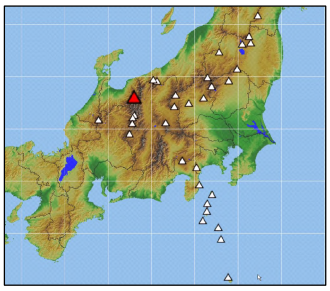
49. Midagahara



Latitude: 36°34'16" N, Longitude: 137°35'23" E, Elevation: 2,621 m (Kunimidake)
(Triangulation Point - Oyokote)

Murododaira, at Upper Part of Midagahara tken from the summit of Oyama on September 15, 2011 by the Japan Meteorological Agency

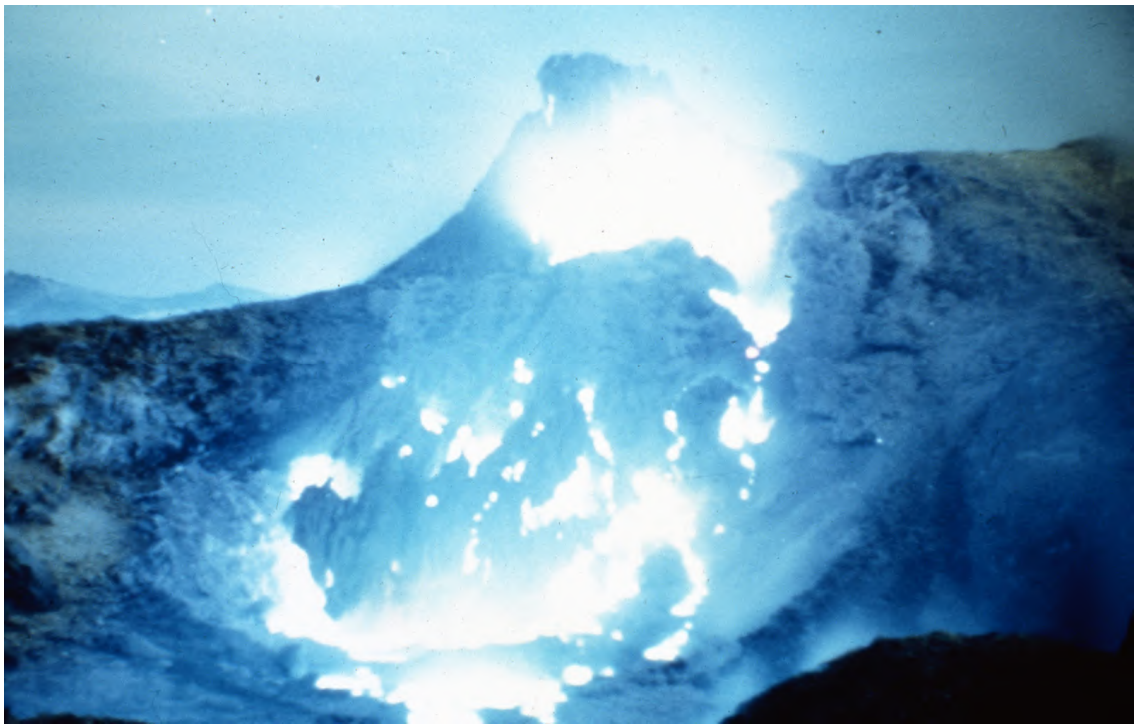
Summary

Midagahara is an andesite-dacite stratovolcano which formed by filling in shallow portions of the steep mountainous area near Tateyama. The summit of the volcano is lost due to erosion. Midagahara, and Goshikigahara form plateaus made up mainly of pyroclastic flow deposits. Magmatic eruptions ended several tens of thousands of years ago, but later phreatic explosions formed many explosion craters to the east of Midagahara, and a high fumarolic activity exists. The SiO_2 content of the andesite and dacite is between 57.4 and 62.9 wt %. The volcano is also known as the Tateyama volcano, but the basement rock of Tateyama mountain range is composed of granite.

Photos

Jigokudani taken from the northeast side on September 15, 2011 by the Japan Meteorological Agency

Jigokudani Crater in the west of Jigokudani on October 31, 2009. Courtesy of the Tateyama Caldera Sabo Museum.



