, 2006 by the Japan Meteorological Agency.

Volcanic Plume. Taken on September 27, 2011 by MLIT Tohoku Regional Bureau Monitoring Camera Located at Kumanodai approximately 5 km southwest of Medake.

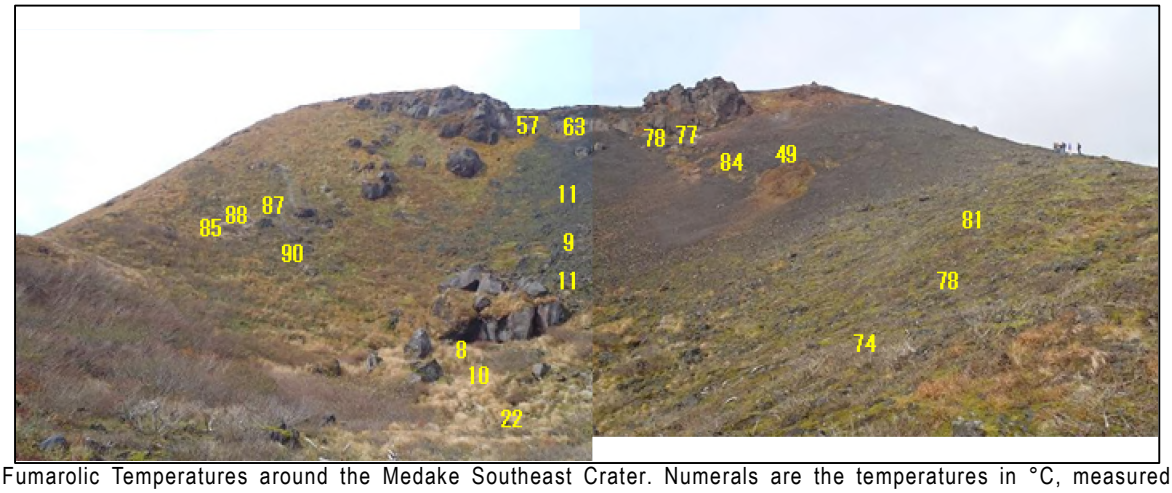


Fumarolic Areas of Medake. Fumarolic activities at the summit and on the northern and northeastern flanks were taken on June 16, 2011 by the Japan Meteorological Agency.

Geothermal Area on the Northwestern Flank of Medake. Taken from the northern side on October 18, 2010 by the Japan Meteorological Agency



Geothermal Area near the Summit of Medake. Taken from the southeastern side on October 18, 2010 by the Japan Meteorological Agency.



Fumarolic Temperatures around the Medake Southeast Crater. Numerals are the temperatures in °C, measured on October 13, 2011 by the Japan Meteorological Agency.

Topography around the Crater

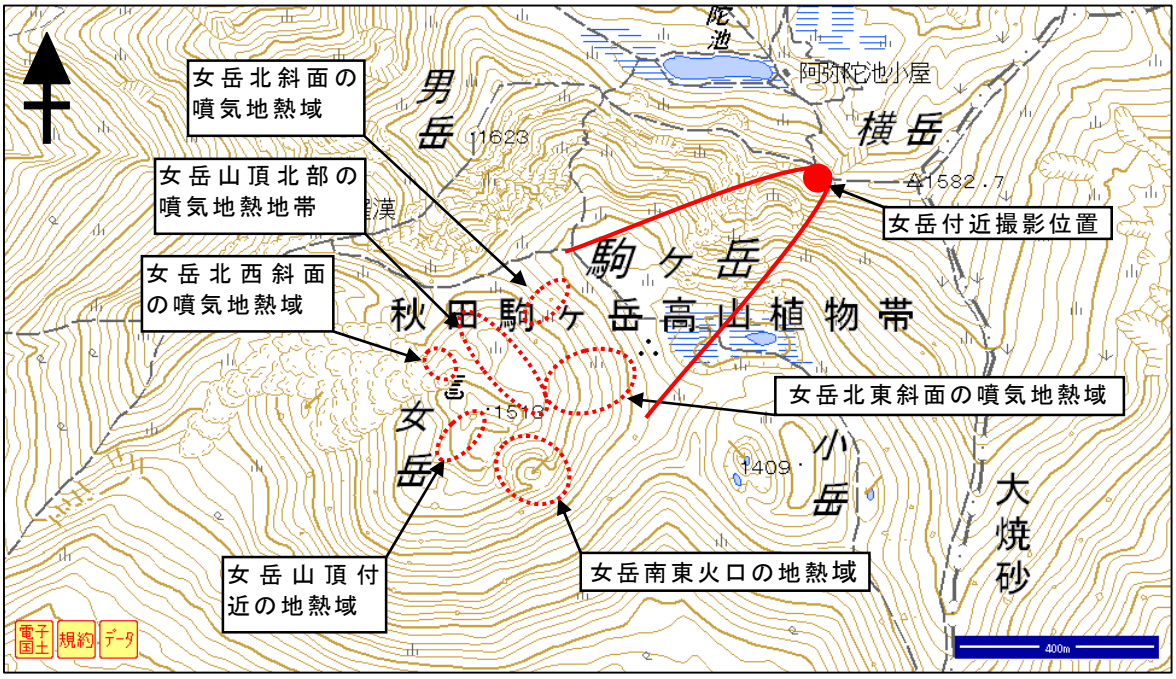


Figure 28-1 Topography around the Medake crater (as of June, 2012).

Red Relief Image Map

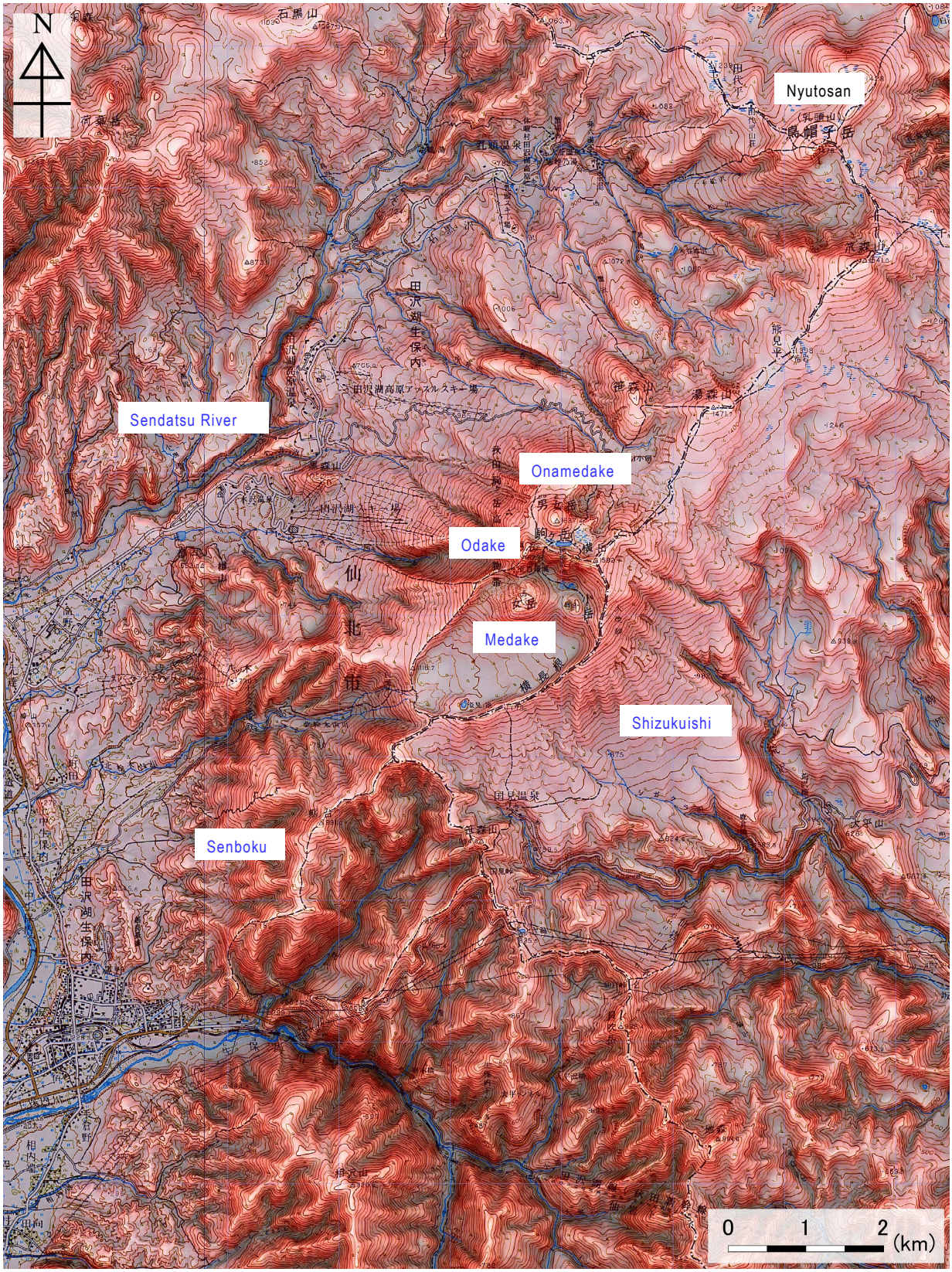


Figure 28-2 Topography of Akita-Komagatake.

