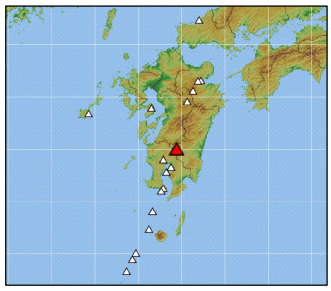
87. Kirishimayama



Continuously Monitored by JMA

Latitude: 31°56'03" N, Longitude: 130°51'42" E, Elevation: 1,700 m (Karakunidake)
(Triangulation Point - Nishi-Kirishimayama)
Latitude: 31°54'34" N, Longitude: 130°53'11" E, Elevation: 1,421 m (Shinmoedake)
(Triangulation Point - Shinmoe)
Latitude: 31°53'11" N, Longitude: 130°55'08" E, Elevation: 1,574 m (Takachihomine)
(Triangulation Point)

Central part of Kirishimayama on October 18, 2011 taken from west side by the Japan Meteorological Agency
Top right: Shinmoedake crater, Bottom center: Onamiike, Center left: Karakunidake, Top left: Hinamoridake

Summary

Kirishimayama consists of small basalt and andesite stratovolcanoes and pyroclastic cones, etc. on the southern rim of the Kakuto caldera, located in Miyazaki, Kagoshima prefectures. It contains over 20 identifiable volcanic edifices. The stratovolcanoes include Koshikidake, Shinmoedake, Nakadake, Ohatayama, Ohachi, and Takachihonomine. The pyroclastic cones include Karakunidake and Onamiike. Miike is a maar. Many volcanoes have large craters compared to the size of their volcanic edifices. Some of them have crater lakes Onamiike, Ohataike, Miike, and Rokkannonike. Ohachi and Shinmoedake volcanoes repeatedly erupted in historical time. The Ohachi was the most active in Kirishimayama, but no eruption occurred since 1923. Several small phreatic eruptions occurred at Shinmoedake in 2008 and in 2010, and finally magmatic eruption occurred in 2011. A hot spring and geothermal area is located on the southwest flank of Kirishimayama, and in the past fume activity was high at Ioyama, on the Ebino Plateau. The SiO_2 content of the volcanic rocks has a wide range from 49.6 to 66.9 wt %.

Red Relief Image Map

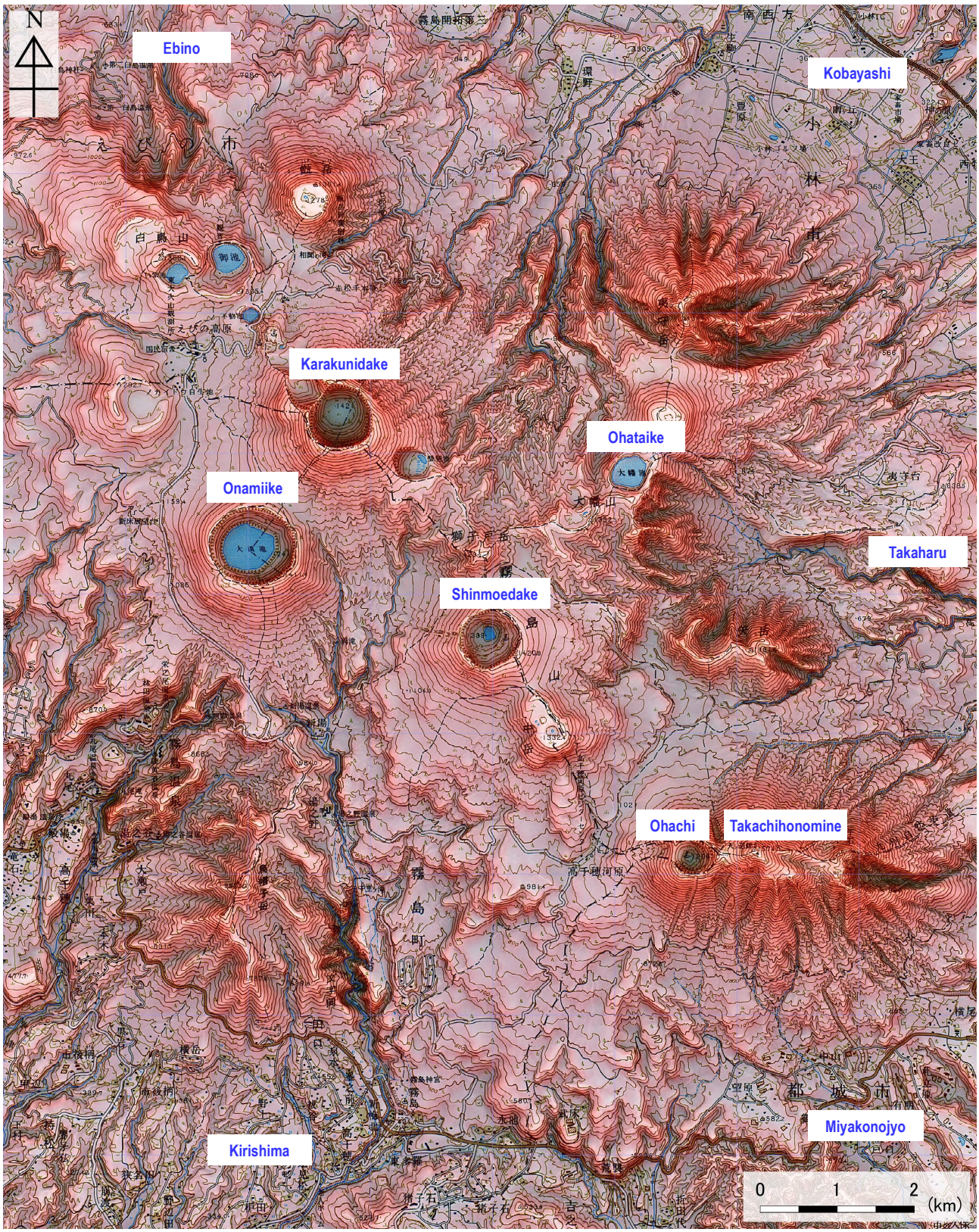


Figure 87-1 Topography of Kirishimayama.

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

Photos

Active fumaroles at Ohachi on March 27, 2004 taken from north side by the Japan Meteorological Agency

Ohachi Crater on March 1, 2007 taken from Northwest by the Japan Meteorological Agency

Fissure eruption at Shinmoedake on August 24, 2008 taken from northwest side by the Japan Meteorological Agency

A small phreatic eruption at Shinmoedake on May 27, 2010 by Crater Camera, taken from south side

Topography around the Crater

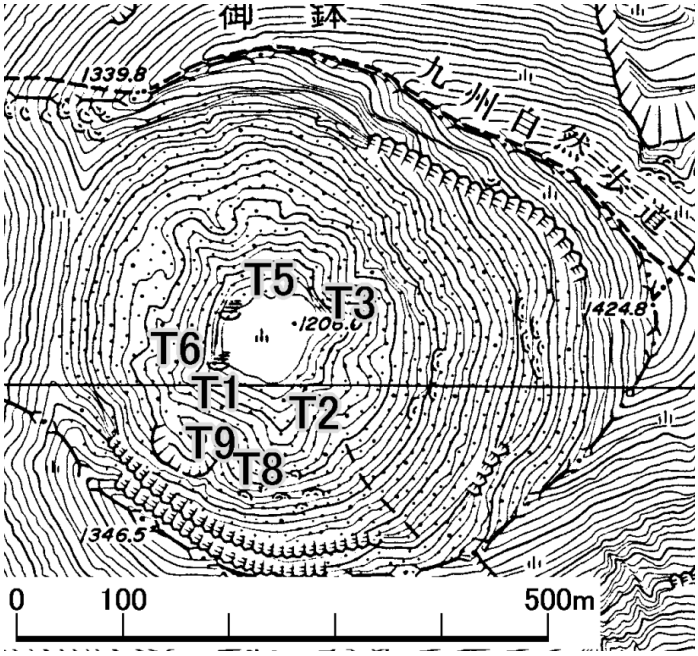


Figure 87-2 Topography around Ohachi.
T1 to T9 indicate fume measurement points.

Geological Map

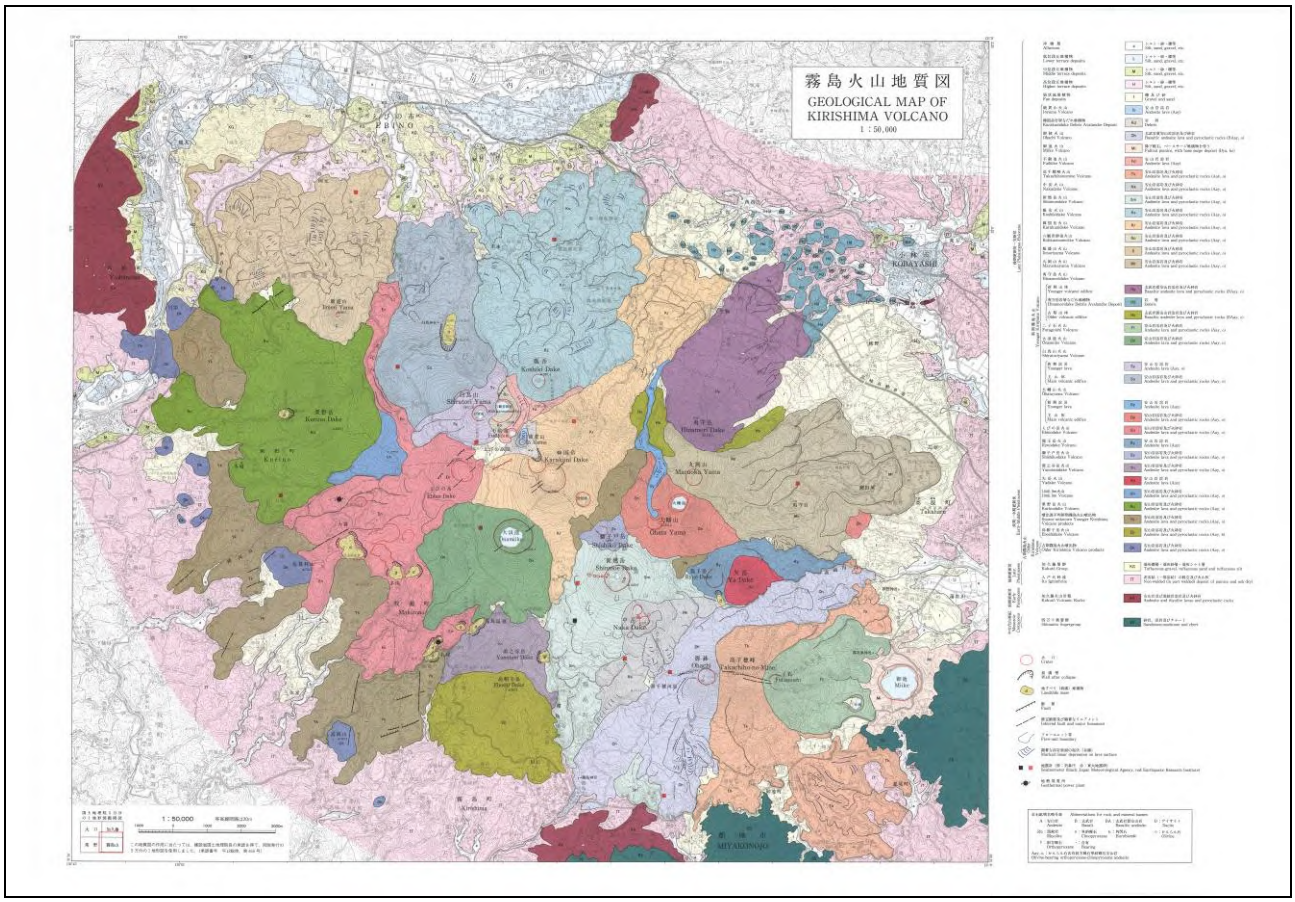


Figure 87-3 Geological map of Kirishimayama volcano (Imura and Kobayashi, 2001).

Chronology of Eruptions

・Volcanic Activity in the Past 10,000 Years

The Biwaike and Ohataike craters and Old-Takachiho volcano were formed between the dates of eruption of the Satsuma tephra (about 13,000 years ago) and the Kikai-Akahoya ash (about 7,300 years ago). After the settlement of the Akahoya ash, the Takachihonomine, Ohachi, and Ohatayama volcanic edifice, and the Miike, Koike, and Fudoike maars were formed. The eruption which formed the Miike maar (about 4,600 years ago) was the Kirishimayama's largest plinian eruption (Imura, 1994; Okuno, 2002).

Period	Area of Activity	Eruption Type	Main Phenomena / Volume of Magma
10.4ka	Shinmoedake crater	Magmatic eruption	Tephra fall (Setao pumice). Magma eruption volume = 0.027 km^3 DRE. (VEI 3)
10.4←→7.3ka	Shinmoedake crater	Magmatic eruption	Lava flow (Ryobu lava C).
8.1ka	Old-Takachiho	Magmatic eruption	Tephra fall (Kamamuta scoria) → lava flow (Natsuo lava). Magma eruption volume = 0.466 km^3 DRE. (VEI 3)
7.6ka<	Shinmoedake crater	Magmatic eruption	Lava flow (Butoko lava flow).
7.6ka<	Nakadake	Magmatic eruption	Lava flow (Nakadake old lava).
12.8←→7.3ka	Fudoike	Magmatic eruption	Tephra fall and lava flow.
7.6ka	Ohatayama	Phreatic eruption	Tephra fall. (VEI 1 or 2)
7.6←→7.1ka	Old-Takachiho	Magmatic eruption	Tephra fall (Ushinosune volcanic ash), lava flow (Tonokuchi lava, old-Takachiho lava). Magma eruption volume = 2.109 km^3 DRE. (VEI 5)
7.1ka>	Nakadake	Magmatic eruption	Lava flow.
7.1←→6.5ka	Ohatayama	Magmatic eruption	Tephra fall and lava flow. Magma eruption volume = 0.0176 km^3 DRE. (VEI 1 or 2) 3 eruptions, spaced apart, occurred during this period.
6.9ka	Takachihonomine	Magmatic eruption	Tephra fall (Mochiharu volcanic ash). Magma eruption volume = 0.012 km^3 DRE. (VEI 3)
6.9←→6.8ka	Takachihonomine	Magmatic eruption	Lava flow (Takachihonomine lava flow I). Magma eruption volume = 0.24 km^3 DRE. (VEI 4)
6.8ka	Takachihonomine	Magmatic eruption	Tephra fall (Oji scoria). Magma eruption volume = 0.09 km^3 DRE. (VEI 3)
6.8←→5.6ka	Takachihonomine	Magmatic eruption	Lava dome (Takachihonomine lava II).
5.6ka	Shinmoedake crater	Magmatic eruption	Tephra fall (Maeyama pumice) → pyroclastic flow deposits → agglutinate. Magma eruption volume = 0.0184 km^3 DRE. (VEI 3)
4.6ka	Miike	Magmatic eruption	Air-fall pumice (Miike pumice), pyroclastic surge. Magmatic eruption volume = 1 km^3 DRE. (VEI 5)
4.5ka	Shinmoedake crater	Magmatic eruption	tephra fall (Shinyu pumice).
4.5←→4.3ka	Karakunidake northwest flank	(Collapse)	Debris avalanche, tephra fall, pyroclastic flow (Ebino D tephra).
2.8←→2.5ka	Shinmoedake crater	Magmatic eruption	Lava flow (Ryobu lava A, Ryobu lava B), tephra fall. "Rabbit's ear" was formed at southwest of crater.
4.7←→1.2ka	Nakadake	Magmatic eruption	Lava flow, tephra fall. Magma eruption volume = 0.25 km^3 DRE.
1.7←→1.5ka	Fudoike	Phreatic eruption, (lahar produced)	Tephra fall (Ebino C tephra), lahar.
1.3ka	Ohachi	Magmatic eruption	Tephra fall (Araso tephra). Magma eruption volume = 0.0002 km^3 DRE. (VEI 1)

* 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.