Burning sulfur in Kajiya Jigoku on August 8, 1973. Courtesy of Matsuo Taguchi.

Burning sulfur lava flow in Kajiya Jigoku on May 6, 2010. Courtesy of Shigeru Shibuya.

Figure 49-1 Photo of Jigokudani taken from Chigaki, Tateyama Town on December 6, 2006, courtesy of the Tateyama Caldera Sabo Museum.

Topography around the Crater

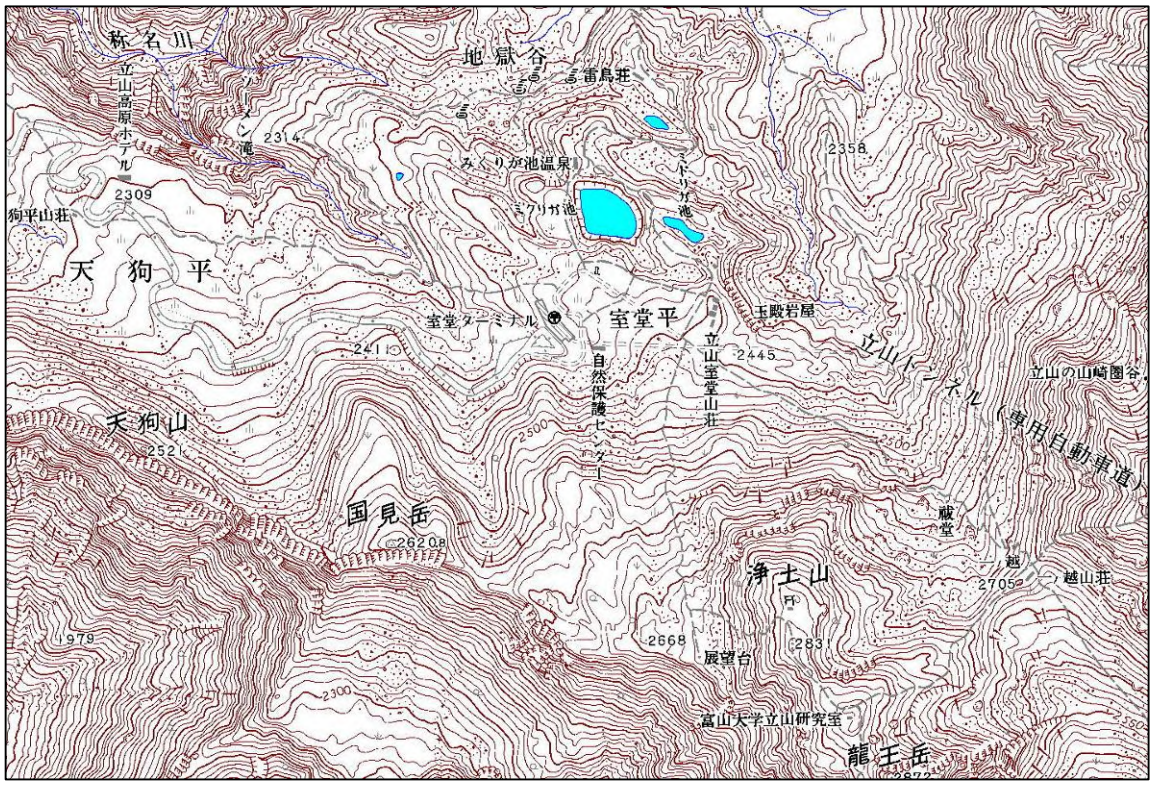


Figure 49-2 Topography of Jigokudani and the Murododaira area.

The 1:25,000 Scale Topographic Map (Tateyama) published by the Geospatial Information Authority of Japan was used to create this map.