1:50,000-scale topographic map (Tazawa Ko and Shizukuishi) and digital map of 50 m grid (elevation) published by the Geospatial Information Authority of Japan were used.

Chronology of Eruptions

・Volcanic Activity in the Past 10,000 Years

Approximately 11,000 to 13,000 years ago a large plinian eruption (Koiwai pumice) and a pyroclastic flow (Obonai pyroclastic flow) occurred at the summit area, as well as a phreatoplinian eruption (Yanagisawa pumice), forming the north and south calderas. Post-caldera activity then occurred within the calderas, with plinian and vulcanian eruptions emitting a large volume of pyroclastic materials, and forming pyroclastic cones such as Medake and Odake. Activity after the calderas formation was mostly concentrated in the periods from approximately 10,000 to 7,000 years ago and approximately 4,000 to 1,000 years ago (Wachi et al., 1997).

Period	Area of Activity	Eruption Type	Main Phenomena / Volume of Magma
10←→9.7ka	Katakuradake	Phreatic eruption → magmatic eruption	Ak-8 eruption: Tephra fall and lava flow.
10←→8.2ka	Northern No. 1 pyroclastic cone	Magmatic eruption	Tephra fall.
10←→8.2ka	Northern No. 3 pyroclastic cone	Magmatic eruption	Tephra fall.
8.5←→8.2ka	Northern No. 3 pyroclastic cone - Onamedake area	Magmatic eruption	Ak-7 eruption: Tephra fall.
8.5→7.8ka	Onamedake	Magmatic eruption	Tephra fall and lava flow. Likely to have been the result of multiple eruptive events.
8.1←→7.8ka	Northern No. 2 pyroclastic cone	Magmatic eruption	Ak-6 eruption: Tephra fall, lava flow.
3.5←→3.4ka	Northern No. 2 horseshoe-shaped crater	Phreatic eruption	Ak-5 eruption: Tephra fall.
3.5←→3.4ka	Northern No. 2 horseshoe-shaped crater	Phreatic eruption	Ak-4 eruption: Tephra fall.
3.5←→3.4ka	Northern No. 4 pyroclastic cone	Magmatic eruption	Ak-3.5 eruption: Tephra fall.
2.5←→2.2ka	Inside the southern caldera	Magmatic eruption	Ak-3 eruption: Tephra fall to lava flow.
2.5←→1.9ka	Inside the southern caldera	Magmatic eruption	Lava flow.
2.5←→1.9ka	Minamidake	Magmatic eruption	Tephra fall?
2.5←→1.9ka	Odake	Magmatic eruption	Lava flow.
2.5←→1.9ka	Odake	Magmatic eruption	Tephra fall.
2.2←→1.9ka	Odake	Magmatic eruption	Ak-2 eruption: Tephra fall to lava flow.
2.2→1ka	Medake	Magmatic eruption	Lava flow and Tephra fall. Likely to have been the result of multiple eruptive events.

* Reference documents have been appended with reference to the catalog of eruptive events during the last 10,000 years in Japan, database of Japanese active volcanoes, and AIST (Kudo and Hoshizumi, 2006) for eruptive period, area of activity and eruption type. All years are noted in calendar years. "ka" within the table indicates "1000 years ago", with the year 2000 set as 0 ka.

・Historical Activity

Year	Phenomenon	Activity Sequence, Damages, etc.
Before 915	Magmatic eruption	Tephra fall from an eruptive activity at Odake. Magma eruption volume = 0.01 km^3 DRE. (VEI 3)
1890 to 1891 (Meiji 23 to 24)	Phreatic eruption	December to January of the following year. Tephra fall? Rumbling, volcanic blocks.

Year	Phenomenon	Activity Sequence, Damages, etc.
1932 (Showa 7)	Phreatic eruption	During July 21 to 26 tephra fall. The eruptive activity occurred to the southwest of Medake. A chain of new craters and new pyroclastic cones were formed. Lahar, tephra fall. Withering and dying of trees. Toxic gas emission.
1933 (Showa 8)	Rumbling, fume anomalies, etc.	Late March. White volcanic plume from Medake. Sudden rise in temperature of Kunimi hot spring.
1942 (Showa 17)	Earthquake swarm	October 18 to 25.
1962 (Showa 37)	Earthquake swarm	During December 10 to 14, earthquake swarms accompanied by rumbling at the northwestern foot of the volcano (maximum JMA scale seismic intensity of approximately 4).
1970 to 1971 (Showa 45 to 46)	Moderate: Magmatic eruption	During September 18 to January 26, lava flow and tephra fall. At the end of August, 1970 new fumaroles were formed near the summit of Medake. Other new fumaroles appeared on September 15, and eruptions started on September 18. These were followed by frequent and small-scaled magmatic eruptions (strombolian eruptions) and lava flows. Magma eruption volume = 0.014 km^3 DRE. (VEI 2)
1972 (Showa 47)	Fume	In October, increase in fumarolic activity on the caldera wall and at Medake. Creation and subsequent expansion of a new fumarolic area.
1975 (Showa 50)	Fume	In February, increase in fumarolic activity on the northern flank of Medake.
1976 (Showa 51)	Fume	In July, ground temperatures at and around the summit of Medake became slightly higher than those of previous year. Slight increase in fumarolic activity.
1988 (Showa 63)	Earthquake swarm	Earthquake swarm from 19 to 22 of June at the southwestern foot of the volcano (Obonai area) with maximum magnitude of M3.9.
November, 1989 (Heisei 1), to April, 1990 (Heisei 2)	Earthquake swarm	Earthquake swarm at the southeastern foot of the volcano.
2003 (Heisei 15)	Earthquake swarm	In May and June, earthquake swarms, including low-frequency earthquakes, at the summit and on the north-northwestern flank.
From 2005 (Heisei 17)	Geothermal activity	Increase in geothermal activity at Medake. Increased ground-temperatures, expansion of fumarolic area, and thermal demagnetization.
March, 2011 (Heisei 23)	Earthquake	The 2011 off the Pacific coast of Tohoku Earthquake (March 11, 2011) triggered a seismic activity over an area from the summit to 5km north of it. Maximum earthquake is of M2.6 (JMA scale seismic intensity: 1) on March 21..

* Reference documents have been appended with reference to the catalog of eruptive events during the last 10,000 years in Japan, database of Japanese active volcanoes, and AIST (Kudo and Hoshizumi, 2006) for eruptive period, area of activity and eruption type.