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

A→B: Indicates a continuous chain of eruption events beginning in year A and ending in year B.

A<: Eruption event before year A. A>: Eruption event after year A.

・Historical Activity

Large eruptions occurred in 788 (Ohachi), 1235 (Ohachi), and 1716 to 1717 (Shinmoedake), with eruption activity mainly taking place at Shinmoedake and Ohachi.

Year	Phenomenon	Activity Sequence, Damages, etc.
742 (Tenpyo 14)	Eruption	4 days, starting on December 24.
788 (Enryaku 7)	Large: Magmatic eruption	April 18. Tephra fall (Katazoe tephra), lava flow (Kirishimajingu lava). The eruption occurred at Ohachi. Magma eruption volume = 0.0539 km^3 DRE. (VEI 3)
Approximately 900 ←→ approximately 1100	Large: Magmatic eruption	Tephra fall (Miyasugi tephra), lava flow (Sano lava). The eruption occurred at Ohachi. Magma eruption volume = 0.0829 km^3 DRE. (VEI 3)
1112 (Ten'ei 3)	Eruption	March 9. A shrine was burned down.
1167 (Nin'an 2)	Eruption	A temple was burned down.
1235 (Bunryaku 1)	Large: Magmatic eruption (subplinian eruption)	January 25. Tephra fall (Takaharu tephra), lava flow (Jingudai lava). The eruption occurred at Ohachi. Magma eruption volume = 0.2599 km^3 DRE. (VEI 4)
Approximately 1250 ←→ approximately 1350	Moderate: Magmatic eruption	Tephra fall (Takachihogawara tephra 1). The eruption occurred at Ohachi. Magma eruption volume = 0.0128 km^3 DRE. (VEI 3)
1278 ←→ 1287 (Koan 1 to 10)	Rumbling	Rumbling during Koan period (1278 to 1287).
Approximately 1300 ←→ approximately 1500	Magmatic eruption	Tephra fall (Ebino B1 tephra). The eruption occurred at Ioyama.
1307 (Tokuji 2)	Rumbling	Details unknown.
Approximately 1350	Moderate: Magmatic eruption	Tephra fall (Takachihogawara tephra 2), lava flow (Takachihogawara lava). The eruption occurred at Ohachi. Magma eruption volume = 0.0034 km^3 DRE. (VEI 2)
Approximately 1350 ←→ approximately 1650	Moderate: Magmatic eruption	Tephra fall (Takachihogawara tephra 3). The eruption occurred at Ohachi. Magma eruption volume = 0.0023 km^3 DRE. (VEI 2)
Approximately 1500 ←→ approximately 1700	Moderate: Magmatic eruption	Air-fall pyroclastic material (Ebino B2 tephra), lava flow (Ioyama lava flow). The eruption occurred at Ioyama. Magma eruption volume = 0.0024 km^3 DRE. (VEI 2)
1554 ←→ 1555 (Tenbun 23 to Koji 1)	Eruption	The eruption occurred at Ohachi.
1566 (Eiroku 9)	Eruption	May 6. The eruption occurred at Ohachi.
	Eruption	October 31. The eruption occurred at Ohachi. Many people were killed.
1574 (Tensho 2)	Eruption	February. The eruption occurred at Ohachi.
1576 ←→ 1578 (Tensho 4 to 6)	Eruption	The eruption occurred at Ohachi.
1587 (Tensho 15)	Eruption	April 17. 3 eruptions occurred in 1 day at Ohachi.
1588 (Tensho 16)	Eruption, earthquake	March 12. The eruption occurred at Ohachi.
1598 ←→ 1600 (Keicho 3 to 5)	Eruption	The eruption occurred at Ohachi.
1613 ←→ 1614 (Keicho 18 to 19)	Eruption	The eruption occurred at Ohachi.
1615 ←→ 1616 (Genna 1 to 2)	Eruption	The eruption occurred at Ohachi.
1617 ←→ 1618 (Genna 3 to 4)	Eruption	The eruption occurred at Ohachi.
1620 (Genna 6)	Eruption	The eruption occurred at Ohachi.
1628 (Kan'ei 5)	Eruption?	September 29.
1637 ←→ 1638 (Kan'ei 14 to 15)	Eruption	A wildfire occurred, burning down a temple.
Approximately 1650 (Keian 3)	Moderate: Magmatic eruption	Tephra fall (Takachihogawara tephra 4). The eruption occurred at Ohachi. Magma eruption volume = 0.0057 km^3 DRE. (VEI 3)
Approximately 1650 ←→ approximately 1700	Magmatic eruption	Tephra fall (Takachihogawara tephra 5 to 11). The eruption occurred at Ohachi.

Year	Phenomenon	Activity Sequence, Damages, etc.
1659 ←→ 1661 (Manji 2 to Kanbun 1)	Eruption	The eruption occurred at Ohachi.
1662 ←→ 1664 (Kanbun 2 to 4)	Eruption	The eruption occurred at Ohachi.
1677 (Enpo 5)	Eruption	The eruption occurred at Ohachi.
1678 (Enpo 6)	Eruption	January 9. The eruption occurred at Ohachi.
1706 (Hoei 2)	Eruption	December 15. The eruption occurred at Ohachi. A shrine and other buildings were burned down.
1716 (Kyoho 1)	Large: Magmatic eruption (producing lahar)	Kyoho eruption stage 1 (April 10, May 7). Small eruption. The eruption occurred at Shinmoedake Kyoho eruption stage 2 (September 26). First tephra fall at the foot of the volcano. Kyoho eruption stage 3 (November 9). First large scale pumice eruption. Pyroclastic flow. The eruption occurred at Shinmoedake. Eruptions occurred at several locations within a 15 km area. 5 people were killed, 31 injured, shrines and temples were burned down, over 600 houses were burned down, and over 405 livestock were killed. Magma eruption volume from all tephra produced by the Kyoho eruptions = 0.07 km^3 DRE. (VEI 4) Kyoho eruption stage 4 (4 to 6 days in December). Small-scale eruption.
1717 (Kyoho 2)	Eruption	Kyoho eruption stage 5 (February 9 to 22). The eruption occurred at Shinmoedake. 3 large pumice eruptions occurred, separated by quiet periods of several days. After the 3 eruptions relatively small eruptions occurred almost every day. During this time, nearby fields were buried 10 to 20 cm deep in coarse pyroclastic material.
	Eruption	Kyoho eruption stage 6 (March 3, March 8, March 13, April 8 (?)). Multiple relatively small eruptions occurred. The eruptions occurred at Shinmoedake.
	Eruption	Kyoho eruption stage 7 (September 6). Subplinian eruptions. Pyroclastic flow. The eruptions occurred at Shinmoedake. The eruptions began with relatively small eruptions, followed by 2 large eruptions, separated by small eruptions. Records exist of a lahar flow in 1721.
1768 (Meiwa 5)	Moderate: Phreatic eruption (collapse)	Collapse at Karakunidake (Ebino A tephra).
1771 ←→ 1772 (Meiwa 8 to 9)	Eruption	The eruption occurred at Ohachi. Ash fell as far as Kirishima-city Fukuyama, and Shibushi-city in Kagoshima Prefecture. Lahar was also produced ("a stream of muddy water flowed from Kirishimayama").
1822 (Bunsei 4)	Eruption	The eruption occurred at Shinmoedake. Records from what is now Kokubu in Kirishima-city state that a white volcanic plume rose on January 12, and from the evening a great volume of black smoke was emitted, accompanied by rumbling, which gradually tailed off. After some rain on approximately January 14 a lahar flow occurred (the "sulfur flow"), and river levels rose. On January 17 an investigation into the source of the eruptions found four new highly active fumaroles on the sides of Shinmoedake (the "burning holes"), and that mud mixed with sulfur was flowing from the area into the Kirishima River.
1832 (Tenpo 3)	Eruption?	April 20.
1880 (Meiji 13)	Eruption	September. The eruption occurred at Ohachi. After the eruption, fume activity was strong. Sulfur was deposited within the crater. Mining began, but an explosion on December, 1889, scattered the sulfur outside the fumes.
1887 (Meiji 20)	Eruption	Around May. The eruption occurred at Ohachi. Records state, "around May in the area four sudden eruptions occurred, scattering a large volume of sulfur both day and night", and, "From August an eruption and fissure occurred in northern Kirishima, with a boom that sounded like distant thunder and simultaneous tremors. Rain shutters and sliding doors in and around Sano and Hanando were shaken strongly, and looking up at Kirishimayama one could see a volcanic plume swirling up into the sky. Lightning flashed in the volcanic plume, and after 2 or 3 minutes a sudden rain of thumb-sized heated stones mixed with sand began, resulting in a cacophony of noise from their striking roof tiles and trees (from records at the Sano shrine).
1888 (Meiji 21)	Eruption	February. May 9. The eruptions occurred at Ohachi. This eruption is known from a record stating "May 9, eruption", but no other records of this eruption exist, so details are unknown. However, activity was ongoing throughout the year.
1889 (Meiji 22)	Eruption	December 10. The eruptions occurred at Ohachi. The eruption occurred at approximately 1:00.
	Eruption	December 18. The eruptions occurred at Ohachi. The eruption occurred at approximately 12:30.

Year	Phenomenon	Activity Sequence, Damages, etc.
1891 (Meiji 24)	Eruption	June 19. The eruptions occurred at Ohachi. 14 rumbles occurred over the course of a full day, and a black volcanic plume. Grass and leaves were withered in an area around 4 km from the foot of the volcano.
	Eruption	November 10 to 20. The eruptions occurred at Ohachi. 14 to 15 eruptions occurred over the course of a full day, and a black volcanic plume. Ash fell in an area approximately of 4 km, withering grass and leaves.
1893 (Meiji 26)	Eruption	November 21. The eruptions occurred at Ohachi. "On the 21 of last month (November), from 7:30 in the evening sudden rumbling occurred, accompanied by an eruption, scattering volcanic rocks around a 22 km area. Some blocks as large as 3.18 m fell as far as 4 km to the south. For some time, the mountain was robed in fire, with 7 or 8 eruptions over the course of the full day, a rarity in recent times."
1894 (Meiji 27)	Eruption	February 25, February 26, February 28. The eruptions occurred at Ohachi. An explosion occurred at 10:30, with a black volcanic plume drifting to the east, and tephra fall in the Miyazaki area. Ash and soybean sized pebbles fell on Haraigawa River, in Kamamuta, Takaharu Village, Nishimorokata-gun (approximately 6 km east of Ohachi). The Miyazaki weather station measured tephra fall during the 20 minutes between 11:37 and 11:57 to be 2.6 g/m^2.
1895 (Meiji 28)	Eruption	October 16. The eruption occurred at Ohachi at 12:26. In Kagoshima, a huge explosion sound could be heard and a black volcanic plume could be seen. A large volume of volcanic smoke was emitted from 4 or 5 days before the eruption, and occasional rumbling could be heard. Strong explosion sounds was observed in Miyakonojo, with heated stones falling at the foot of the volcano, and a volcanic plume rising from the entire area. Strong rumbling was confirmedin Kobayashi, with strong shaking of houses and buildings, the entire village going dark, and tephra fall. Heated stones fell on Yamanone, causing fires in 22 homes. A volcanic block 2 m in diameter fell in Taguchi (just under 8 km southwest of Ohachi). Approximately 200 to 300 m around Ohachi, volcanic blocks caused the death of three men, and one elderly woman.
	Eruption	December 18. The eruption occurred at Ohachi. At approximately 15:30 strong rumbling occurred, accompanied by a black volcanic plume. Heated stones were scattered at the eastern foot of Ohachi. No damage occurred other than the burning of withered leaves. Ash fell in Miyakonojo and Obi in Minaminaka-gun (approximately 50 km southeast of the Ohachi crater).
	Eruption	December 21. The eruption occurred at Ohachi. At 13:15 an explosion occurred, with a black volcanic plume drifting to the east, and tephra fall in villages near Miyakonojo (Hochi Shimbun, December 29, 1895).
1896 (Meiji 29)	Eruption	March 15. The eruption occurred at Ohachi. An explosion occurred at 8:26. French naval paymaster Lierre, who was climbing a mountain, was struck and injured by volcanic blocks, and his guide was killed.
	Eruption	June 23. The eruption occurred at Ohachi. Slight rumbling occurred at approximately midnight in Miyazaki, followed by an explosion sound and tephra fall after 1:00 on the same day.
1897 (Meiji 30)	Eruption	May 3. The eruption occurred at Ohachi. Rumbling occurred, a volcanic plume was emitted, and ash fell in the Miyakonojo area. Some tea plants and mulberry trees were damaged.
	Eruption	June 25. The eruption occurred at Ohachi. At approximately 12:00 light rain mixed with a small amount of ash fell in Kagoshima.
	Eruption	September 4. The eruption occurred at Ohachi at approximately 20:00. It lasted for approximately 10 minutes, and resulted in the falling of a moderate amount of heated stones.
1898 (Meiji 31)	Eruption	February 8. The eruption occurred at Ohachi. Rumbling occurred and a volcanic plume was emitted at approximately 1:00 am, as well as tephra fall and the scattering of heated stones. Rumbling occurred again at approximately 1:30 of the same day.
	Eruption	March 11. The eruption occurred at Ohachi. On March 11 at approximately 18:20 an eruption and rumbling occurred, with heated stones scattered on several towns. The rumbling continued for approximately 5 minutes. On March 11 at approximately 19:00 a loud roar could be heard, rattling paper screen doors and raining ash in Miyazaki.
	Eruption	December 26 to 30. The eruption occurred at Ohachi. On December 26 ash fell on Kochi City. On December 27 at approximately 2:00 in the morning three loud rumbles, like distant thunder, could be heard in Matsuyama City. On the morning of December 28 ash fell in and around Meiji and Yoshinobu in Kitauwa-gun. On December 30 at approximately 23:00 rumbling occurred, and ash fell in Miyazaki that resembled piled-up snow.