Red Relief Image Map

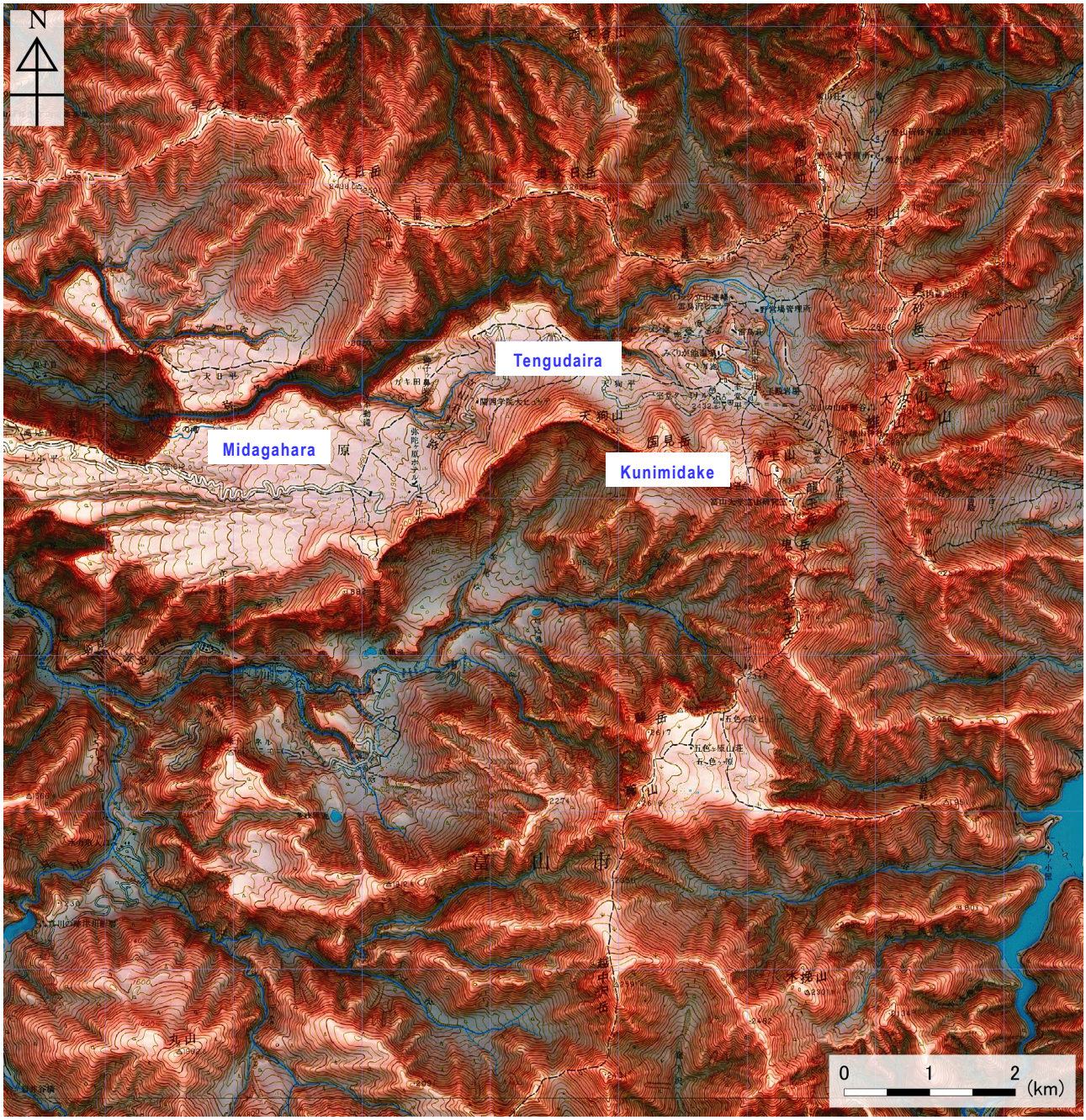


Figure 49-3 Topography of Midagahara.

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

History of Eruption Activity

- Eruption Activity in the Past 10,000 Years

The volcano has been in a period of dormancy for the past 40,000 years, and no magma has been produced. The volcanic activity mainly consisted of phreatic explosions in explosion craters such as Jigokudani, and fumaroles and hot spring activity in Jigokudani.

In addition to eruptive activity at Jigokudani during the Edo period (the 1600s to the 1800s), deposits from several phreatic eruptions were identified.

Eruption Age	Eruption site	Eruption Style	Main Phenomena
10.3←→8.3 ka	Jigokudani	Phreatic eruption	Tephra fall.
10.3←→8.3 ka	Jigokudani	Phreatic eruption	Tephra fall.
7.3←→3.1 ka	Northern basin of Jigokudani	Phreatic eruption	Tephra fall.
3.4←→2.4 ka	Southern basin of Jigokudani	Phreatic eruption	Tephra fall.