Magma Discharge Rate

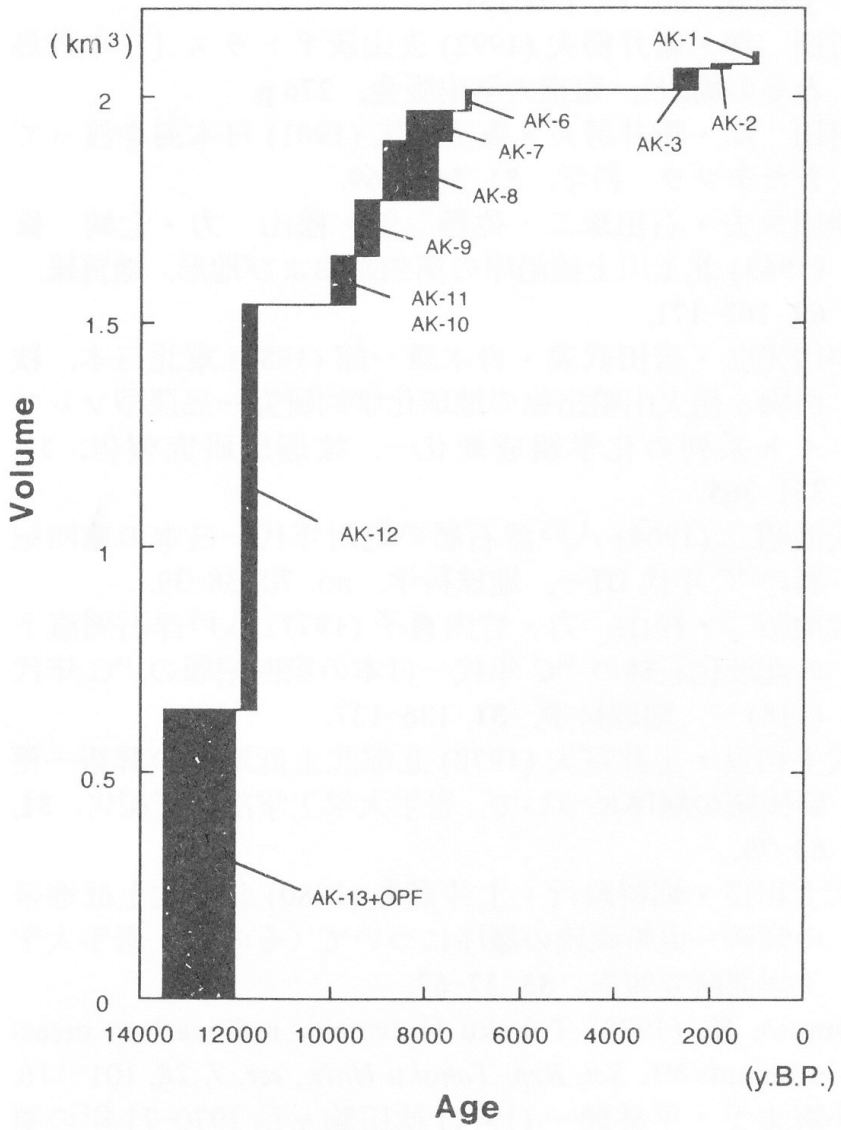


Figure 28-3 Cumulative volume of magma vs. time (Wachi et al., 1997). "AK-1" to "AK-13" indicate volcanic ash strata. Till about 7,000 years ago, large eruptions of both plinian and vulcanian occurred. Since 7,000 years ago, eruptions were mainly vulcanian and phreatic, generally decreasing in scale with time.

Major Volcanic Activities

・1932 Eruption

Phreatic eruptions began between July 21 and 24, 1932, on the crater floor of the southern caldera (known as Ishipora). Eleven explosion craters were formed along a line over 600 m from the southwestern foot of Medake towards the southwest, parallel to the somma wall. Lahar was produced, ash fell, toxic gas was emitted and trees withered and died. Eruptions continued afterwards intermittently for a week to about 10 days (Otuka, 1932).

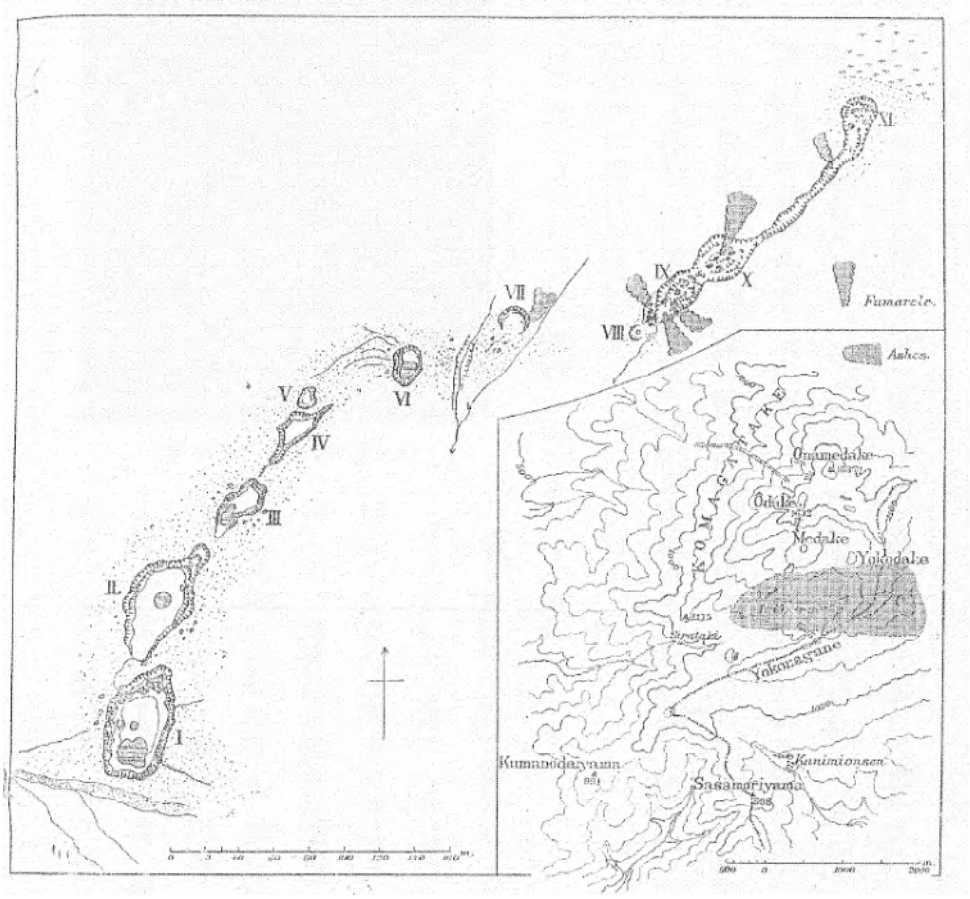


Figure 28-4 Distribution of the 1932 eruption craters and ash fall deposits (inset) (Otuka, 1932).

・1970-71 Eruption

Climbers discovered fumes on the rim of the old Medake crater on September 15. New fumaroles with cracks appeared on September 15, and an eruption began on September 18. This was followed by frequent and small-scale strombolian eruptions, which continued until January 26, 1971. No significant precursory seismic activity was recognized. During the eruption, all earthquake signals observed were from explosions. The explosive activity suddenly declined after the earthquake of October 16 in the southeast of Akita Prefecture (M6.2). It is considered to be due to stress field changes by the earthquake (Tanaka, 1971a,b). The eruption produced a lava flow of about 500 m long and 300m wide as a maximum. Total volume of ejecta is $1.4 \times 10^6 m^3$.

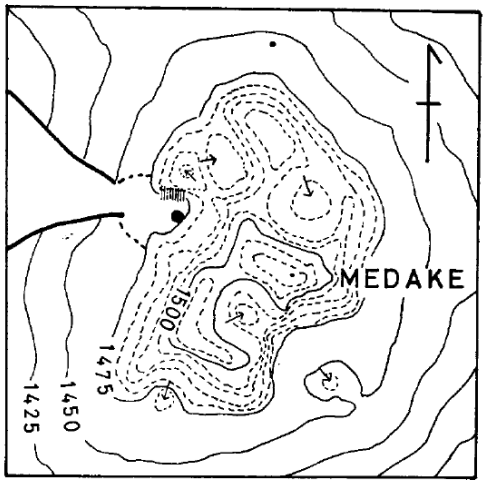


Figure 28-5 Locations of the crater and fumaroles of the 1970 eruption (Tanaka, 1971a). Small black circle indicates the position of the crater. Hatched area indicates the fumarolic area.

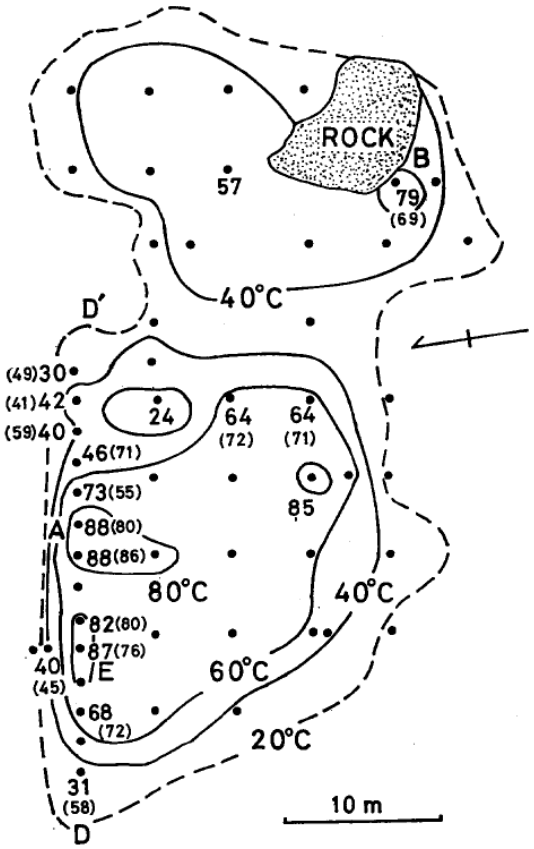


Figure 28-6 Distribution of ground temperatures before the 1970 eruption (Tanaka, 1971a). Black dots indicate observation points of ground temperature at 10 cm depth. Numerals are the temperatures measured on September 3, 1970 and those in parentheses are on September 6.