Year	Phenomenon	Activity Sequence, Damages, etc.
1899 (Meiji 32)	Eruption	July 28. The eruption occurred at Ohachi. At approximately 13:30 strong rumbling, like distant thunder, occurred, and houses at the foot of the volcano were shaken. A black volcanic plume was emitted.
	Eruption	September 12. The eruption occurred at Ohachi. On the morning of September 12 rumbling occurred and ash fell in Miyazaki.
	Eruption	October 13. The eruption occurred at Ohachi. At approximately 03:05 rumbling occurred and a volcanic plume was emitted. The black volcanic plume was carried east and dissipated. The rumbling continued for approximately 2 minutes, initially sounded like giant cannons and gradually coming to resemble distant thunder.
	Eruption	November 7. The eruption occurred at Ohachi. In the morning, rumbling occurred and ash fell in Miyazaki.
1900 (Meiji 33)	Eruption	February 16. The eruption occurred at Ohachi at approximately 09:00. A group of hunters leading 7 dogs out on a hunt was at Oonotani, on the southwest flank of Kirishimayama, when the explosion occurred. All 5 hunters sustained heavy injuries, and 2 died afterwards. Their location they went missing at when the explosion occurred was 1450 to 1820 m from the eruption crater.
1903 (Meiji 36)	Eruption	August 18. The eruption occurred at Ohachi. "At 2:00 in the morning on the 18th, rumbling occurred at Kirishima, accompanied by a strong eruption. A huge volume of tephra fall was produced, causing damage to mulberry leaves in the Takaharu area, and causing significant problems for summer silkworm cultivators. The eruption also killed a large number of carp in Miike Lake, in the Kirishima area, though it is unknown if they were killed by the rumbling or by an influx of sulfur carried in by rain." (Miyazaki Shimpou, August 22, 1903)
	Eruption	August 29. The eruption occurred at Ohachi. An explosion occurred, and strong rumbling could be heard in Kakuto.
	Eruption	November 25. The eruption occurred at Ohachi. An explosion occurred at 20:25. Houses were shaken in Miyazaki. Fist-sized volcanic blocks fell on Ushinosune (7 km east-southeast of Ohachi).
1913 (Taisho 2)	Eruption	April 2 and April 13. The eruptions occurred at Ohachi. "On April 2, performers reached the top of the Ohachi crater wall at approximately 10:30 in order to climb Takachihomine, on the Kirishimayama. The volcano suddenly erupted, and they managed to take shelter and avoid injury. The explosion threw two chunks of dark black debris straight up from the crater floor. Both were sharp, and looked like pieces of cedar. No explosion could be heard other than the sound of rocks grating against each other and falling rocks. The chunks of debris appeared to have been ejected 400 m above the crater floor. No volcanic plume was noted when the explosion occurred. However, a volcanic plume appeared soon afterwards. After taking shelter, the group returned again to the top of the crater wall and looked inside the crater. They saw a dark gray volcanic plume being emitted, and smelled the strong odor of sulfurous gas. Blocks were ejected as far as the top of the crater wall on which the performers had first been standing, at a horizontal distance of approximately 250 m from the discharge point. The rocks were ejected straight up, so most appeared to have fallen back to the crater floor, but the amount that reached the inside and outside of the crater wall was estimated to be enormous".
	Eruption	November 8. The eruptions occurred at Ohachi. On May 19, at approximately 4:20, an earthquake was felt in Kakuto, Nishimorokata-gun. 175 earthquakes occurred between this time and September 1. From October 17 to 19, 3 strong earthquakes occurred. On November 8 at approximately 23:00 an explosion occurred on Ohachi. Heated stones were ejected. Heated stones were scattered to Sano (Takaharu, 7 km east-northeast of Ohachi) and Nishifumoto (Takaharu, 10km northeast of Ohachi). A fire column was observed at Kakuto.
	Eruption	December 9. The eruptions occurred at Ohachi. An explosion occurred at 4:15. Ash fell in Miyazaki. A sound like a cannon could be heard in Takaharu. Large and small rocks ejected by the eruption were scattered on Takachihonomine and the volcano's flanks, shining like stars. 12 to 15 cm volcanic blocks were scattered in the Nishidake village Nakanoyama area (location?). The 2 eruptions this year were far smaller than the explosions of November 25, 1903.
1914 (Taisho 3)	Eruption	January 8. The eruption occurred at Ohachi. An explosion occurred at 02:20. The explosion sound in Miyazaki was louder than that of the previous eruption. Paper screen doors were rattled, but no ash fell. Rocks as large as chestnuts fell in the Ushinosune, Nishidake village area (7 km east-southeast of Ohachi). Rocks fell on roofs in one village in Akamichi, near the eruption crater west of Miike. An air shock could be felt in Mitai, to the far north of Hyuga (100 km north-northeast of Ohachi) and Nobeoka (105 km northeast of Ohachi). An explosion sound could be heard in Tano (35 km north-northeast of Ohachi) and Miyakonojo (25 km northeast of Ohachi). Ash fell in Higashisonoyama town.

Year	Phenomenon	Activity Sequence, Damages, etc.
1915 (Taisho 4)	Earthquake	July to August. Strong intensities in Yoshimatsu and Kurino.
1923 (Taisho 12)	Eruption	July 11, July 15, July 16, July 20. The eruptions occurred at Ohachi. One person was killed.
1934 (Showa 9)	Lake surface discoloration, volcanic gas	The water in the crater lake grew cloudy, and gas was emitted from under the surface. Many shrubs within 10 m of the crater lake withered.
1958 (Showa 33)	Fume	November 19. Small fume activity occurred at the Onamiike crater rim.
1959 (Showa 34)	Moderate: Phreatic eruption	February 13 and February 17. The eruption occurred at Shinmoedake. After a small explosion on February 13, an explosive eruption began at 14:50. It formed a crater chain extending 500 m east-west. A wireless police relay station, approximately 3 km north-northwest of the crater, was damaged. It produced a large volume of volcanic blocks and tephra fall, and major forest, agricultural land, and crop damage, in Kobayashi and Takaharu in Miyazaki Prefecture, and in Kirishima in Kagoshima Prefecture. (VEI 2)。
1961 (Showa 36)	Earthquake	March, April. An earthquake swarm occurred near Yoshimatsu.
1966 (Showa 41)	Earthquake	An earthquake swarm occurred from April 27 to April 30. The hypocenters were located in the Yoshimatsu and Kyomachi areas.
1968 (Showa 43)	Earthquake	"Ebino Earthquake". An earthquake swarm occurred in Ebino and Yoshimatsu. The largest earthquake was an M6.1 earthquake on February 21, with its hypocenter 15 km northwest of Karakunidake. It killed 3, injured 42, and caused the complete collapse of 368 houses. There were 4 other earthquakes which caused damages.
1971 (Showa 46)	Phreatic eruption	August 5. The eruption occurred at Tearai Onsen. Heavy rains caused landslides and debris flows, and fumarole closure resulted in an explosion.
1975 (Showa 50)	Earthquake	Approximately September 29 to mid-October. An earthquake swarm occurred in the Ebino and Yoshimatsu area, with the largest earthquake being an M4.1 earthquake on October 17, with a JMA scale seismic intensity of 4 at Ebino.
1976 (Showa 51)	Earthquake	February 8. An earthquake occurred near Yoshimatsu, accompanied by rumbling. The earthquake had a JMA scale seismic intensity of 3.
1978 (Showa 53)	Earthquake	An earthquake swarm occurred from July 7 to 8. On July 7 rumbling and an earthquake occurred with a JMA scale seismic intensity of 1 at the Kirishima Rosai Hospital (3 km southwest of Shinmoedake). From August 29 to mid-September earthquakes occurred near Ebino, with the largest being a M4.3 earthquake on August 28, with a JMA scale seismic intensity of 3 at Ebino.
1980 (Showa 55)	Earthquake	December 3. An M3.2 earthquake occurred near Karakunidake, with a JMA scale seismic intensity of 3 at Ebino.
1980 to 1981 (Showa 55 to 56)	Fume	December, 1980 to September, 1981. The fumarolic area near Iodani Onsen grew.
1981 (Showa 56)	Earthquake	January 13 to 14. Earthquake swarm (not felt) near Shinmoedake.
1981 to 1982 (Showa 56 to 57)	Fume	December, 1981 to May, 1982. Temperature rose at the Shinmoedake No. 6 fumarole (maximum temperature of 208 °C).
1983 (Showa 58)	Earthquakes, volcanic tremors	December 28 to 29. Earthquake swarm (not felt) near Shinmoedake. Volcanic tremors on December 29.
1985 (Showa 60)	Earthquake	August 28 to 30. Earthquake swarm (not felt) near Shinmoedake.
1986 (Showa 61)	Earthquake	April, September. On April 28 3 earthquakes occurred in Makizono, with estimated maximum JMA scale seismic intensities of 4 to 5, resulting in damages. On September 21 2 earthquakes occurred near Kurinodake, at a depth of approximately 3 km, with a maximum magnitude of M2.0, and measuring 1 on the JMA seismic intensity scale throughout the Ebinokougen.
1988 (Showa 63)	Earthquake	October 3 to 9. Earthquake swarm (not felt) near Shinmoedake. Volcanic tremors on October 8 (first time since 1983).
1991 to 1992 (Heisei 3 to 4)	Phreatic eruption[15]	The eruption occurred at Shinmoedake. Beginning on November 13 the number of earthquakes directly below Shinmoedake suddenly increased, with a high number of earthquakes continuing until November 26. The number of tremors was also high. Continuous and frequent tremors continued until January, 1992. On November 24 fume activity was confirmed at the Shinmoedake crater. From December, 1991, to February, 1992, volcanic ash was occasionally discharged.
1992 to 1994 (Heisei 4 to 6)	Earthquake	The number of volcanic earthquakes increased occasionally near Shinmoedake.
1995 (Heisei 7)	Earthquakes, volcanic tremors	The number of volcanic earthquakes increased near Shinmoedake. April 26, August 25 to 30, late September. Volcanic tremors occurred on April 26.
1999 (Heisei 11)	Earthquakes, volcanic tremors	From November 6, the number of earthquakes with their hypocenters at Shinmoedake increased. The peak number of earthquakes per day was 192 on November 10. On December 16 volcanic tremors occurred, which continued for a total of 32 minutes, followed by approximately 20 tremors throughout December.

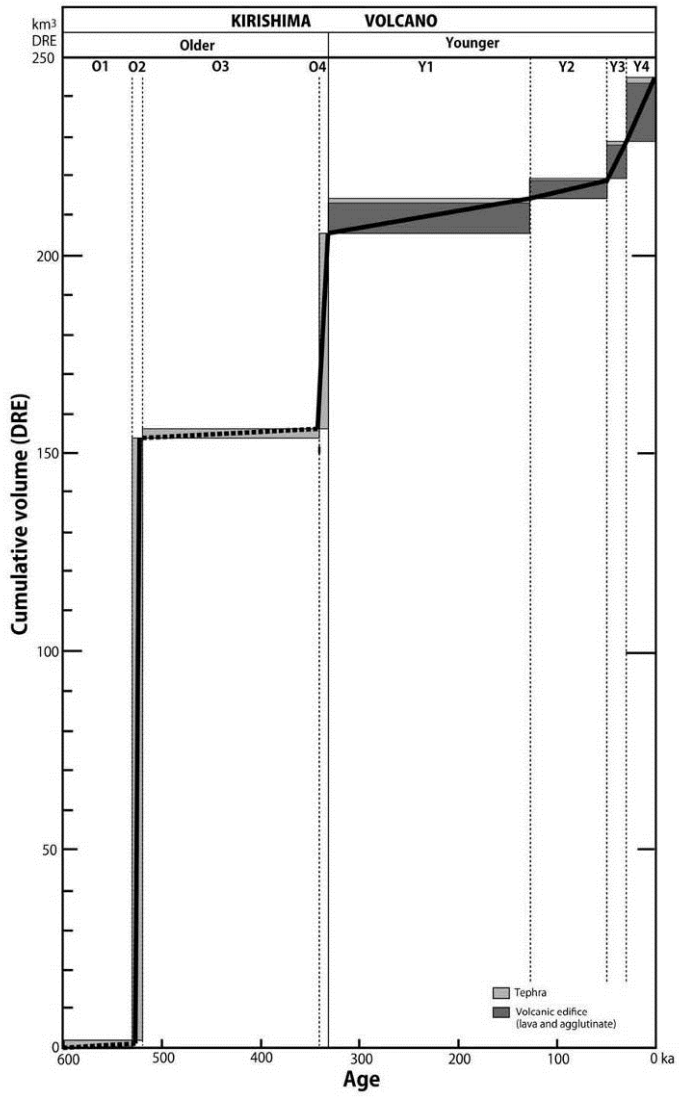
Year	Phenomenon	Activity Sequence, Damages, etc.
2003 (Heisei 15)	Volcanic tremors	Volcanic tremors occurred occasionally at Ohachi. On December 12, the longest tremor occurred, and the following day, a fumarole was confirmed on the south interior of the Ohachi crater. Fume occasionally extended beyond the crater rim.
2004 (Heisei 16)	Volcanic tremors	Volcanic tremors with long durations occurred in January, March, and November at Ohachi. Fume intensities rose and fell repeatedly, for an overall slightly high level of activity. Fume occasionally extended beyond the crater rim.
2005 (Heisei 17)	Volcanic tremors	Volcanic tremors occurred occasionally at Ohachi. Fume occasionally rose above the crater rim.
2006 (Heisei 18)	Volcanic tremors, earthquakes	Volcanic tremors and volcanic earthquakes occurred at Shinmoedake. Occasional volcanic tremors occurred at Ohachi. Fume occasionally extended beyond the crater rim.
2007 (Heisei 19)	Volcanic tremors	Volcanic tremors occurred occasionally at Ohachi.
2008 (Heisei 20)	Small-scale: Phreatic eruption	August 22. The eruption occurred at Shinmoedake. Ash fell in the Kobayashi area. (VEI 1)。
2010 (Heisei 22)	Phreatic eruption	March 30, April 17. The eruption occurred at Shinmoedake. On May 6 a large number of volcanic earthquakes occurred, followed by very small to small eruptions at Shinmoedake on May 27, June 27, 28, July 5, and 10.
2011 (Heisei 23)	Moderate: Magmatic eruption	A small eruption began on Shinmoedake on January 19, which turned into a subplinian eruption on January 26. A large amount of volcanic ash and pumice was ejected. The subplinian eruption continued until January 27. From roughly January 27, lava was discharged within the crater. Growth continued until early February, reaching a diameter of approximately 600 m. 13 explosive eruptions occurred between January 27 and March 1. The February 1 explosive eruption scattered large volcanic blocks approximately 3.2 km southwest of the Shinmoedake crater. An air shock caused damage to windowpanes in Kirishima, Kagoshima Prefecture. The February 14 explosive eruption scattered small volcanic blocks (lapilli) on Kobayashi, Miyazaki Prefecture, causing damage including damage to a car's sunroof. Eruptions continued until early September, 2011. The March 13 eruption produced ash which fell as far as the sea of Hyuga, and lapilli fell in Natsuo, Miyakonojo, approximately 9 km southeast of the Shinmoedake crater. The April 3 eruption scattered volcanic blocks approximately 600 m from the Shinmoedake crater. The April 18 eruption scattered volcanic blocks approximately 1 km from the west to the north of the Shinmoedake crater. Small lapilli fell from on Takaharu, Miyazaki Prefecture, approximately 9 km to the east of the Shinmoedake crater, damaging solar water heaters and solar panels. In April, June, and September eruptions were accompanied by confirmed tephra fall in areas such as Kumamoto Prefecture, 50 to 60 km away. Magma eruption volume = 0.0172 km^3 DRE. (VEI 3)

* 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.

A→B: Indicates a continuous chain of eruption events beginning in year A and ending in year B.

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

Period - Cumulative Magma Volume



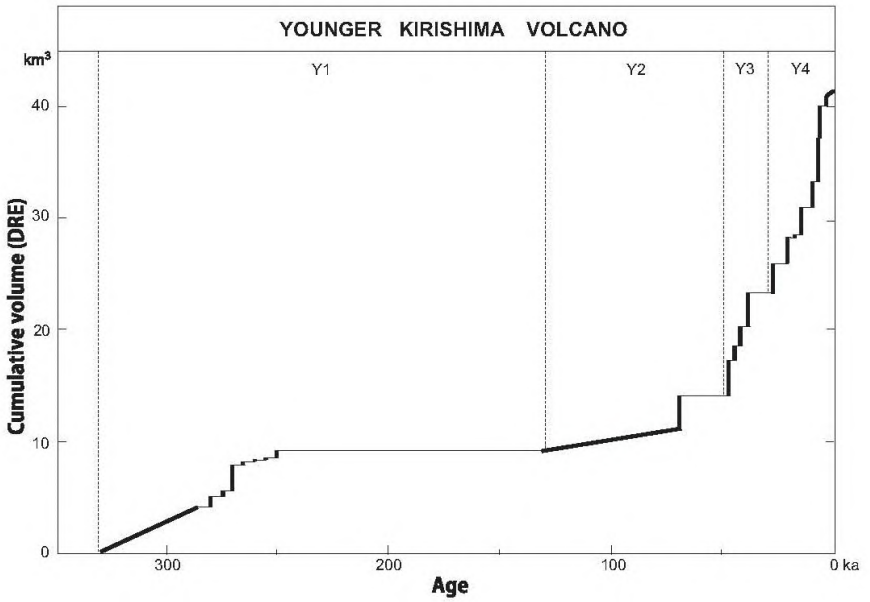


Figure 87-4 Eruption period - cumulative magma volume (Nagaoka and Okuno, 2011).