* Eruption ages, sites, and styles taken from the Active Volcano Database of Japan, AIST, latest version. All years are noted in Western date notation. "ka" means 1000 years before the year 2000.
A←→B: Possible range in which eruption events took place.

・Historical Activity

Molten sulfur combustion and molten sulfur flows are confirmed to have occurred several times in Jigokudani from the mid-1970s to the late 1980s, and in 2010 (Kouno, 1988, Masubuchi, 2012).

Eruption Age	Phenomenon	Activity Sequence, Damages, etc.
1836 (Tenpo 7)	Small-scale: Phreatic eruption	July. The eruptive activity occurred at Jigokudani. (VEI 1)
1858 (Ansei 5)	(Landslide → lahar)	"Otombi Landslide". The landslide occurred at Otombiyama and Kotombiyama. It was caused by the M7.0 to M7.1 Hietsu earthquake of April 8, 1858.
1946 (Showa 21)	Phreatic eruption?	September 11. Increased volcanic plume activity. Mud-like ejecta were scattered over 100 meters in the area.
1949 (Showa 24)	Phreatic eruption?	October 23? Increased volcanic plume activity.
1967 (Showa 42)	Volcanic gas	November 4. Volcanic gas (hydrogen sulfide) killed 2 campers.
1973 (Showa 48)	Sulfur flow	August.
1981 (Showa 56)	Sulfur flow	July.
1982 to 1987 (Showa 57 to 62)	Sulfur flow	Occurred multiple times within this period.
1990 (Heisei 2)	Earthquake	February 18 to early March. Earthquake swarms approximately 10km to the south-southeast, with a maximum magnitude of M4.9. October 29 to November 4. Earthquake swarms in the same location mentioned above, with a maximum magnitude of M2.6.
2006 (Heisei 18)	Volcanic plume	December 6. Increased volcanic plume activity (Figure 49-1).
2010 (Heisei 22)	Sulfur flow	May. Sulfur combustion in area around Kajiya Jigoku, forming several sulfur flows (the largest being approximately 2 m wide, 20 m long, and up to 15 cm thick).
2011 (Heisei 23)	Earthquake	October to December. Temporary increase in earthquakes with hypocenters between roughly 5 to 10 km southeast of Midagahara and approximately 15 km east of Midagahara.

* Reference documents have been appended with reference to the Active Volcano Database of Japan, AIST, latest version for eruption ages, areas of activity, eruption types, and eruption events.

Recent Volcanic Activity

Figure 49-4 Photo of Kajiya Jigoku taken on August 31, 2010. Courtesy of the Toyama Science Museum.