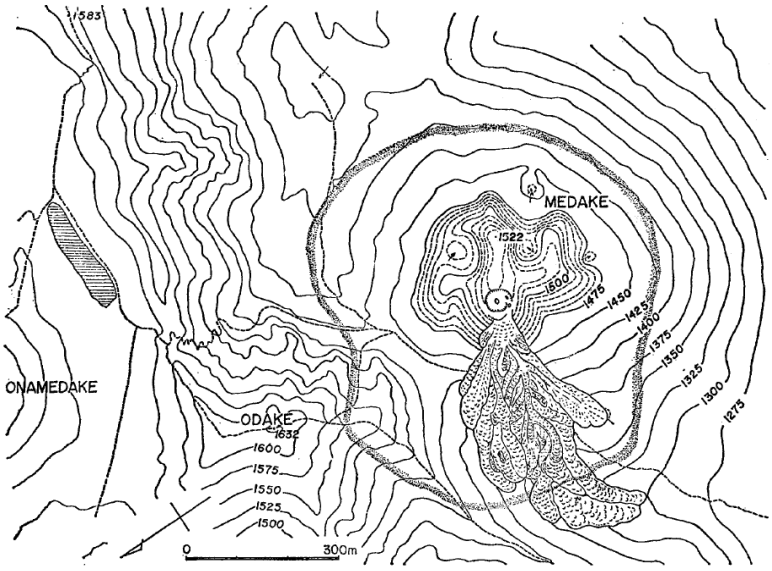


Figure 28-7 Topography after the 1970 eruption (Ossaka and Hirabayashi, 1971). The thick line indicates the limit of the distribution of ejected projectiles, up to 450 to 500 m from the crater.

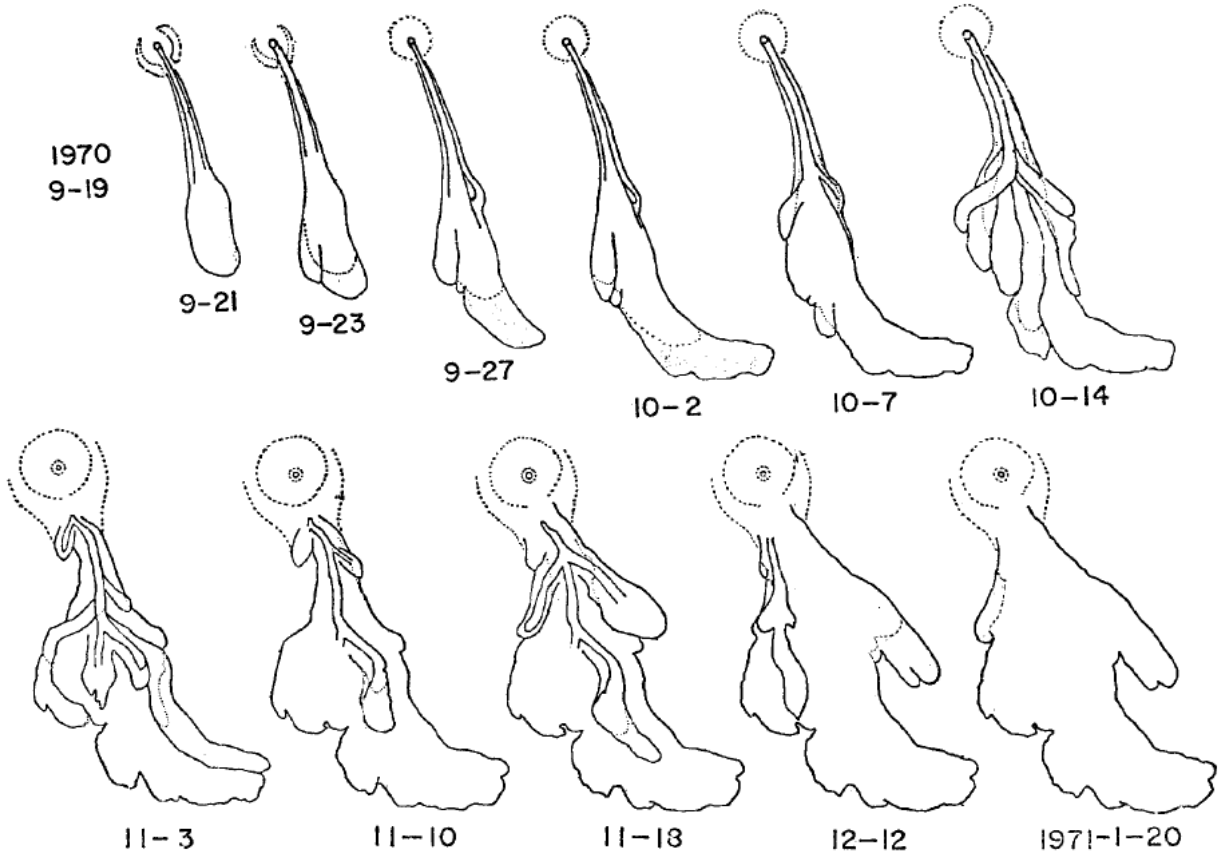


Figure 28-8 Changes in distribution of lava flow in the 1970 eruption (Ossaka and Hirabayashi, 1971).

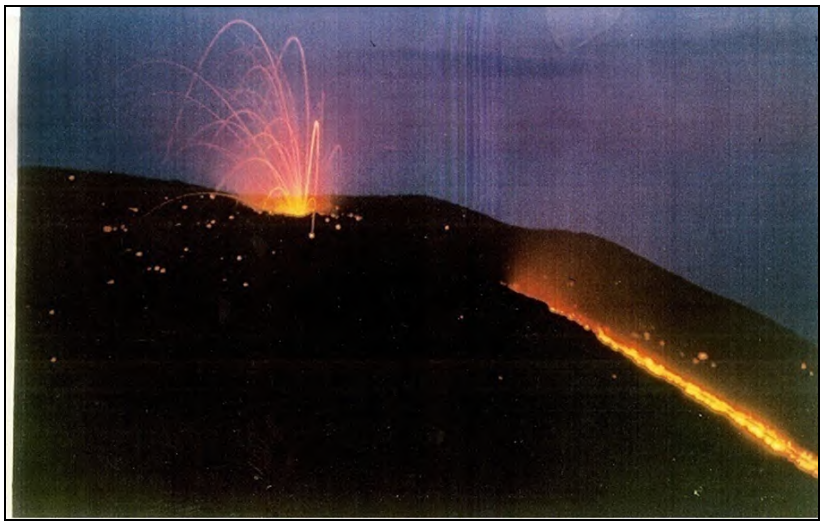


Figure 28-9 Photograph of the 1970 eruption taken from Odake on October 24, 1970. Courtesy of C. Kitsunezaki and N. Goto.

Precursory Phenomena

Fumarolic activity began and intensified fromabout 3 weeks before the start of the magmatic eruption in 1970.

Recent Volcanic Activity

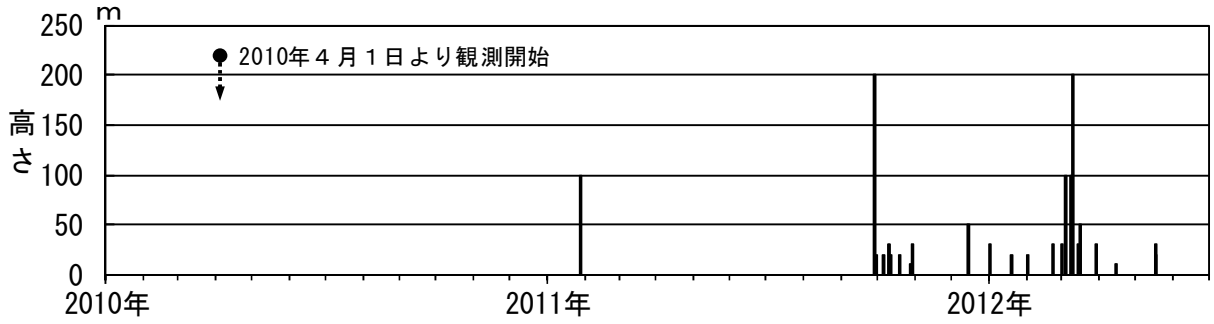


Figure 28-10 Maximum fume height per day (April 1, 2010 to June 30, 2012). Data are taken by monitor cameras of the Tohoku Regional Bureau, MLIT at Kumanodai (approximately 5 km southwest of Medake) and Sengan Pass (approximately 5 km south of Medake).