Major Volcanic Activity

▪ 2011 Eruption

Shinmoedake Eruption on January 27, 2011 taken from Kagoshima Airport to Northeast by the Japan Meteorological Agency

▪ January 26-27, 2011, Eruption Ash Fall Distribution

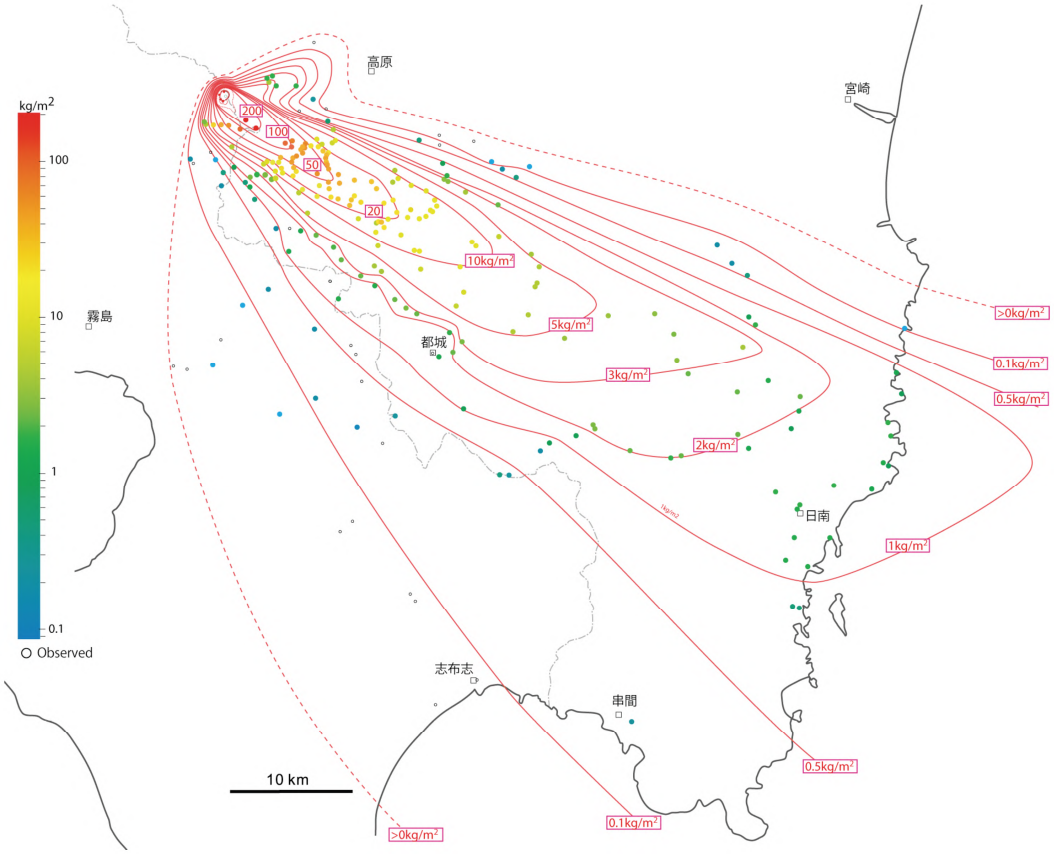


Figure 87-5 Distribution of air-fall tephra ejected by the January 26-27 Shinmoedake eruption (National Institute of Advanced Industrial Science and Technology et al., 2011).

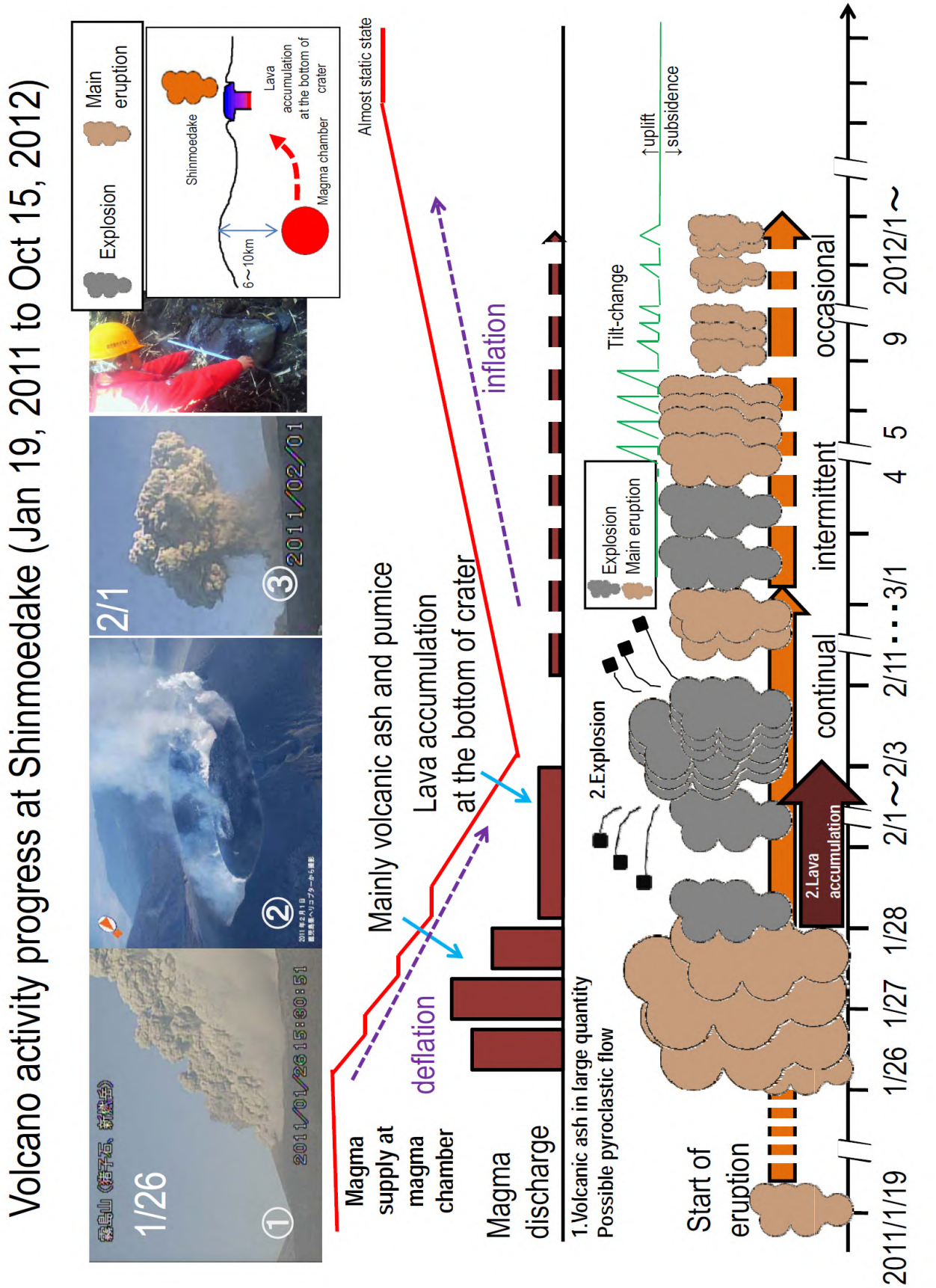


Figure 87-6 Time series of the Shinmoedake volcano activity (January 19, 2011 to October, 2012) (Japan Meteorological Agency, 2012).

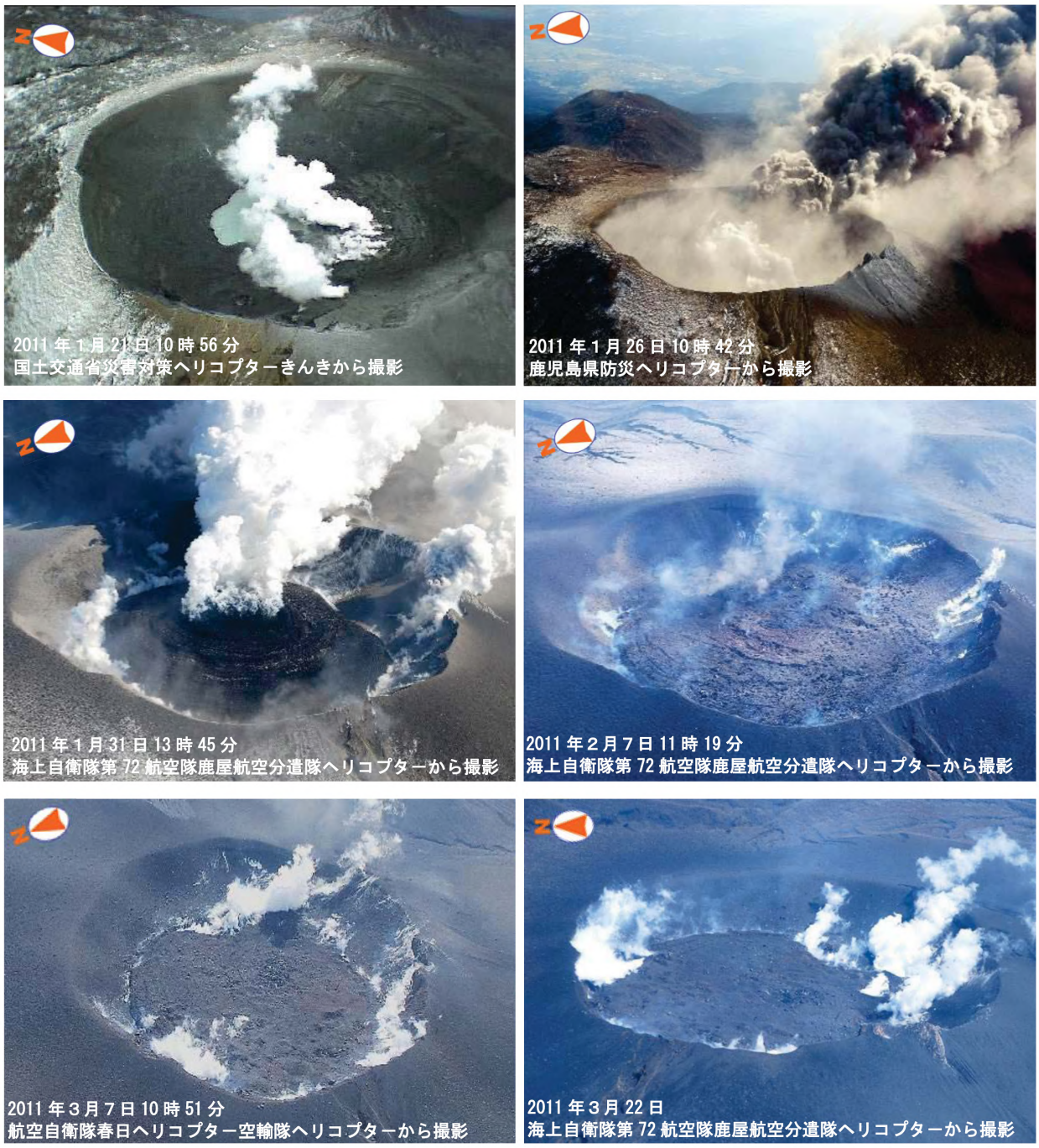
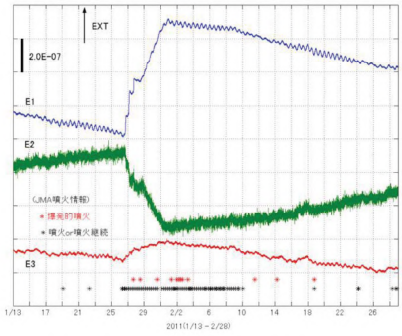
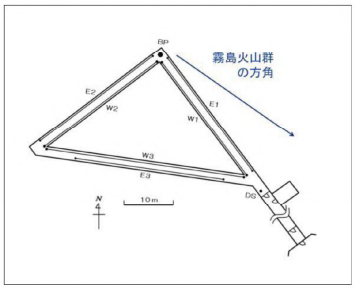


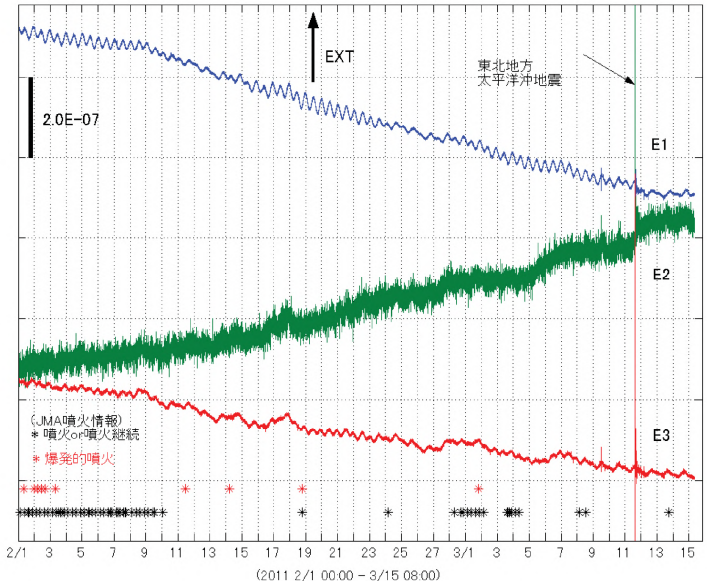
Figure 87-7 Changes inside the Shinmoedake crater (January to March, 2011).



2011年1月13日～2月28日

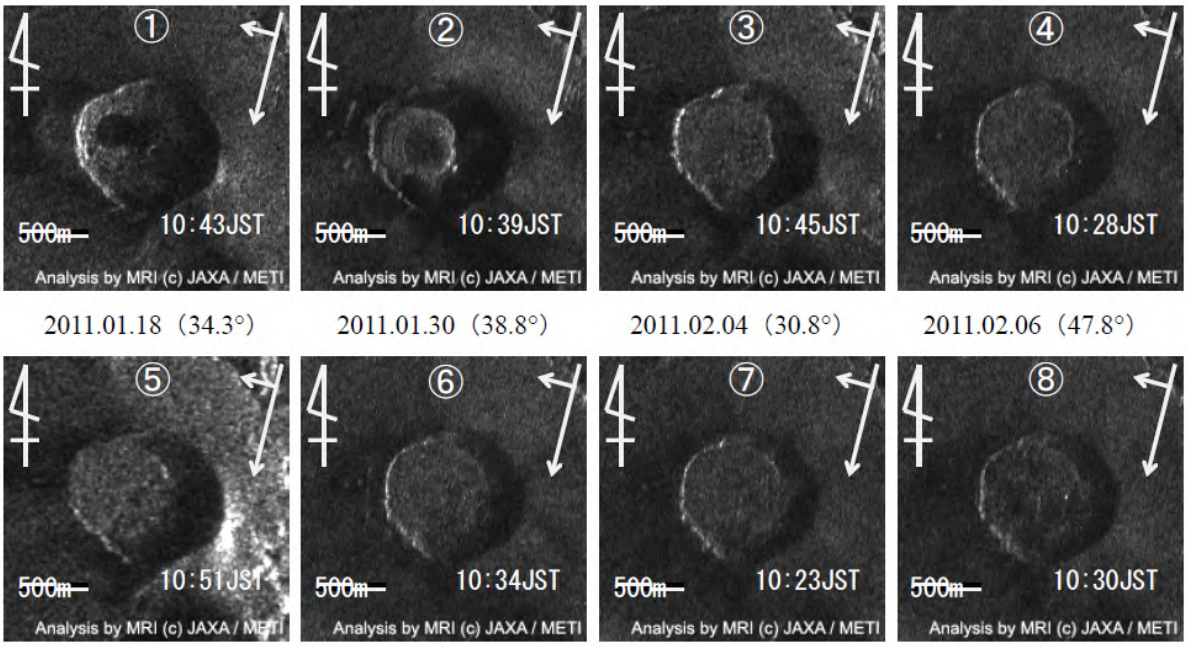


伊佐観測坑道伸縮計配置
（鹿児島県湧水町：新燃岳の北西約17km）



2011年2月1日～3月15日の歪変化

Figure 87-8 Extensometer records for Kirishimayama (Shinmoedake) eruption, from Yoshimatsu (Isa) station.
Strain changes was recorded over 2 days, from January 26 to January 27, corresponding to prominent volcanic plume emission, and strain changes was also recorded, corresponding to lava emissions from the crater from January 28 to January 31.