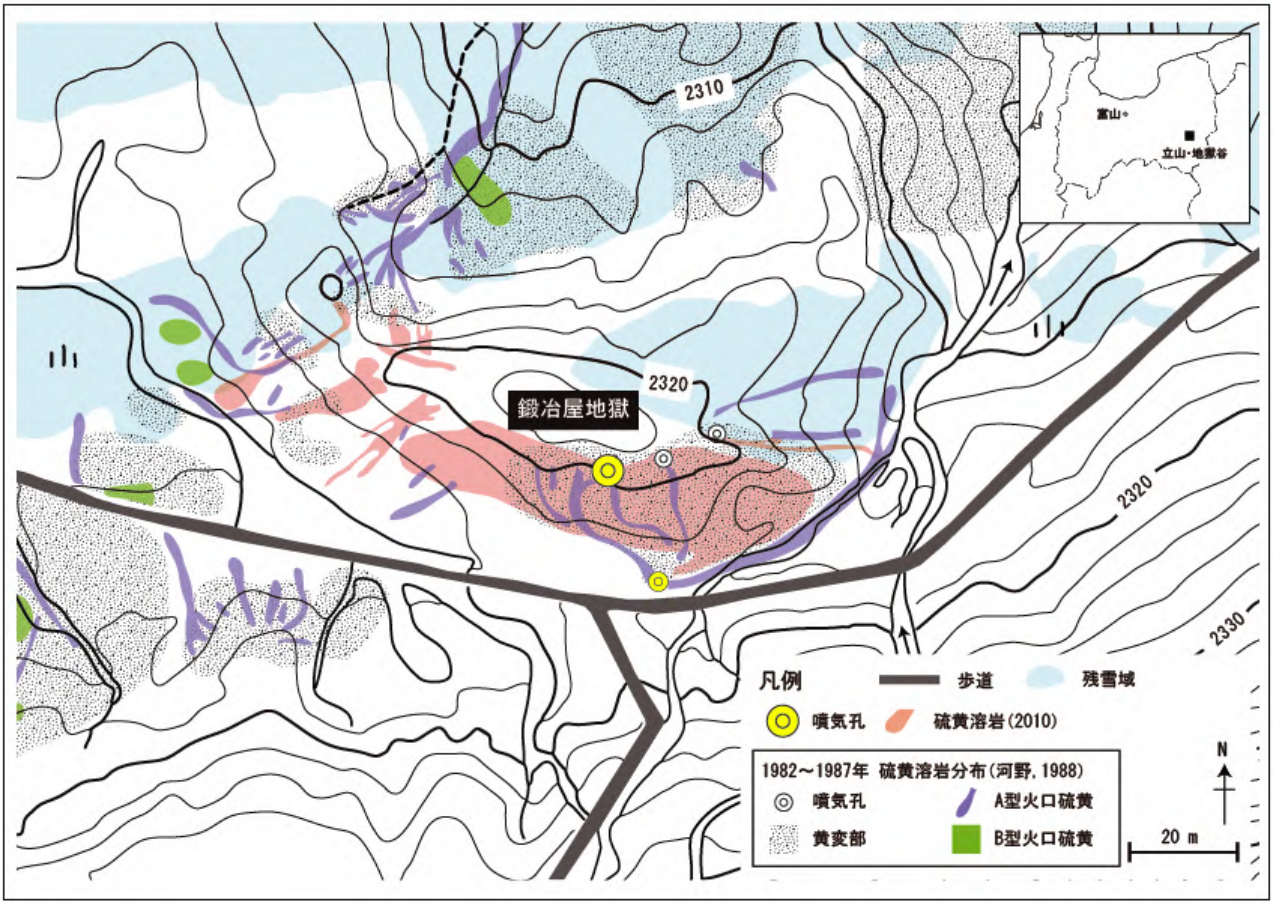


Figure 49-5 Topographic map of Tateyama-Jigokudani (Kajiya Jigoku area) showing the distribution of sulfur flows formed in 2010 (colored with red) and fumaroles (yellow double circle; Masubuchi, 2012).

Most of the 2010 sulfur lava flows were burned during flow. The distribution of sulfur flows (combusted-type, in green; non-combusted type, in purple) that formed in 1982–1987, fumaroles (white double circles) and whitish yellow sulfur-rich sediments (dotted pattern) is based on Kohno (1988).

The 1/2000 Scale Topographic Map (Chubu-Sangaku National Park Murodo Group Facility Area) created by the Toyama Prefecture Toyama Agriculture and Forestry Promotion Center was used to create this map.