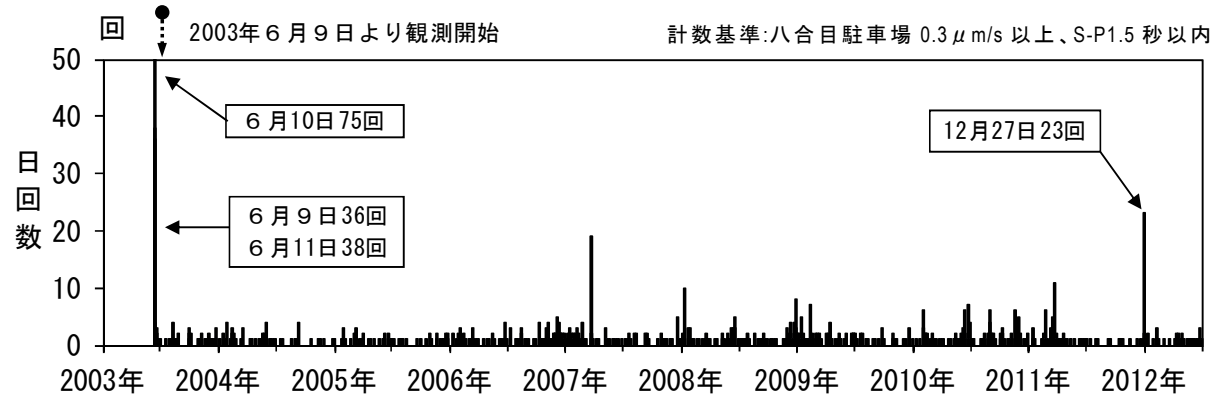


Figure 28-11 Daily number of earthquakes (June 9, 2003 to June 30, 2012). Based on the data from the Akita-Komagatake observation station of Tohoku University.

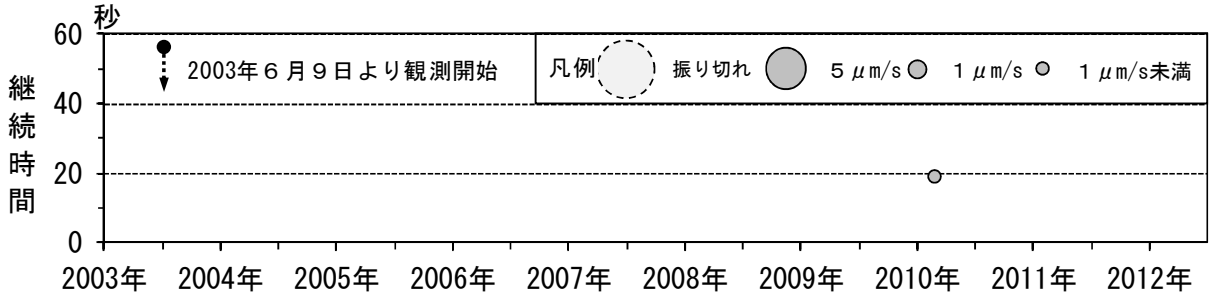


Figure 28-12 Tremor duration (vertical axis) and maximum amplitude (radius of the circle) in the U-D component (June 9, 2003 to June 30, 2012). Based on the data from Akita-Komagatake observation station, Tohoku University.

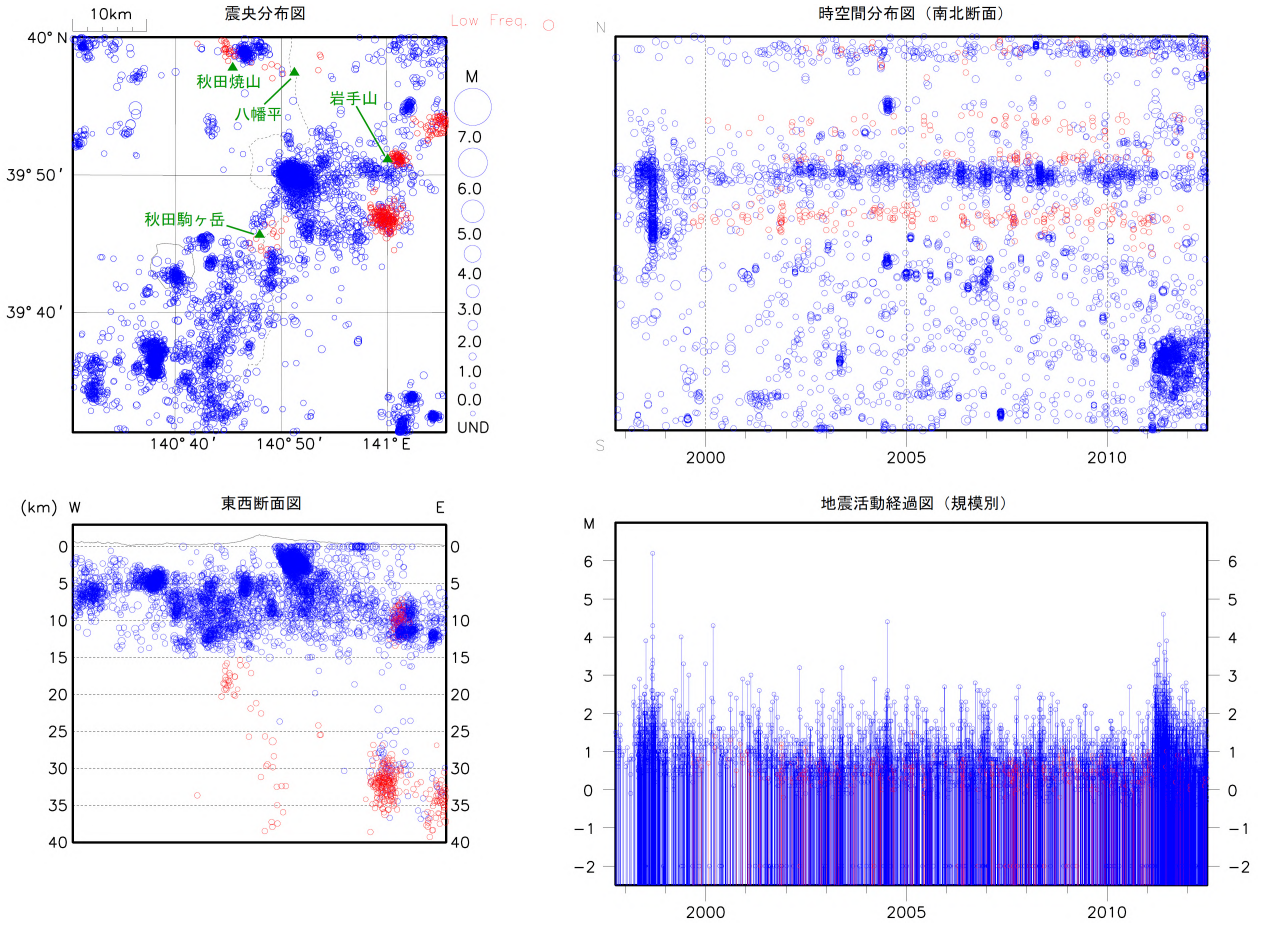


Figure 28-13 Activity of shallow VT earthquakes (blue circles) and deep low-frequency earthquakes (red circles) observed in a regional seismometer network (October 1, 1997 to June 30, 2012). Epicenter distribution (upper left), space-time plot in the N-S cross-section (upper right) and the E-W cross-section (lower left) and magnitude-time diagram (lower right).