2011.01.18（34.3°） 2011.01.30（38.8°） 2011.02.04（30.8°） 2011.02.06（47.8°）

2011.02.09（21.5°） 2011.02.11（43.4°） 2011.02.18（50.0°） 2011.02.23（46.6°）

Figure 87-9 Changes inside the crater at Shinmoedake crater, observed by the "Daichi" (ALOS/PALSAR) Advanced Land Observing Satellite (southward orbit).
(November 20, 2010 to February 18, 2010) (Meteorological Research Institute, 2011) Numbers in parentheses below figures indicate off-nadir angles.

Crater lakes were observed on the day before a series of eruptive activity began (from January 26). On January 30 lava was confirmed. No changes in lava supply volume or shape were confirmed inside the crater until mid-February, but the image of February 23 shows a high degree of inhomogeneity on the surface of lava.

Precursory Phenomena

The 2011 magmatic eruption of Shinmoedake was preceded by inflation of the shallow area directly below the crater from several years ago, frequent volcanic earthquakes beneath the crater, and sporadic phreatic eruptions, as well as continuous inflation (magma chamber is several km away to the northwest of Shinmoedake), from about 1 year ago before the eruption. Frequent earthquakes were sometimes observed before the phreatic eruptions. From several hours to 60 hours before individual eruptions, slight ground deformation and seismic activity (BH-type earthquakes) were occasionally observed.

Recent Volcanic Activity

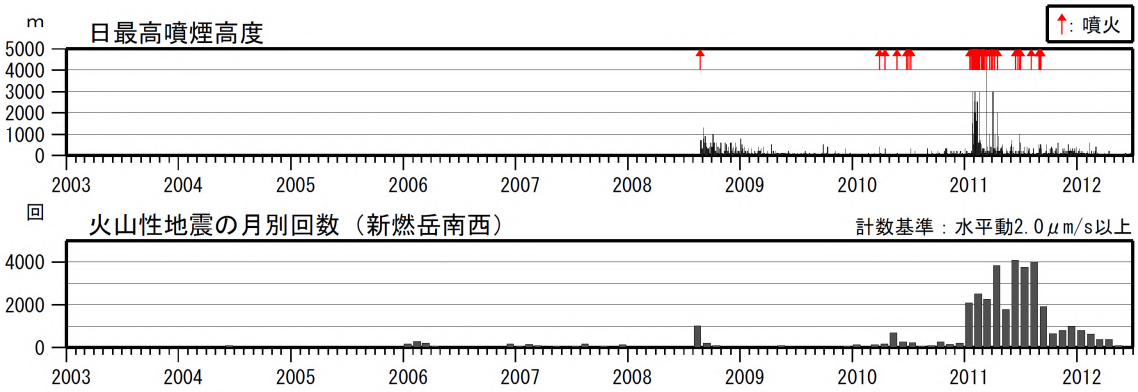


Figure 87-10 Activity at Shinmoedake (January, 2003 to June, 2012).

① Daily maximum volcanic plume height

② Number of volcanic earthquakes per month (southwest of Shinmoedake)

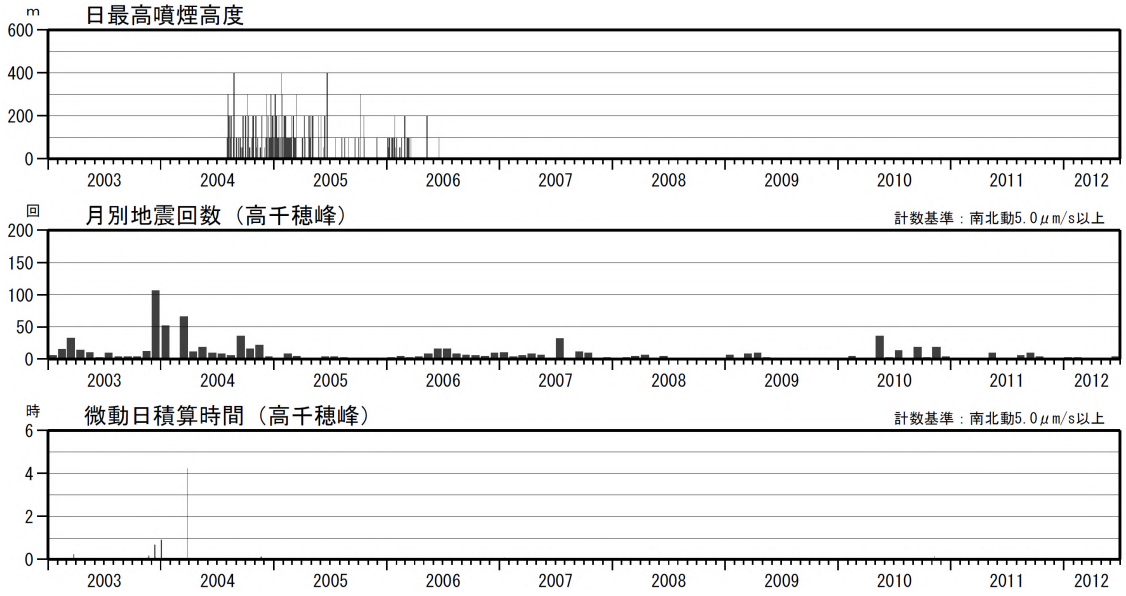


Figure 87-11 Activity at Ohachi (January, 2003 to June, 2012).

① Daily maximum volcanic plume height

② Number of volcanic earthquakes per month (Takachihonomine)

③ Total amount of volcanic tremor time per day (Takachihonomine)

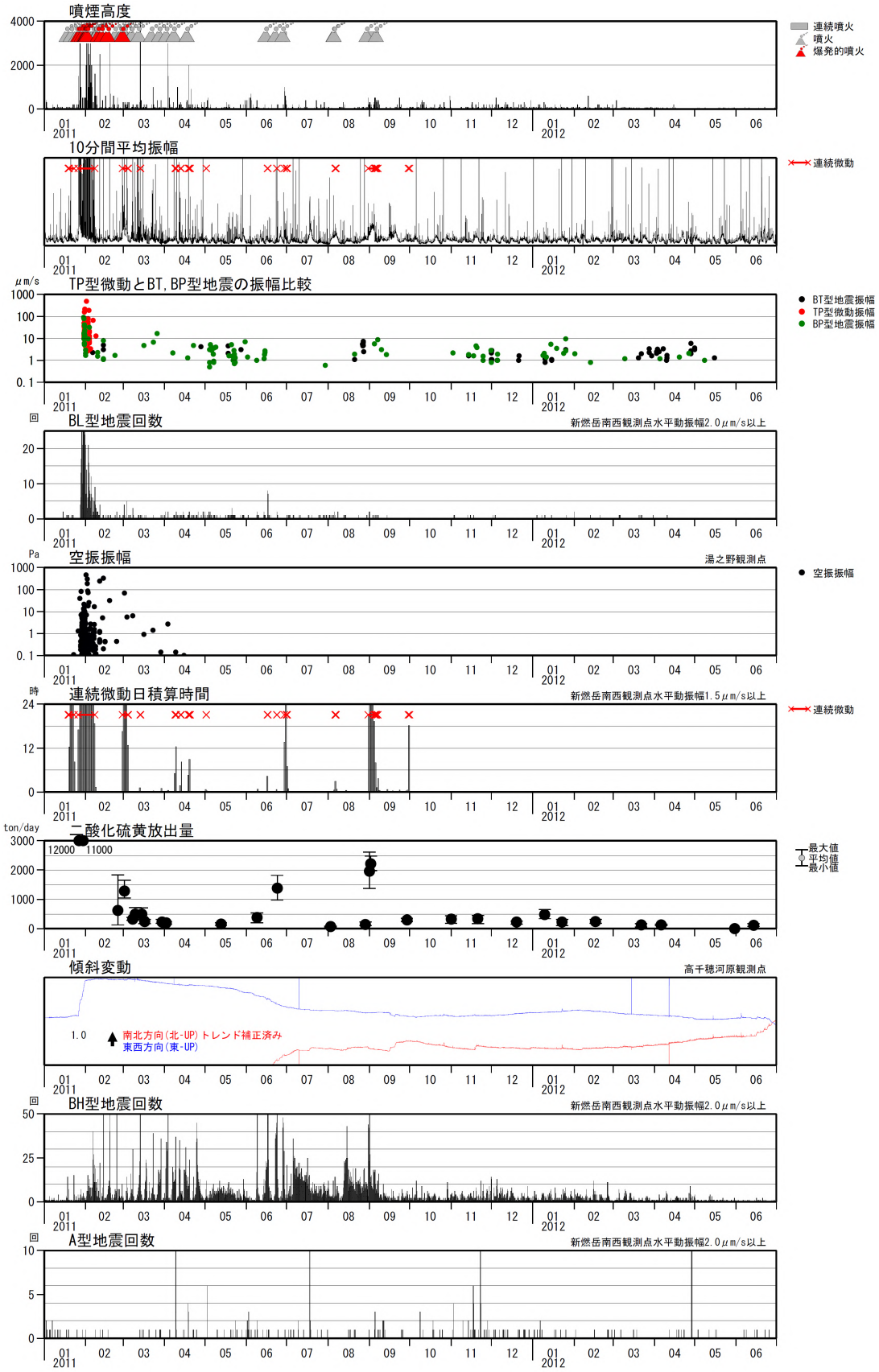


Figure 87-12 Shinmoedake activity (January 1, 2011 to June 30, 2012).

① Volcanic plume height, ② Average amplitude per 10 minutes, ③ Comparison of TP-type tremor and BT and BP-type earthquake amplitudes, ④ Number of BL-type earthquakes, ⑤ Infrasonic wave amplitudes, ⑥ Duration of tremors per day, ⑦ Amount of sulfur dioxide emitted, ⑧ Change in tilt, ⑨ Number of BH-type earthquakes, ⑩ Number of A-type earthquakes

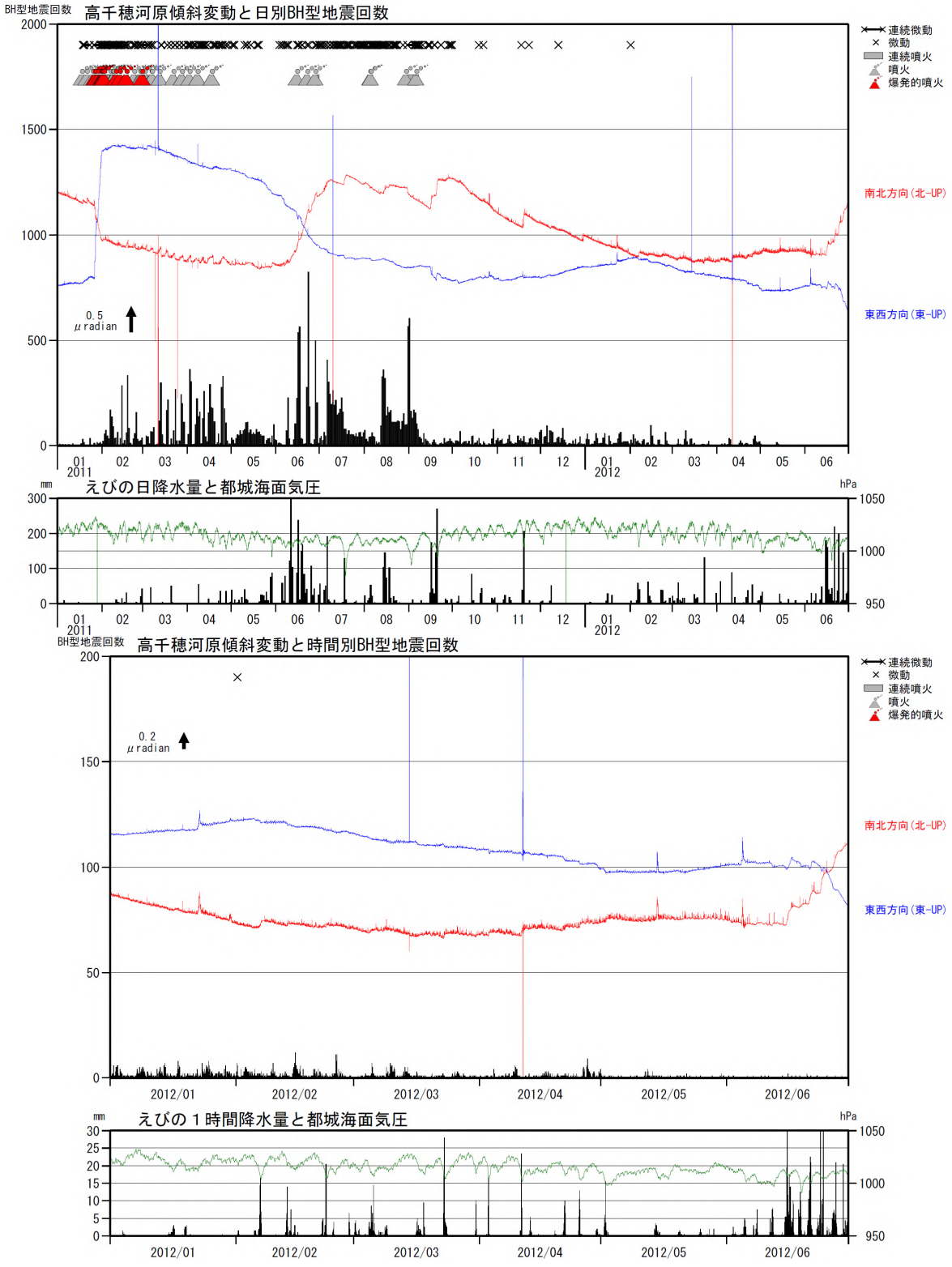


Figure 87-13 Tilt-changes in Takachihogawara (January 1, 2011, to June 30, 2012).