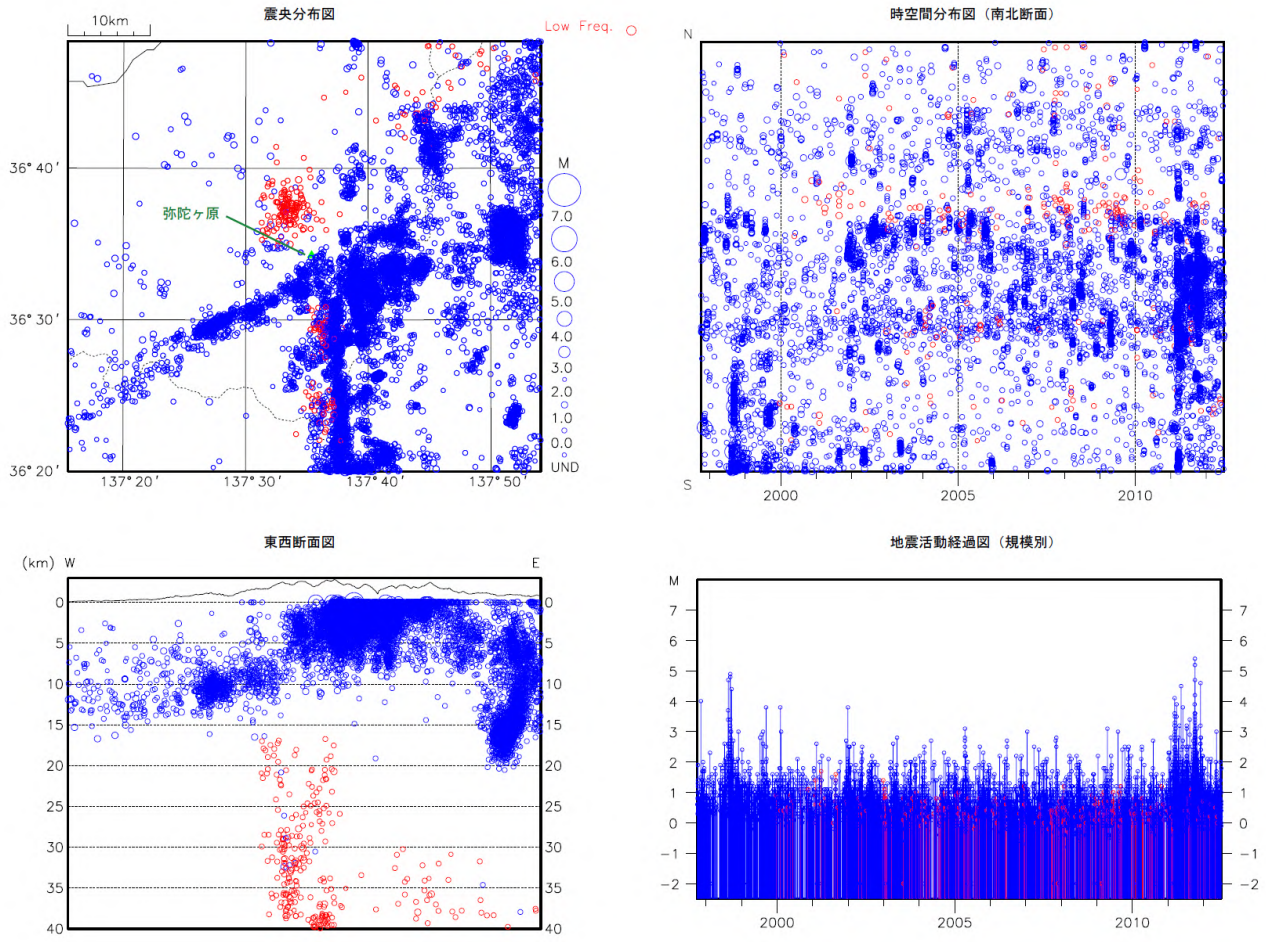


Figure 49-6 Activity of shallow VT earthquakes (blue circles) and deep low-frequency earthquakes (red circles) observed by a regional seismometer network (October 1, 1997, to June 30, 2012). Epicenter distribution (upper left), space-time plot (N-S cross-section) (upper right), E-W cross-section (lower left) and magnitude-time diagram (by scale) (lower right).

Information on Disaster Prevention

①Hazard Map

None

Social Circumstances

①Populations

- Toyama City: 416,835 (As of June 30, 2012)
- Tateyama Town: 27,376 (As of July 1, 2012)
- Kamiichi Town: 22,062 (As of July 1, 2012)

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

- Chubu-Sangaku National Park

Over 1 million sightseers and mountain-climbers visit the Tateyama - Kurobe alpine route each year