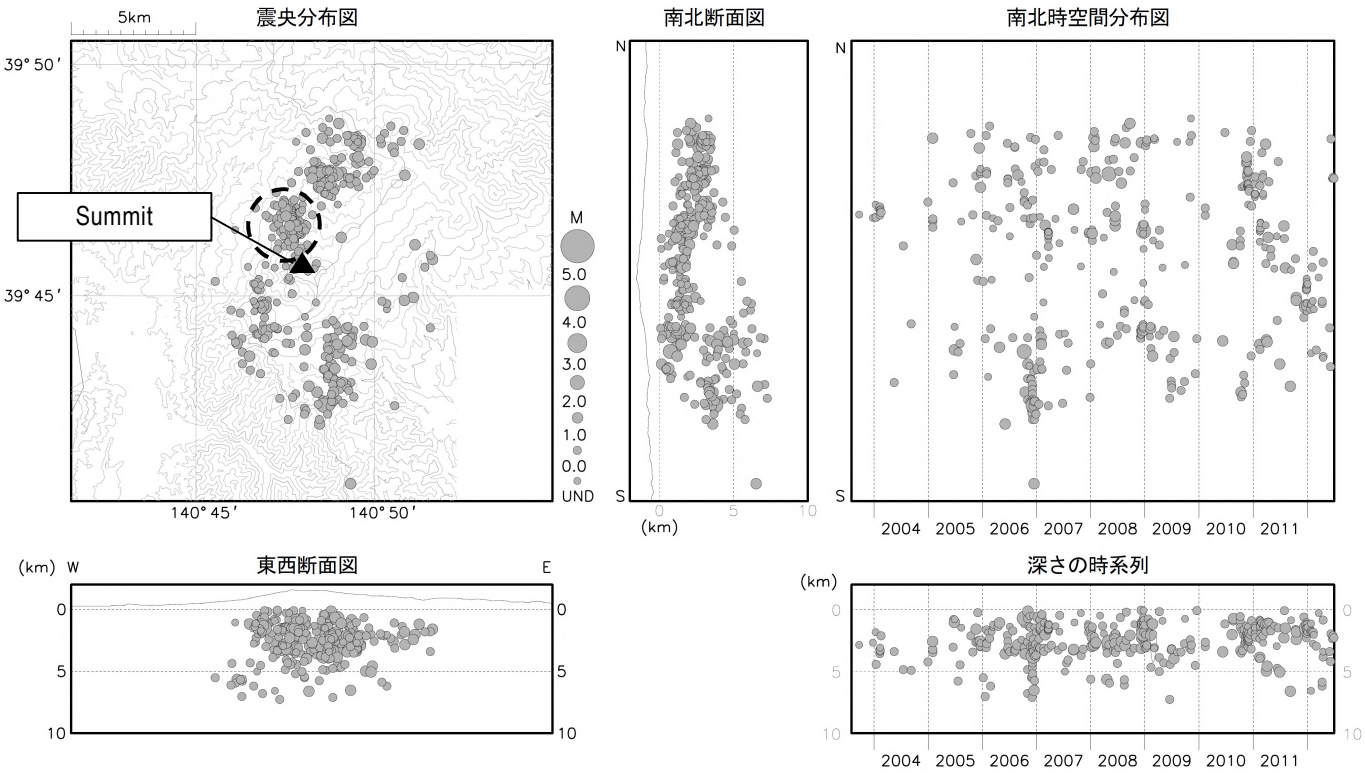


Figure 28-14 Seismic activity in the Akita-Komagatake area (August, 2003 to June, 2012). Broken circle in the epicenter map indicates the area observed in June 2003 (according to the observation by Tohoku University).

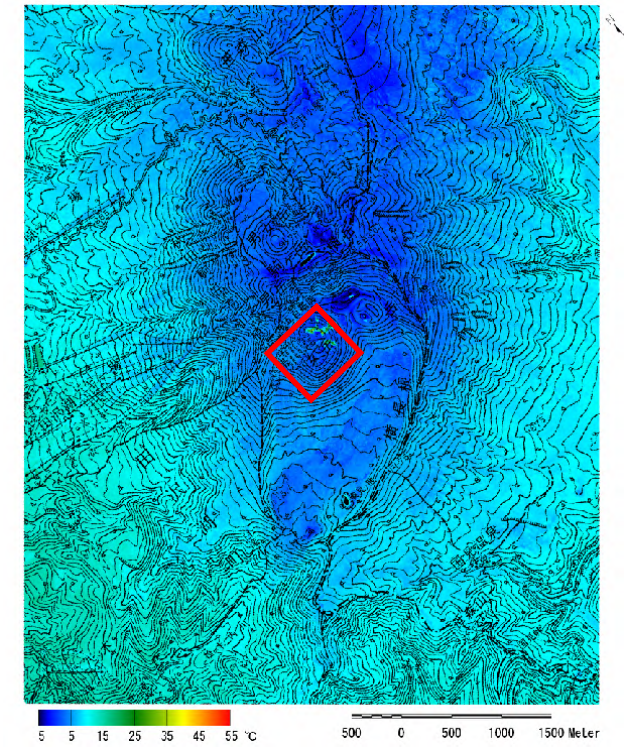


Figure 28-15 Aerial thermal image of Akita-Komagatake taken on the night of September 26, 2011 by the Japan Meteorological Agency. A red rectangle indicates the area shown in Figure 28-16.
The 1:50,000-scale digital maps (Map Image) (Tazawa-ko and Shizukuishi) published by the Geospatial Information Authority of Japan were used to create this map.

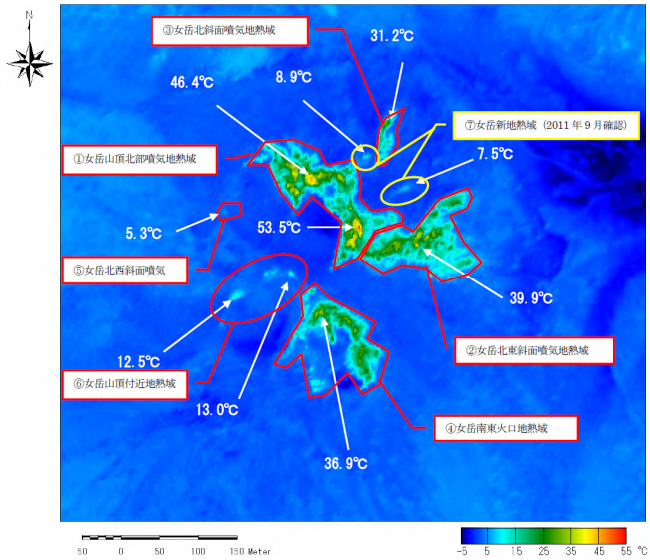


Figure 28-16 Aerial thermal image of the Medake area taken on the night of September 26, 2011by Japan Meteorological Agency, 2011. Shown are the geothermal areas where high fumarolic activity and geothermal temperature increase have been observed since 2005.

Information on Disaster Prevention

①Hazard Map

Akita-Komagatake Volcano Disaster Prevention Map (wide area version), published in February, 2003 by the Yuzawa River and National Road Office and Iwate River and National Road Office of the Ministry of Land, Infrastructure, Transport and Tourism, Akita Prefecture, Iwate Prefecture, Senboku City, and Shizukuishi Town. Editorial supervision by the Akita-Komagatake Volcano Disaster Prevention Measure Deliberating Committee

2010 Shizukuishi Comprehensive Disaster Prevention Map, published by Shizukuishi Town.

Source: Akita-Komagatake Volcano Disaster Prevention Map

Date of Publication: February 2013

Created by: Akita-Komagatake Volcano Disaster Prevention Measure Deliberating Committee (Yuzawa River and National Road Office, Iwate River and National Road Office, Akita Prefecture, Iwate Prefecture, Senboku, City and Shizukuishi Town)

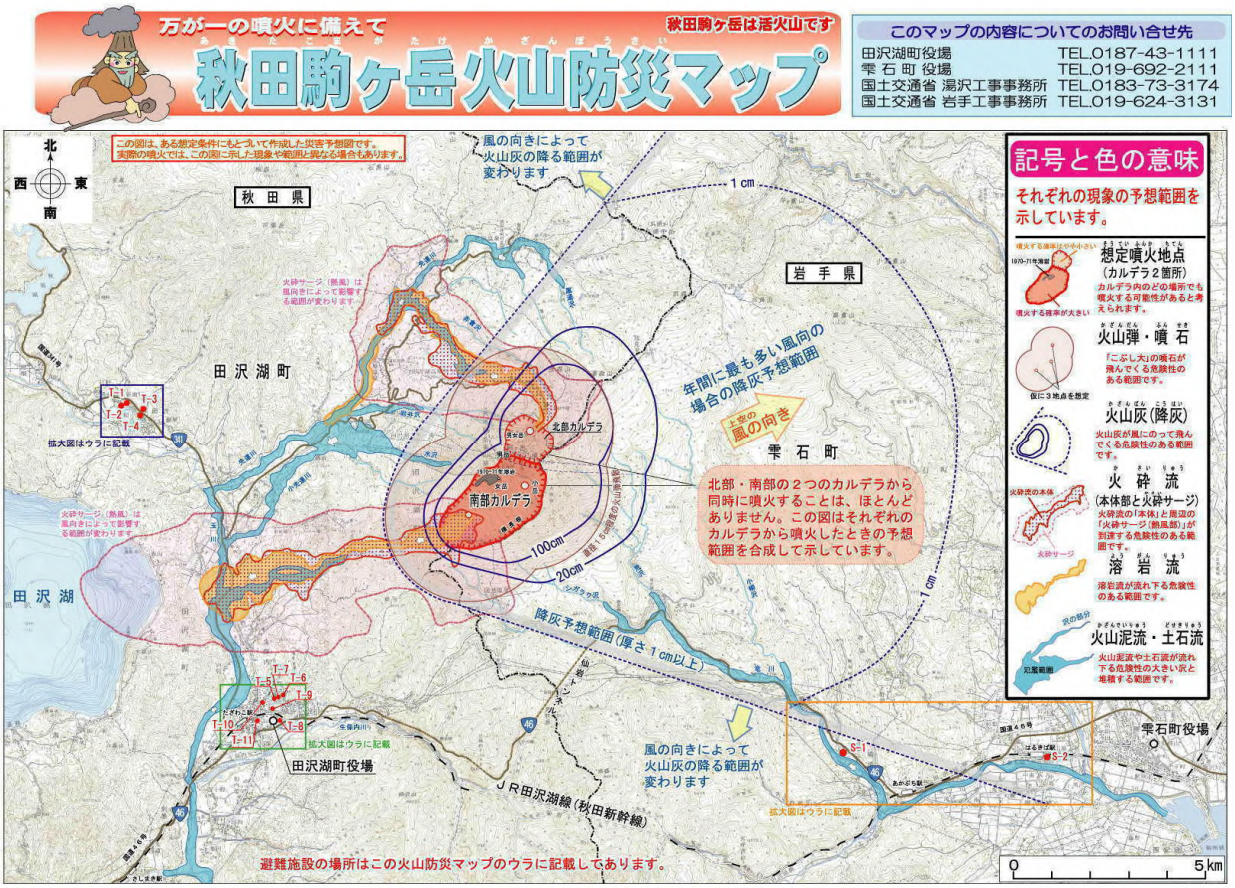
URL:

Iwate Prefecture

http://www.pref.iwate.jp/view.rbz?nd=922&of=1&ik=3&pnp=17&pnp=67&pnp=882&pnp=922&cd=2525

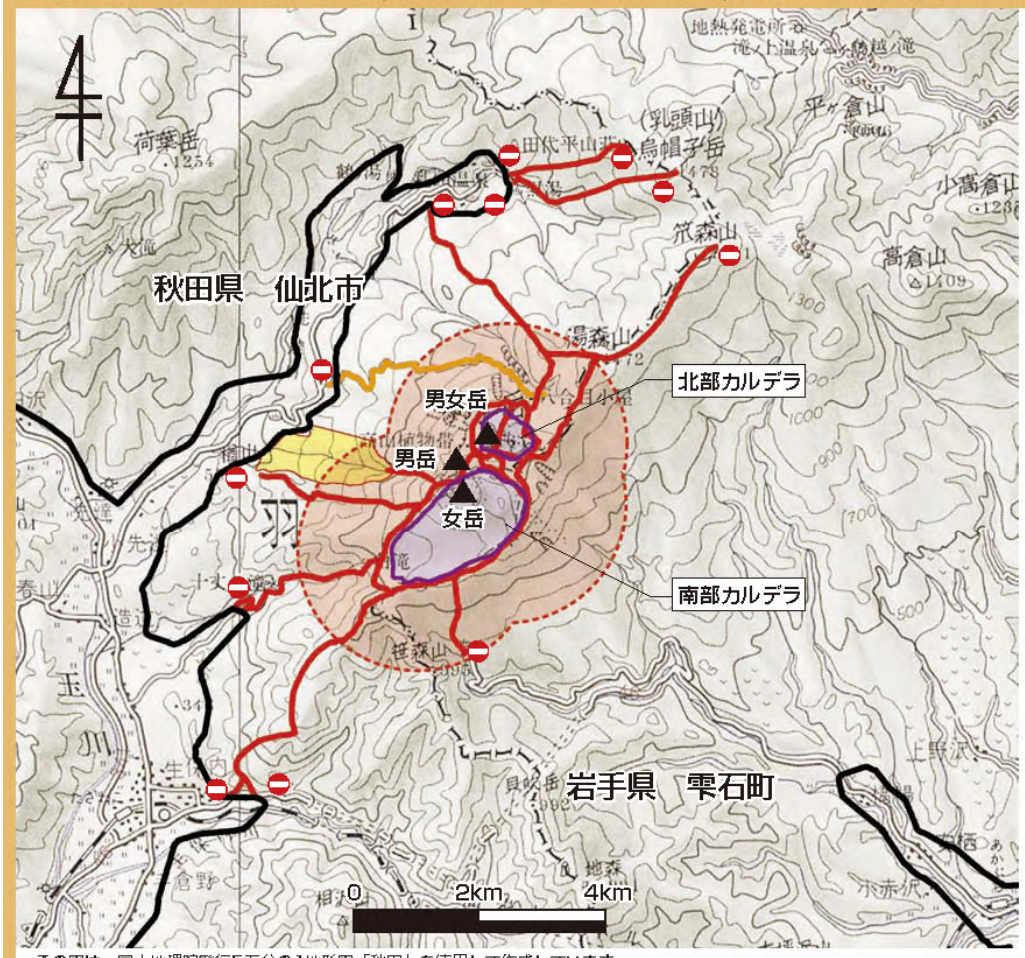
Yuzawa River and National Road Office, the Ministry of Land, Infrastructure, Transport and Tourism

http://www.thr.mlit.go.jp/yuzawa/01_kawa/kikikanri/akikoma/map.html



②Volcanic Alert Levels (Used since October 27, 2009)

■秋田駒ヶ岳　火口周辺警報(噴火警戒レベル3、入山規制)に対応した、登山道規制区間、県道規制区間



秋田駒ヶ岳の火山活動について

秋田駒ヶ岳では、1970年に南部カルデラの女岳山頂から噴火しています。この噴火で噴石の一部は、西側では外輪山を越え、東側では小岳(中央火口丘)まで、600～700m飛散(主にカルデラ内)しています。

凡　例
- 想定火口
- 噴石飛散範囲(火口から約2km)
- 登山道規制区間
- 県道規制
- 規制地点
- 規制施設
- 居住地域の境界

この図は、国土地理院発行5万分の1地形図「秋田」を使用して作成しています。

■この図は「秋田駒ヶ岳火山防災マップ」(仙北市(旧田沢湖町)、雫石町、秋田県、岩手県、国土交通省東北地方整備局湯沢河川国道事務所、岩手河川国道事務所、平成15年2月)に基づき作成しています。

■秋田駒ヶ岳の噴火警戒レベルは、地元自治体等と調整して作成しました。各レベルにおける具体的な規制範囲等については、地域防災計画等で定められていますので、詳細については地元市町村にお問い合わせください。

Volcanic Alert Levels for the Akita-Komagatake Volcano

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**	Imminent risk of serious damage to residential areas due to eruption. ●Possibility of pyroclastic flow from caldera or melted snow volcanic lahar caused by eruption. Past Examples No observed examples in historical times.
		4 Prepare to evacuate	**Possibility 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 an disaster must be evacuated.* Access restricted to all mountains.**	Possibility of serious damage to residential areas due to eruption. ●Risk of pyroclastic flow or melted snow volcanic lahar produced by eruption reaching area of caldera rim. ●Possibility of volcanic blocks scattered by eruption reaching near residential areas. Past Examples No observed examples in historical times.
Crater Area Warning	**Non-residential areas near the volcano**	**3 Do not approach the volcano**	**Eruption or prediction of eruption causing significant damage from crater area to areas near residential areas.**	**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.**	Area affected by the eruption is area within roughly 2 km of crater. ●Pyroclastic flow or melted snow volcanic lahar produced by eruption occurring (confirmed) within caldera. ●Eruption scattering or expected to scatter volcanic blocks over the caldera rim. Past Examples 1970 eruption at Medake
	Crater area	**2 Do not approach the crater**	**Eruption or prediction of eruption affecting area around crater.**	**Residents can go about daily activities as normal. Access to crater area restricted, etc.**	Area affected by the eruption is area within roughly 500 m of crater. ●Eruption expected as a result of increase in earthquake activity and fumarolic activity, etc. Past Examples 1932 phreatic explosion within northern caldera (Ishipora)
Eruption Forecast	**Inside the crater**	**1 Normal**	**Little or no volcanic activity.**	**Access to interior of and area around crater restricted as necessary, etc.**	Little or no volcanic activity. ●Weak fumarolic activity observed on north side of Medake, but not prominent surface phenomena in southern or northern caldera.

* Evacuation must be carried out quickly for areas in which there is a risk of evacuation routes being made inaccessible by volcanic blocks, pyroclastic flows, or melted snow lahars.