① Tilt-changes and number of BH-type earthquakes per day at Takachihogawara

② Daily rainfall at Ebino and Miyakonojo sea-level air pressure

③ Tilt-changes and number of BH-type earthquakes per time of day at Takachihogawara

④ Hourly rainfall at Ebino and sea-level air pressure at Miyakonojo

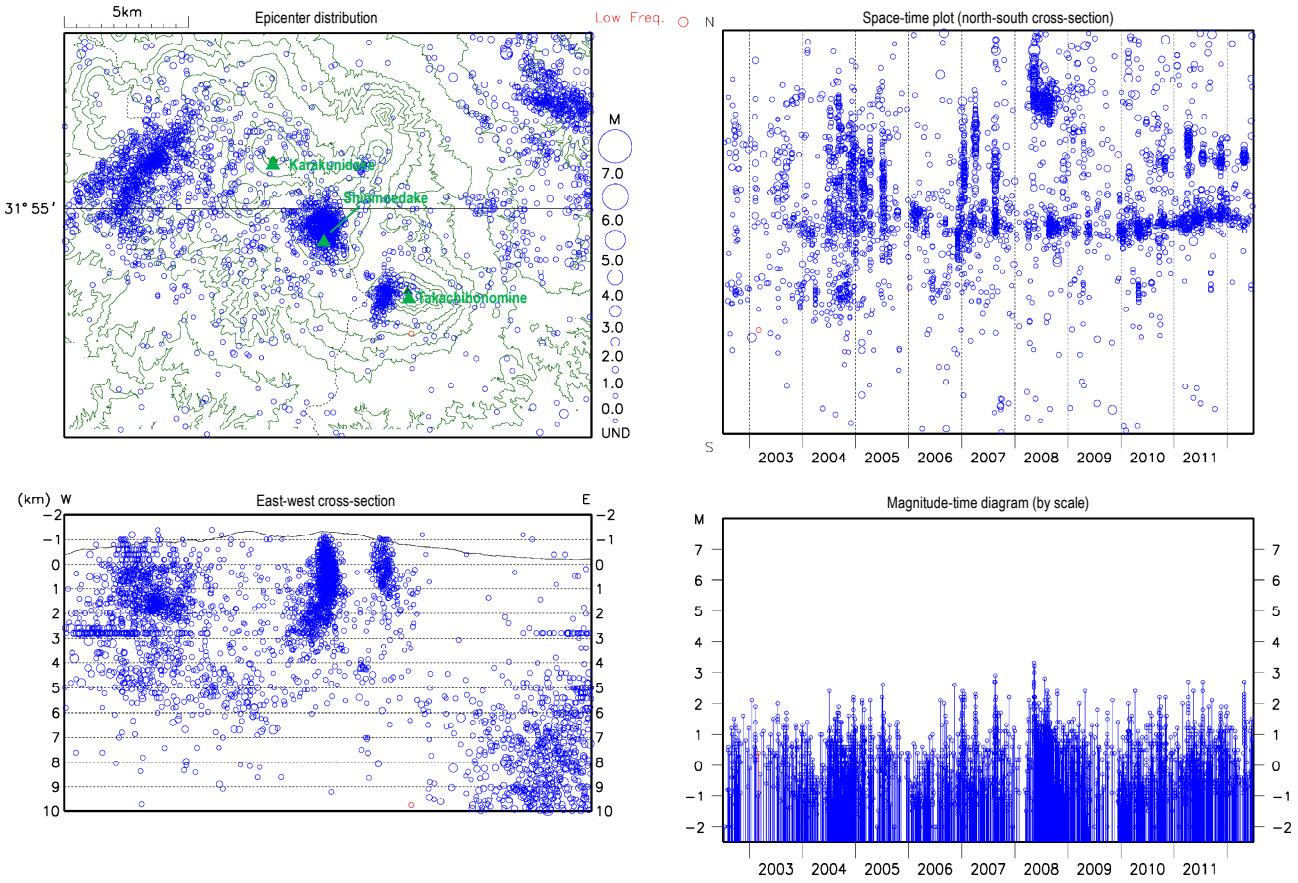


Figure 87-14 Distribution of volcanic earthquakes at Kirishimayama (2002 to June 30, 2012).

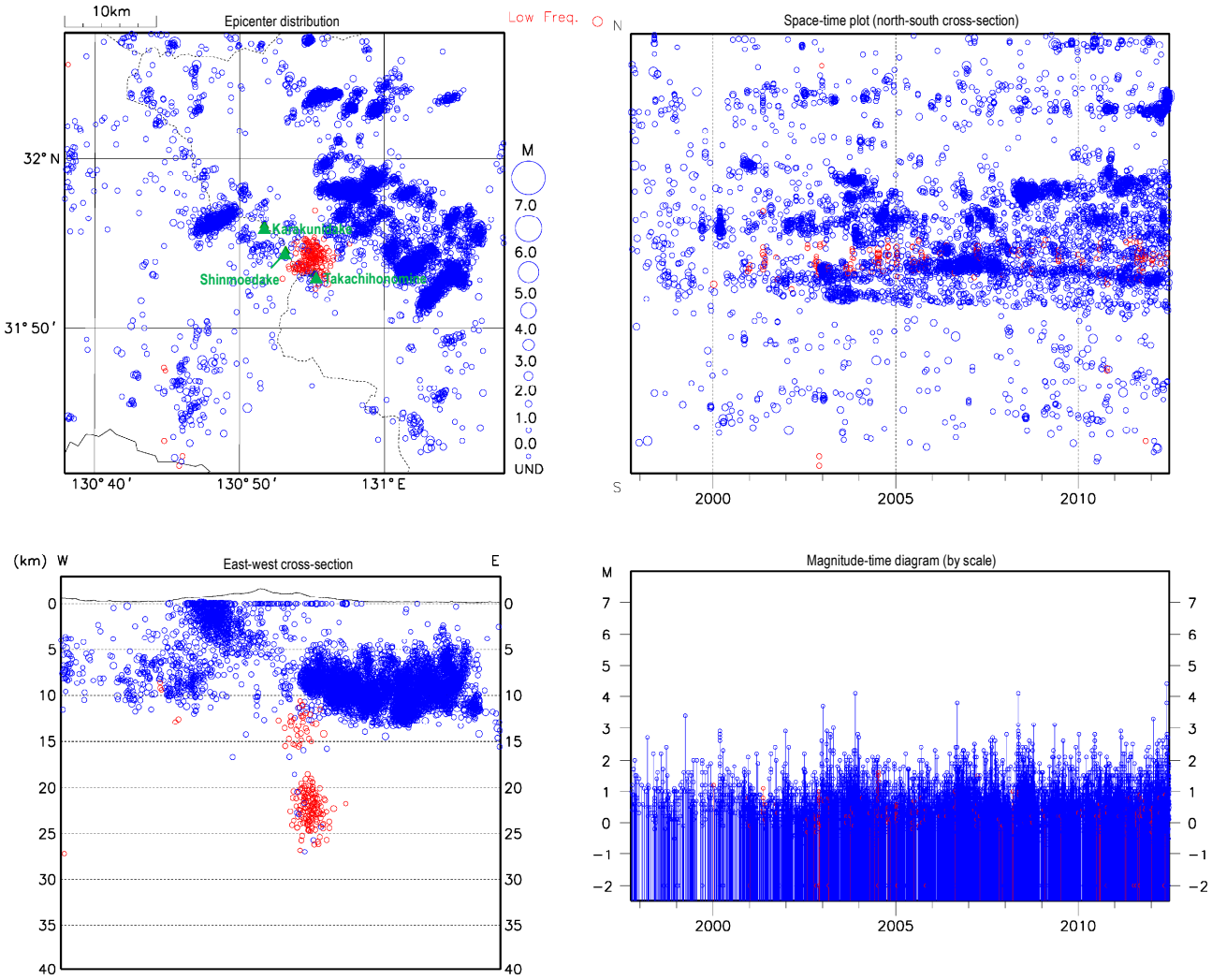


Figure 87-15 Activity of shallow VT earthquakes (blue circles) and deep low-frequency earthquakes (red circles) observed by a regional seismometer network (October 1, 1997, to June 30, 2012).Epicenter distribution (upper left), space-time plot(N-S cross-section) (upper right), E-W cross-section (lower left) and magnitude-time diagram (lower right).

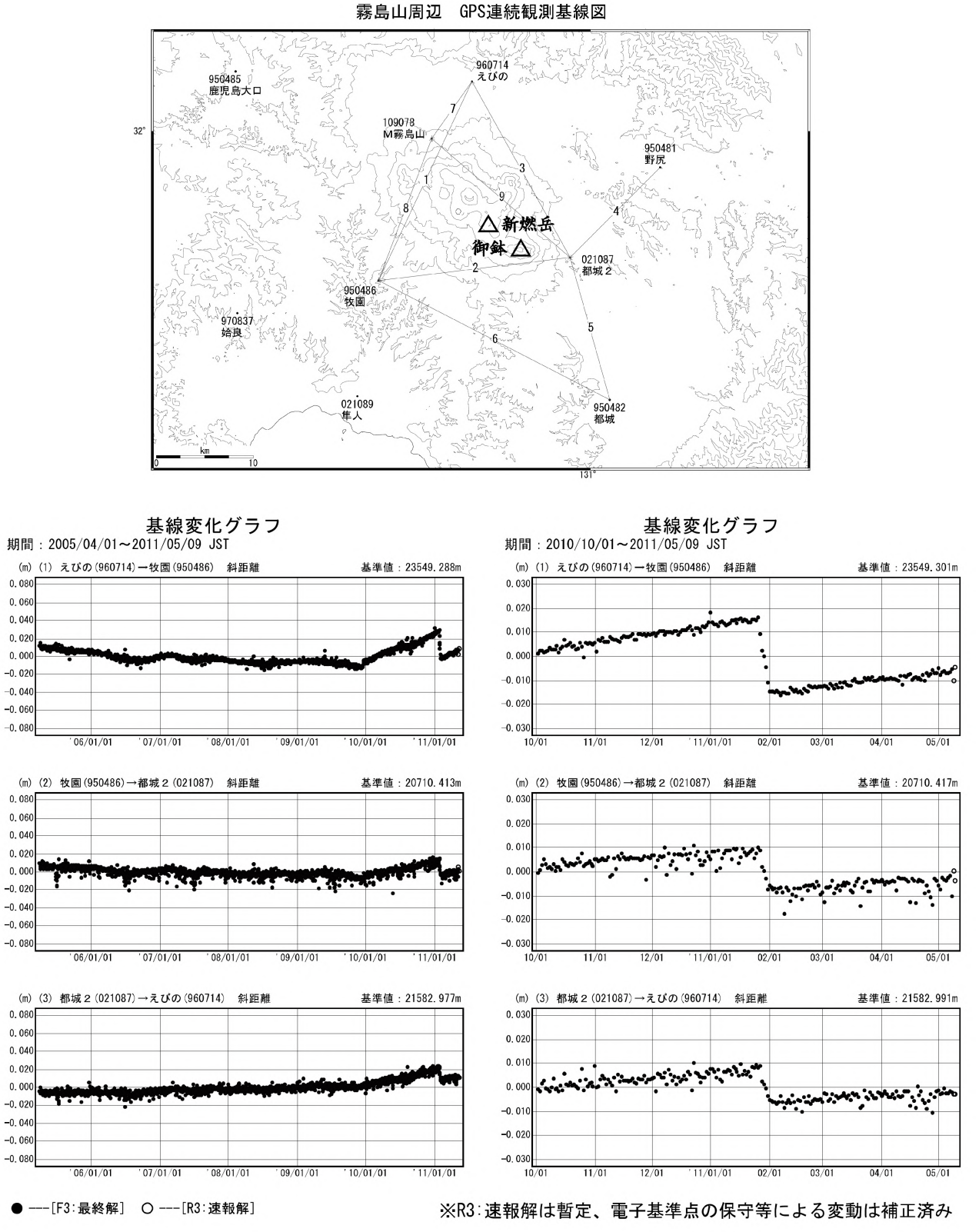


Figure 87-16 Baselines around Kirishimayama by GPS analysis (Geospatial Information Authority of Japan, 2013).

(Baseline length: Left: April 2005, to May 2011. Right: October 2010, to May 2011)

Baseline extension indicated inflation for approximately 1 year before the January, 2011, eruption, sudden shortening after the eruption on January 26 2011, baseline growth, indicating resumed inflation after February 1, and little to no change in baseline length beginning in roughly December.

Beginning in roughly June, 2012, slight contraction occurred for (1) "Ebino" - "Makizono" baseline after roughly May, 2012, (2) "Makizono" - "Miyakonojo 2", and (8) "Makizono" - "M Kirishimayama A".

Information on Disaster Prevention

①Hazard Map

・"Kirishimayama Volcano Disaster Prevention Map"
Kirishima Rim Conference (Miyakonojo, Takaharu, Kobayashi, Ebino, Yusui, Kirishima, Soo)
Created March, 2009

Miyakonojo URL:
http://cms.city.miyakonojo.miyazaki.jp/display.php?cont=120912090640

Takaharu URL:
http://www.town.takaharu.lg.jp/modules/contents02/index.php?content_id=9

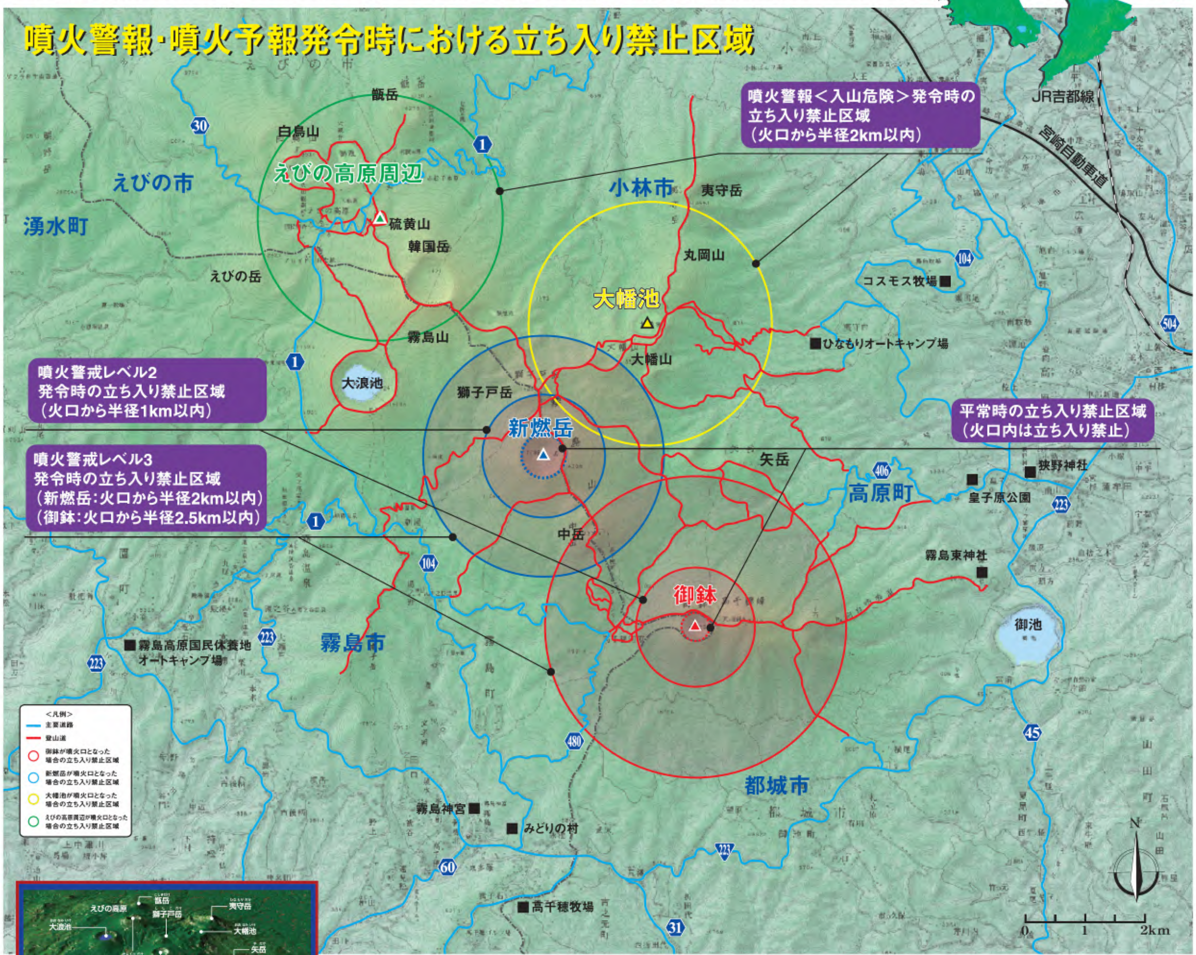
Kobayashi URL:
http://www.city.kobayashi.lg.jp/soumu/bousai1.jsp

Kirishima URL:
http://www.city-kirishima.jp/modules/page003/index.php?id=86

霧島火山防災マップ

このマップは、今後噴火口となる可能性の高い4箇所（「新燃岳」「御鉢」「えびの高原周辺」「大幡池」）において、火山活動が活発になった場合の立ち入り禁止区域の範囲を示したものです。噴火警報・噴火予報の発表に応じて、登山道の入口などから通行規制がかかる場合がありますので、立ち入り禁止区域・通行規制区域内には絶対に入らないで下さい。