⑤Facilities

Tateyama

- Tateyama Caldera Sabo Museum
- Tateyama Nature Conservation Center

Omachi

- Omachi Alpine Museum

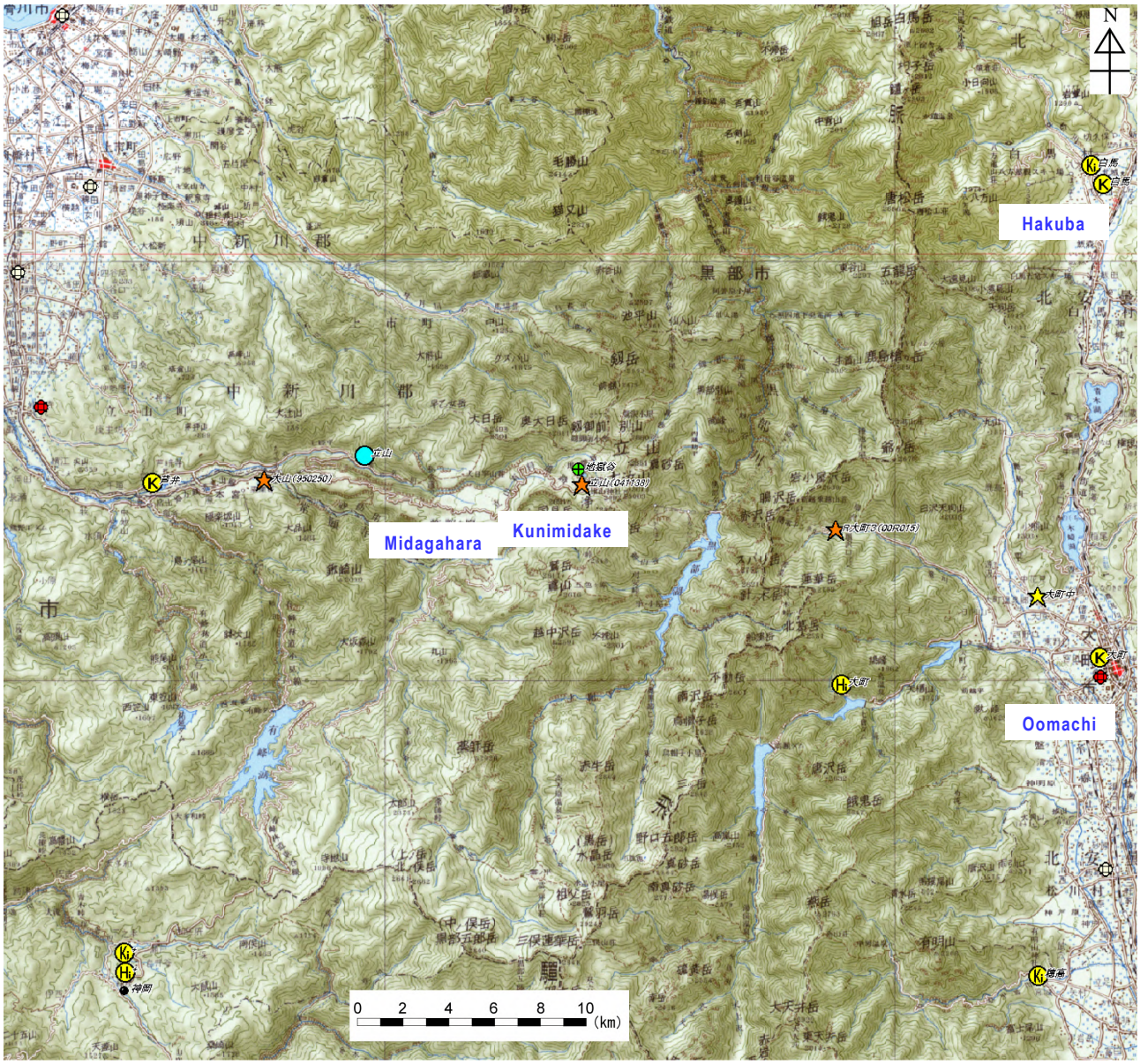
Toyama

- Toyama Science Museum

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 (Toyama and Takayama) published by the Geospatial Information Authority of Japan were used.

Legend

(JMA) seismic intensity meter

(NIED) Hi-net, K-NET, KiK-net

(DPRI) seismometer(SP)

(Municipalities) seismic intensity meter

(GSI) GPS

(ENV) gas sensor

Figure 49-7 Regional monitoring network.

* In response to the increased fumarolic activity of the Tateyama Jigoku, the JMA established a temporary seismometer at Tateyama Murodo, and has been monitoring volcanic activity at Midagahara 24 hours a day since October, 2012.

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(Masubuchi, Y.)