Social Circumstances

①Populations

- Iwate Prefecture

  Shizukuishi Town: 18,906 (as of March 31, 2008, according to annual report on basic resident register)

- Akita Prefecture

  Senboku City: 30,007 (as of October 31, 2011, according to the Senboku City website)

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

- Towada Hachimantai National Park

  Number of sightseers per year: Approximately 1,650,000 (according to the 2010 sightseeing statistics, Akita Prefecture)

  Number of mountain-climbers: Unknown

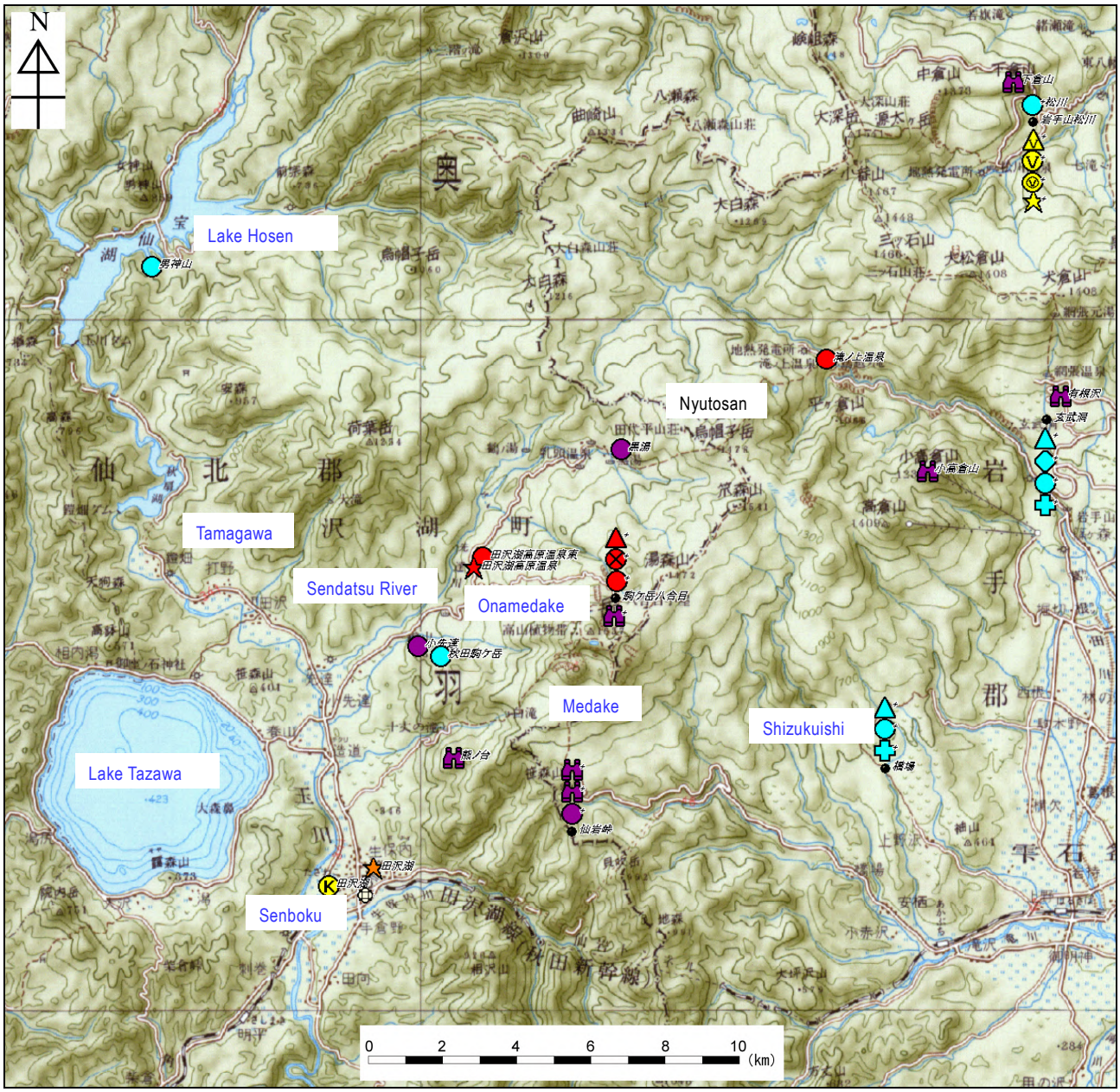
③Facilities

- Akita-Komagatake Volcano Disaster Prevention Station (Arupa Komakusa)

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 (Hirosaki, Hachinohe, Akita and Morioka) published by the Geospatial Information Authority of Japan were used.

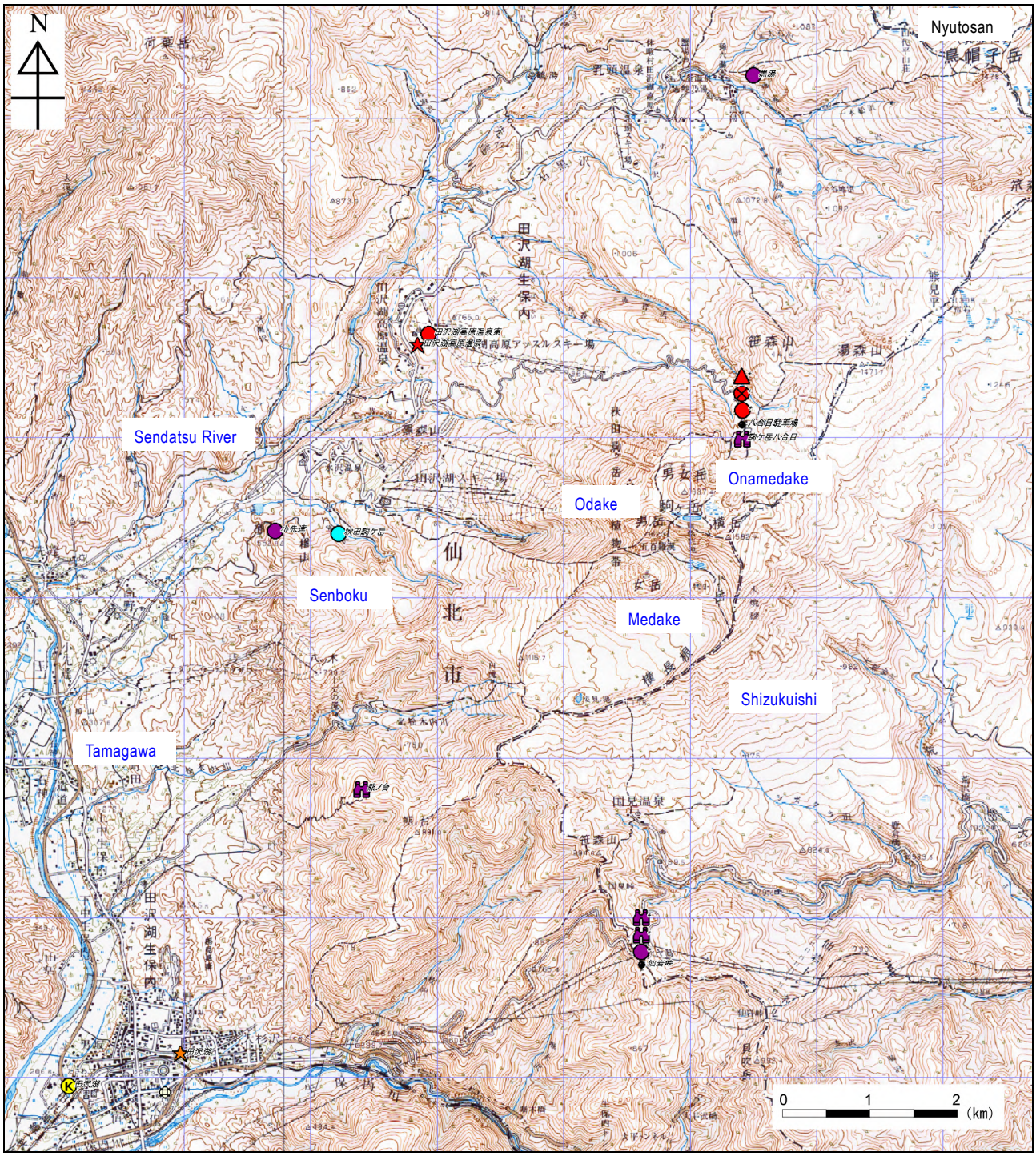
Legend

(JMA)	(GSI)	(NIED)	(Tohoku Univ.)	(MILT)
seismometer(SP)	GPS	V-net(SP)	seismometer(SP)	seismometer(SP)
GPS		V-net(broadband)	tiltmeter	visual camera
tiltmeter		V-net(tiltmeter)	strainmeter	
infrasonic microphone		K-NET	thermometer	(Municipalities)
		GPS		seismic intensity meter

Figure 28-17 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 (Tazawa Ko and Shizukuishi) published by the Geospatial Information Authority of Japan were used.

Legend

(JMA)
- seismometer(SP)
- GPS
- tiltmeter
- infrasonic microphone

(GSI)
- GPS

(NIED)
- V-net(SP)
- V-net(broadband)
- V-net(tiltmeter)
- K-NET
- GPS

(Tohoku Univ.)
- seismometer(SP)
- tiltmeter
- strainmeter
- thermometer

(MILT)
- seismometer(SP)
- visual camera

(Municipalities)
- seismic intensity meter

Figure 28-18 Local monitoring network.

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