噴火警報・噴火予報発令時における立ち入り禁止区域

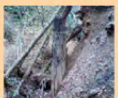


霧島山周辺に点在する噴火の歴史

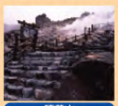
霧島山は、比較的小規模な火山が集まってできた火山群です。現在見られる火山のほとんどは、約30万年前に加久藤カルデラで発生した大規模火砕流（加久藤火砕流）の後に形成されたものです。霧島山は、たくさんの噴火活動が歴史記録に残されている、日本でも活動的な火山のひとつです。

御池
御池は、4200年前の爆発的な噴火によって作られた、霧島火山では最大・最深の火口湖です。その噴火による軽石は、都城市街地でも1mくらいの厚さで堆積しています。御池の噴火は、知られている霧島火山の爆発的噴火の中では、最も規模の大きいものでした。

高千穂峰
秀麗な姿を見せる高千穂峰は、複雑な形成史を持つ複成火山です。尖った山頂部は溶岩ドームでできています。後にその西側で活動を始めた御鉢火山の噴火の影響のため、山頂部から西側斜面にかけては植生のない裸地となっています。



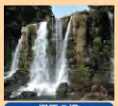
炭化木
新燃岳の1716～1717年の噴火による火砕流にのみ込まれて立木のまま炭になった木です。周辺には、ひとかかえ以上もある大きな炭化木がたくさん見られ、この噴火の前には、ここに豊かな森が広がっていたことがわかります。



硫黄山
江戸時代の1768年にできたと考えられている硫黄山は、霧島火山の中では最も若い火山体です。山体の周辺には、大きな火山弾がいくつも見られます。その浅い火口の中には、昭和30年代頃まで稼動していた、硫黄採掘のための煙道跡が残っています。

栗野岳
栗野岳は、現在見られる霧島火山の中では、比較的古い時代に活動した火山です。火山体は浸食が進み、明瞭な火口跡も見られませんが、その中腹には八幡地獄と呼ばれる噴気地帯があり、現在も盛んに噴気を上げています。

韓国岳
霧島火山の最高峰韓国岳は、約15000年前の噴火によって形成されました。その時の軽石は遠く宮崎市内でも観察することができます。韓国岳の形成後、南東側と北西側で爆発が起こり、その山体の一部が壊されました。このときの南東側の火口跡が琵琶池です。



桐原の滝
桐原の滝は、霧島火山の北西側にある加久藤カルデラから約30万年前に噴出した大規模火砕流堆積物にかかる滝です。堅く溶結した凝灰岩が川の浸食に抗して段差ができたもので、この下流にある関ノ尾滝や甌穴群も同じ溶結凝灰岩でできています。

歴史時代の主な噴火活動

噴火年	噴火地点	噴火現象	災害状況
788年	御鉢	溶岩流、火砕流	
1235年	御鉢	噴石、火砕流、溶岩流	
1566年	御鉢	噴石	死者多数
1716−1717年	新燃岳	噴石、火砕流、火山泥流	死傷者60名以上 寺社、家屋焼失
1768年	硫黄山	溶岩流	
1895−1900年	御鉢	噴石	死者7名
1923年	御鉢	噴石	死者1名
1959年	新燃岳	火山灰、水蒸気爆発	
1991年	新燃岳	火山灰	
2008年	新燃岳	火山灰	

噴火警報・噴火予報とは

噴火警戒レベル導入火山＜新燃岳・御鉢＞では、5段階のレベル（キーワード）で、噴火警戒レベル未導入火山＜えびの高原周辺・大幡池＞では、4種類のキーワードで、気象庁より噴火警報・予報として発表されます。

予報・警報の名称	予報・警報の略称	新燃岳・御鉢の場合	えびの高原周辺・大幡池の場合
噴火警報	噴火警報	レベル5 避難	居住地域厳重警戒
		レベル4 避難準備	
	火口周辺警報	レベル3 入山規制	入山危険
		レベル2 火口周辺規制	火口周辺危険
噴火予報	噴火予報	レベル1 平常	平　常

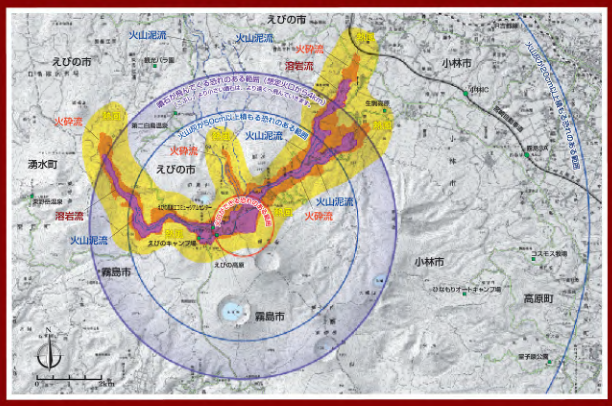
火山活動が活発化し、
避難が必要な場合は、各自治体より
避難情報の伝達がなされます。
指定された避難所へ避難してください。

環霧島会議（都城市、高原町、小林市、えびの市、湧水町、霧島市、曽於市）は、霧島火山防災対策をすすめ、安全・安心な地域づくりを推進するとともに、霧島ジオパーク推進連絡協議会を設立し、世界ジオパーク認定を目指しています。

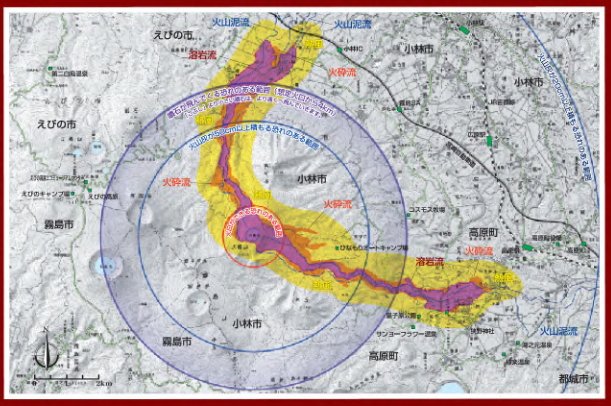
規模の大きな噴火が起こった場合の災害区域予測図

この予測図は、霧島火山防災検討委員会（平成19年度）による火山災害予測図検討分科会の成果に基づいて作成したものである。

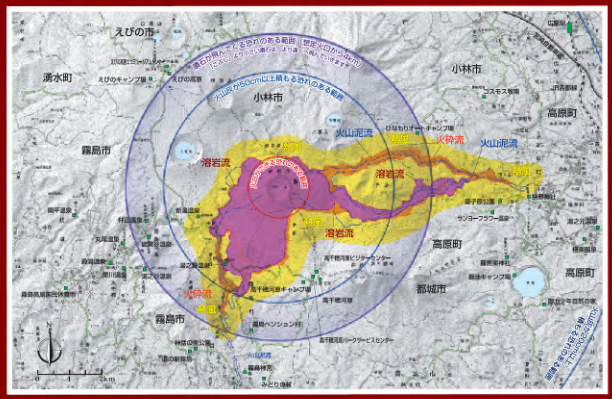
えびの高原周辺が火口となった場合



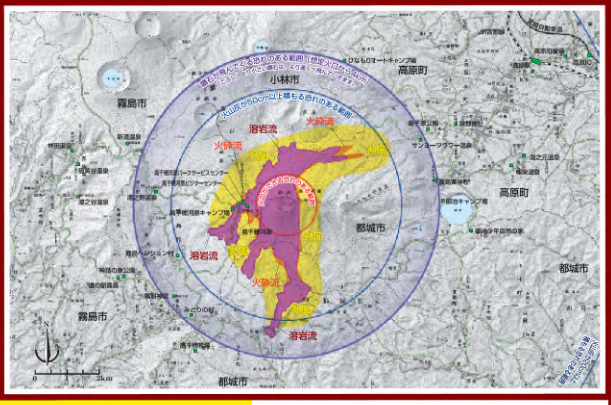
大幡池が火口となった場合



新燃岳が火口となった場合



御鉢が火口となった場合



「この地図の作成にあたっては、国土地理院の了承を得て、同院発行の1万分の1地形図、数値地図25000（地図画像）及び数値地図50mメッシュ（標高）を使用したものである。（承認番号　平20東使、第16号）」

降灰の可能性の高い範囲は、霧島上空の風が年間を通し西から吹いているため、火口の東側になります。ただし風向きで、どの方向にも降灰する可能性があり、全方向について降灰した場合の厚さを示しています。

※図示した噴火の規模や現象は、過去の噴火から想定したもので、気象庁の発表する「噴火警戒レベル」について示したものではありません。

※火山灰が10cm以上積もる地域では、土石流が発生しやすくなります。

主要な観光・公共施設
主要な国道・県道等
高速道路（IC名等）
鉄道路（駅名）

噴火で起きる現象

噴　石

噴火によって岩石が、火口から勢い良く上空に飛び出し、高速で地上に落下したものを噴石といいます。噴石は、どの方向にも飛んでいき、火口に近いほど量が多く、サイズも大きくなります。大きなものだと屋根に穴があき、熱いので火事になることもあります。

火砕流・熱風

高温の溶岩片、火山灰、火山ガスなどが混ざりあって、周囲に熱風を伴いながら斜面を高速に流下する現象を火砕流といいます。高温で車よりも早く、全ての建物や動植物に破壊的な被害を与える大変危険な現象です。火砕流に遭遇すると逃げることはできません。

溶岩流

マグマが火口から流出し、斜面を流下する現象を溶岩流といいます。低い場所を選んで、通り道にある建物や樹木は焼かれ、火事になることがあります。溶岩流の速度は遅いため、落ち着いて避難することができます。

降　灰

噴火によって火砕物が火口から巻き上げられ、地上に降下したものを降灰（降下火砕物）といいます。上空に風に乗って広範囲に拡散します。また、大量に降灰が堆積した場合には、農作物の被害や車が走れなくなるなど、生活に大きな影響を与えます。

火山泥流

不動池、六観音御池、大幡池、新燃岳のように、火口湖で噴火が起きると火口湖が決壊し、大量の水が火山灰、石や砂を巻き込みながら、高速で流れ下ることがあり、これを火口湖決壊型火山泥流といいます。流れは勢いが強く、破壊力も大きいため広範囲に被害が及ぶことがあります。

いざというときの心得

平常時（噴火警戒レベル1）のときには

- 霧島山の噴火の歴史や噴火の特徴について知っておきましょう。
- 家族で避難場所や避難路について、話し合っておきましょう。
- 避難時に危険な箇所を、事前に把握しておきましょう。
- 非常持ち出し品の準備をしておきましょう。

噴火警戒レベル2～3（火口周辺警報）のときには

- テレビやラジオ、防災無線などを聞いて、正しい情報を得ましょう。
- デマには惑わされないようにしましょう。
- 避難のための準備を進めましょう。
- 電気・ガスの元栓を確認しましょう。

噴火警戒レベル4～5（噴火警報）のときには

- 自治体からの避難勧告・避難指示に従いましょう。
- お年寄りや病人など、手助けが必要な方々の避難を助けましょう。
- 慌てずに落ち着いて行動しましょう。
- 戸締まり、貴重品を忘れないようにしましょう。
- 落ち着いたら親戚や知人へ避難場所などを伝えましょう。

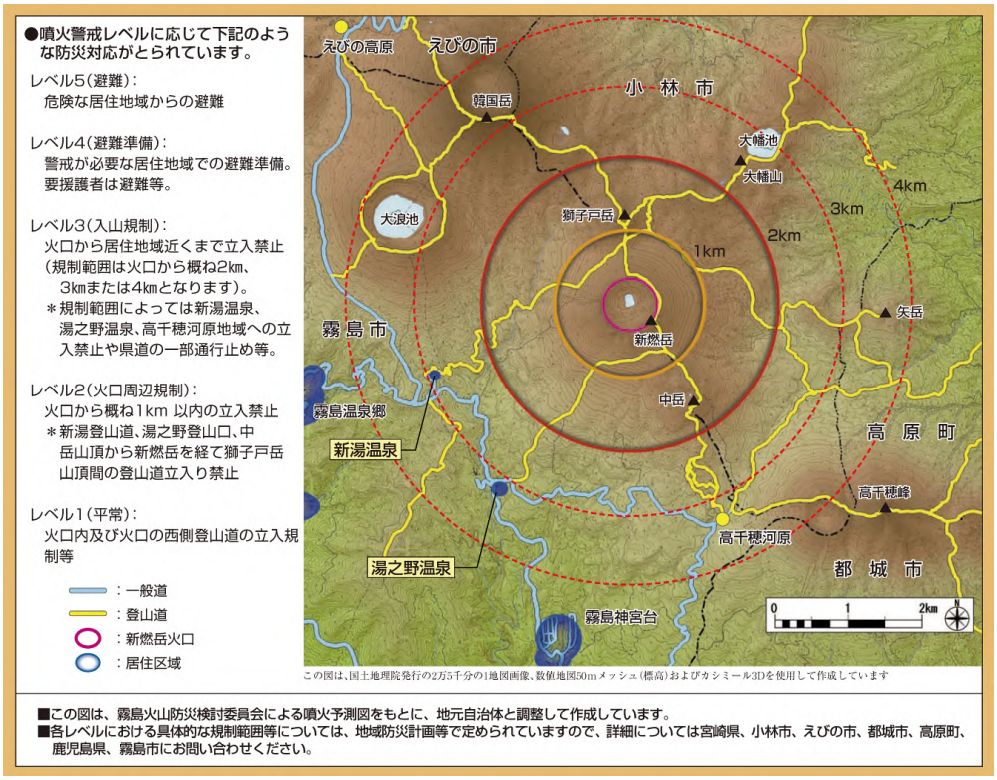
お問い合わせ・緊急時の連絡先　環霧島会議

都城市役所	高原町役場	小林市役所	えびの市役所	湧水町役場	霧島市役所	曽於市役所
0986-23-2111(代)	0984-42-2111(代)	0984-23-1111(代)	0984-35-1111(代)	0995-74-3111(代)	0995-45-5111(代)	0986-76-1111(代)

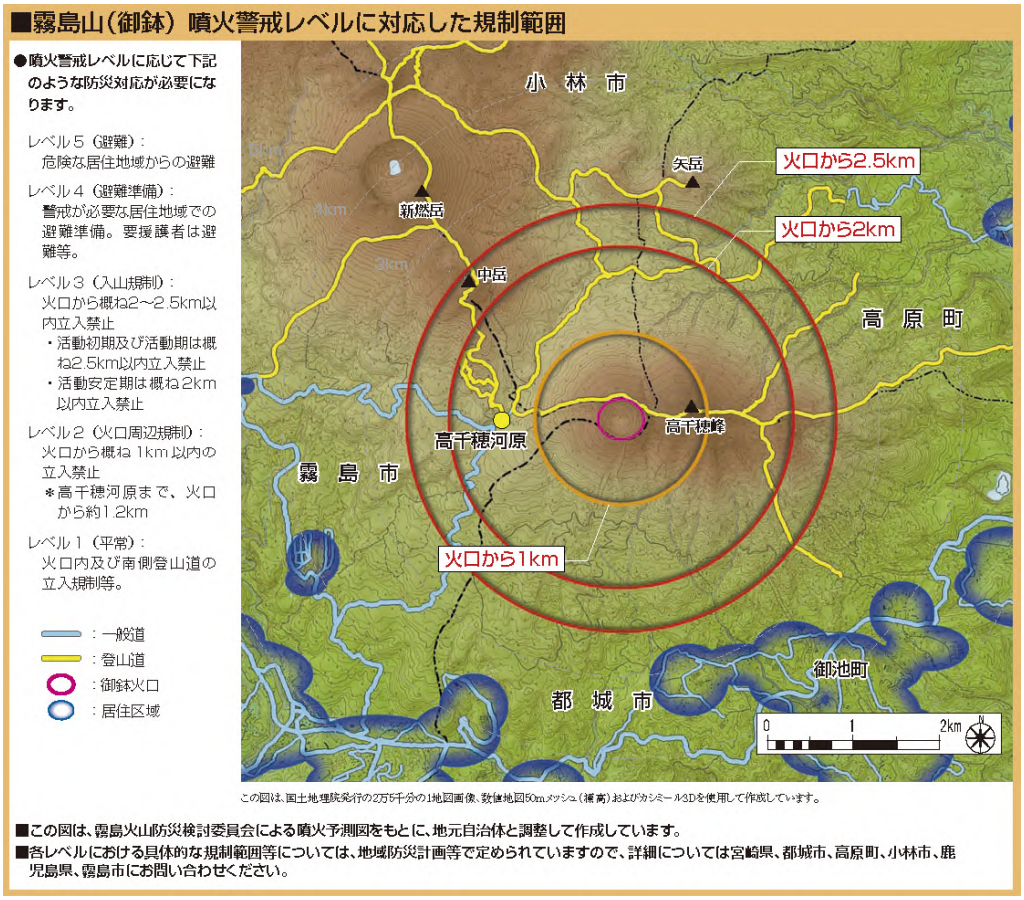
平成21年3月発行

②Volcanic Alert Levels

Kirishimayama (Shinmoedake) (Used since December 1, 2007 (Heisei 19), Revised in January, 2011)



Kirishimayama (Ohachi) (Used since December 1, 2007 (Heisei 19))



Volcanic Alert Levels for the Kirishimayama Volcano (Shinmoedake) (Valid as of December, 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**	●Eruption or imminent eruption, with volcanic blocks, pyroclastic flow, and/or lava flow reaching residential areas. Past Examples 1716 to 1717 (Kyoho Eruption) :Lava flow extended approximately 3.5 km.
		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.**	●Increased eruptive activity, high number of felt-earthquakes, and/or prominent crustal deformation, etc. result in possibility of eruption discharging volcanic blocks, pyroclastic flow, and/or lava flow reaching residential areas. Past Examples No observed examples ●Possibility of pyroclastic flow reaching more than approximately 3 km from the crater. ●Possibility of volcanic blocks being ejected more than approximately 4 km from the crater. Past Examples No observed examples
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 activity 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.**	●Possibility of pyroclastic flow within a distance of approximately 3 km from the crater. Past Examples No clear records ●Scattering of volcanic blocks within a distance of approximately 4 km from the crater. Past Examples January, 2011: An eruption on January 26 and January 27 ejected a large amount of pumice and volcanic ash. February, 2011: Volcanic blocks were scattered up to approximately 3.2 km from the crater. February, 1959: A fissure eruption occurred on the west summit flank, scattering volcanic blocks approximately 1 to 2 km. Caution zone extends approximately 2, 3, or 4 km from the crater, depending on pyroclastic flow arrival and volcanic block scattering conditions.
	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 activity as normal. Access to crater area restricted, etc.**	●Small eruption, with scattering of volcanic blocks within a distance of approximately 1km from the crater. Past Examples July, 2010: Volcanic blocks were scattered around the crater area. ●Possibility of small eruption. Past Examples November, 1991 to February, 1992: The number of volcanic earthquakes and volcanic tremors increased, and a very small eruption occurred.
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.**	●Little or no volcanic activity. Possibility of discharge of volcanic ash which may affect summit crater interior.

* The core member conference of the Kirishima Volcano Disaster Prevention Coordinating Committee considers eruption imminence to be "pyroclastic flows exceeding roughly 3 km from the crater" and/or "volcanic blocks scattered over roughly 4 km from the crater".

Note 1)The volcanic blocks mentioned in this table refer mainly to blocks large enough that their trajectories are not affected by wind. Lapilli carried by the wind may fall far away downwind.

Volcanic Alert Levels for the Kirishimayama Volcano (Ohachi) (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**	●Eruption or imminent eruption, with volcanic blocks and/or lava flow reaching residential areas. 1235 Example January 25: Pyroclastic flow extended approximately 3 km from the crater. ●Lava flow or imminent lava flow reaching residential areas. Past Examples January 25, 1235: Lava flow extended approximately 5 km from the crater.
		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.**	●Increased eruptive activity, high number of felt-earthquakes, and/or prominent crustal deformation, etc. result in possibility of eruption discharging volcanic blocks, pyroclastic flow, and/or lava flow reaching 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 to areas near residential areas (entering area is life threatening).**	**Residents can go about daily activity 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.**	●Possibility of pyroclastic flow within a distance of approximately 2.5 km from the crater. Past Examples No clear records ●Scattering of volcanic blocks within a distance of approximately 2.5 km from the crater. Past Examples February 16, 1900: Volcanic blocks were scattered approximately 1.8 km. October, 1895: Volcanic blocks were scattered approximately 2 km.
	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 activity as normal. Access to crater area restricted, etc.**	●Small eruption, with scattering of volcanic blocks within a distance of approximately 1 km from the crater. Past Examples July, 1923: Eruption March, 1896: Eruption ●Possibility of small eruption. Past Examples December, 2003: Volcanic tremors and high level of fumarolic activity. July and October, 1899: Black volcanic plume emission.
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.**	●Little or no volcanic activity. Possibility of discharge which may affect summit crater interior.

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

Social Circumstances

①Populations

・Miyazaki Prefecture

Miyakonojo City: 169,602 (according to 2010 national census)

Takaharu Town: 10,000 (according to 2010 national census)

Kobayashi City: 48,270 (according to 2010 national census)

Ebino City: 21,606 (according to 2010 national census)

・Kagoshima Prefecture

Kirishima City: 127,880 (as of 2011, according to Kirishima website)

Yusui Town: 10,973 (as of November 1, 2011, according to Yusui website)

Soo City: 40,414 (as of December 1, 2011, according to Soo website)

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

Kirishima-Kinkowan National Park (Kirishima Area)

・The Kirishimayama area was certified as a Japanese Geopark in September, 2010.

Number of mountain-climbers per year: 179,825 (according to six infrared counters installed by the Ministry of the Environment at mountain trail entrances. To be used as a reference value, as there are some entrances without counters, as well as there being a margin of error)

(2009 Ministry of the Environment Kyushu Regional Environment Office materials)

Breakdown: Karakunidake: 65,400, Takachihonomine: 29,800, Onamiike: 26,500, Nakadake: 22,200, Miike ring route: 11,000, Ebino Plateau lake nature exploration route: 24,600 (8 months, starting from August, 2009) (from Ministry of the Environment website)

③Facilities

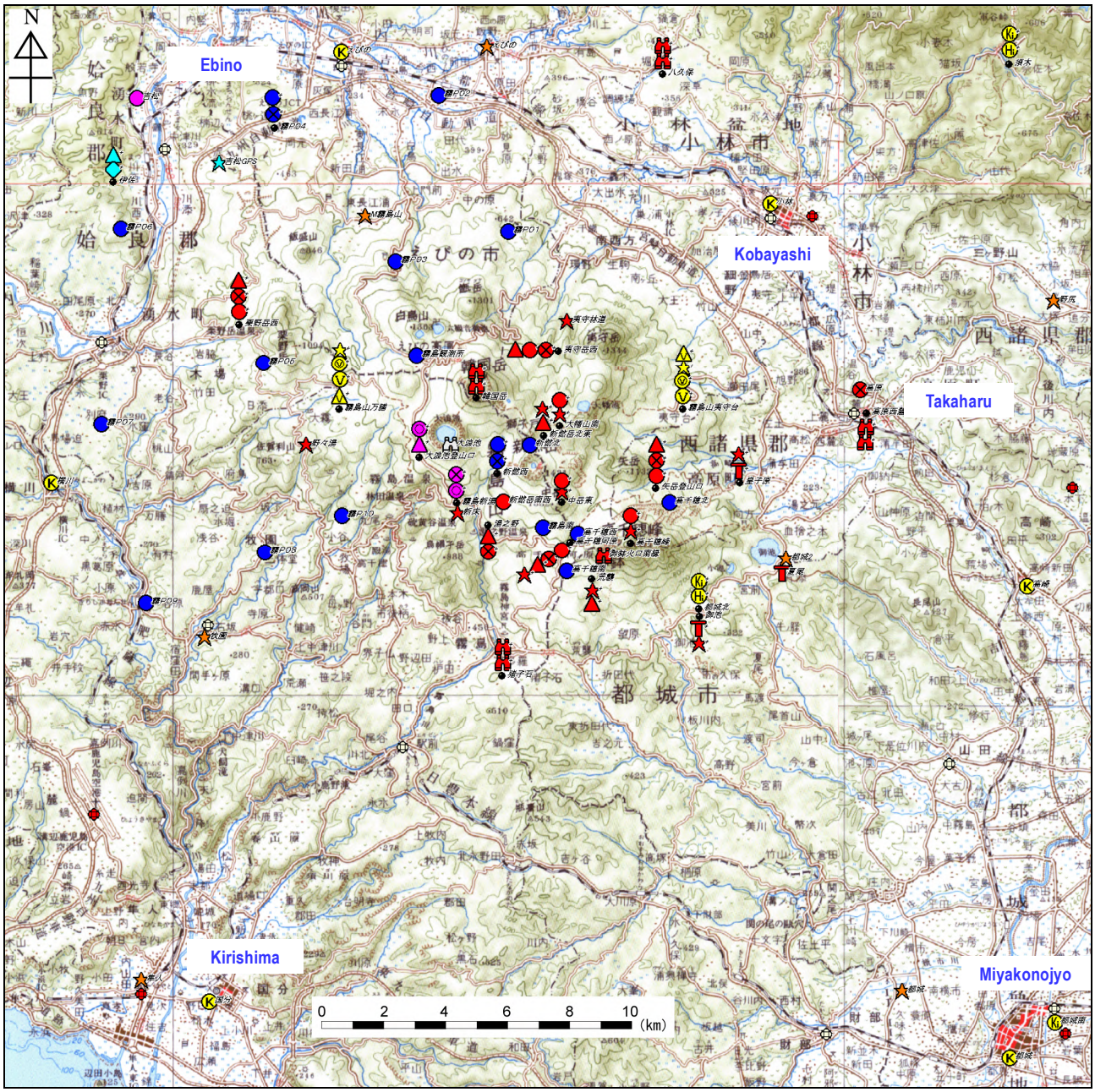
Ministry of the Environment Takachihogawara Visitor Center (2583-12, Kirishima Taguchi, Kirishima City, Kagoshima Prefecture, 0995-57-2505)

Ministry of the Environment Ebino Eco Museum Center (1495-5, Suenaga, Ebino City, Miyazaki Prefecture, 0984-33-3002)

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 (Yatsushiro, Nobeoka, Kagoshima and Miyazaki) published by the Geospatial Information Authority of Japan were used.

Legend

(JMA)
- seismometer(SP)
- GPS
- tiltmeter
- infrasonic microphone
- visual camera
- ash gauge
- seismic intensity meter

(GSI)
- GPS

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

(ERI)
- seismometer(SP)
- infrasonic microphone

(DPRI)
- GPS
- tiltmeter
- strainmeter

(Kyushu Univ.)
- seismometer (broadband)
- tiltmeter
- infrasonic microphone

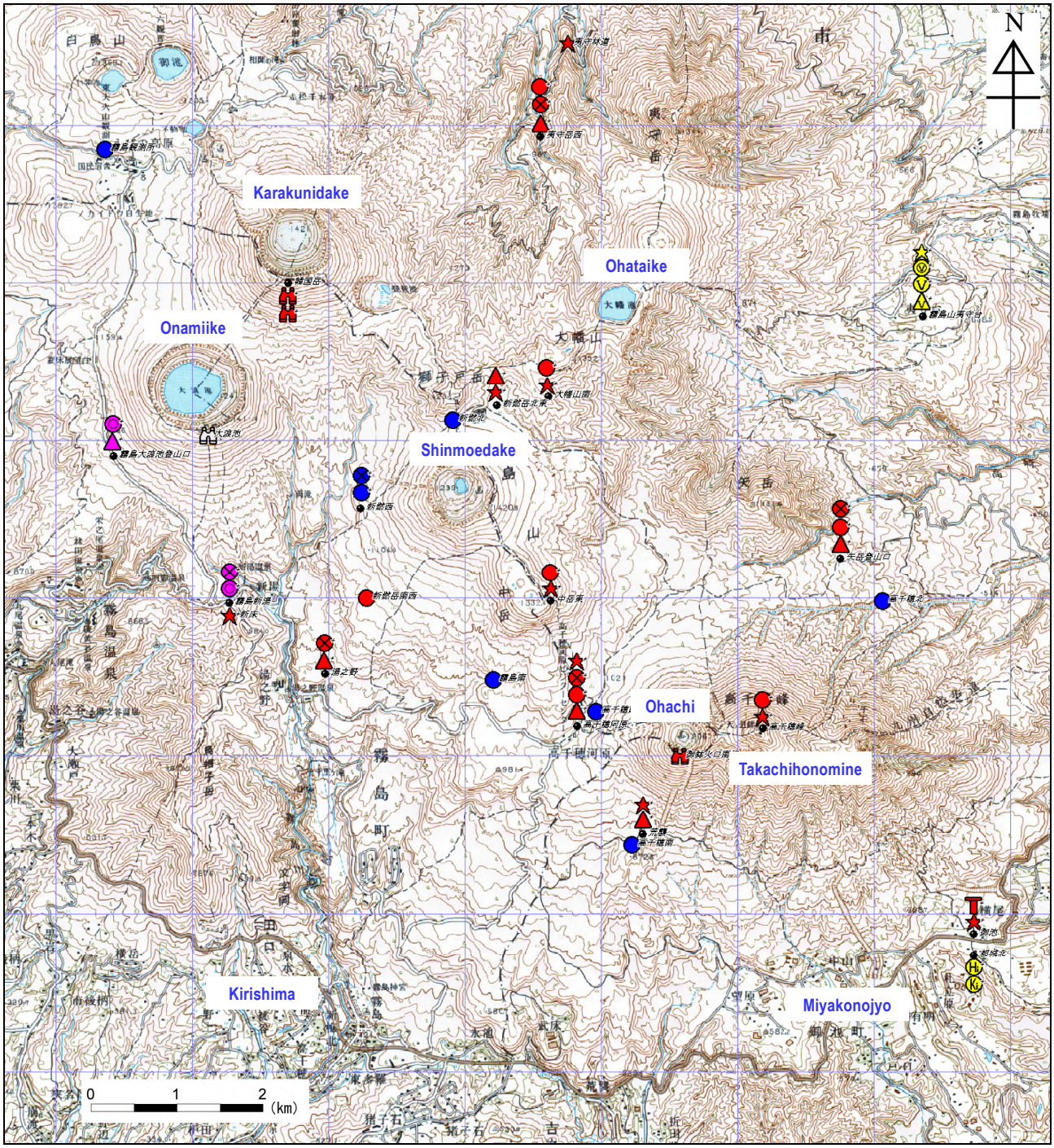
(Kagoshima Univ.)
- seismometer(SP)

(Kagoshima Pref.)
- visual camera

(Municipalities)
- seismic intensity meter

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 map (Kirishimayama) published by the Geospatial Information Authority of Japan was used.

Legend

(JMA)	(NIED)	(ERI)	(Kyushu Univ.)
seismometer(SP)	V-net(SP)	seismometer(SP)	seismometer (broadband)
GPS	V-net(broadband)	infrasonic microphone	tiltmeter
tiltmeter	V-net(tiltmeter)		infrasonic microphone
infrasonic microphone	Hi-net		
visual camera	KiK-net		(Kagoshima Pref.)
ash gauge	GPS		visual camera

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