

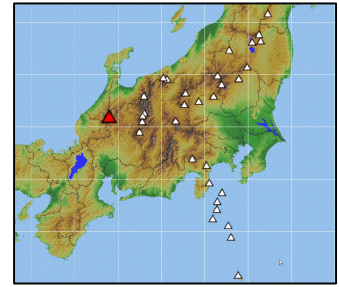
54. Hakusan

Continuously Monitored by JMA

Latitude: 36°09'18" N, Longitude: 136°46'17" E, Elevation: 2,702 m

(Gozenamine)

(Triangulation Point - Hakusan)



Overview of Hakusan taken from northeast side on September 18, 2007 by the Japan Meteorological Agency

Summary

The Hakusan volcano is located on the border of the prefectures of Ishikawa and Gifu, approximately 50 km to the south of Kanazawa. On the south slope of the Ko-Hakusan (Old Hakusan) volcanic edifice, which has been deeply eroded, lies the Shi-Hakusan (New Hakusan) volcano, formed less than 100,000 years ago. The highest peak, Gozenamine, is the top of an eastward sector collapse wall on the summit of the Shi-Hakusan stratovolcano edifice. Kengamine is a younger volcanic edifice of lava dome, which formed in the amphitheater of collapse. The recent activity formed many small craters at the summit, and in 1554 a small pyroclastic flow was produced from Midorigaike crater. Fumarolic areas currently exist at the foot of the volcano, in places such as Jigokudani and Shirakawadani, but no fumarolic activity is found at the summit. The SiO_2 is between 56.4 and 66.6 wt %.

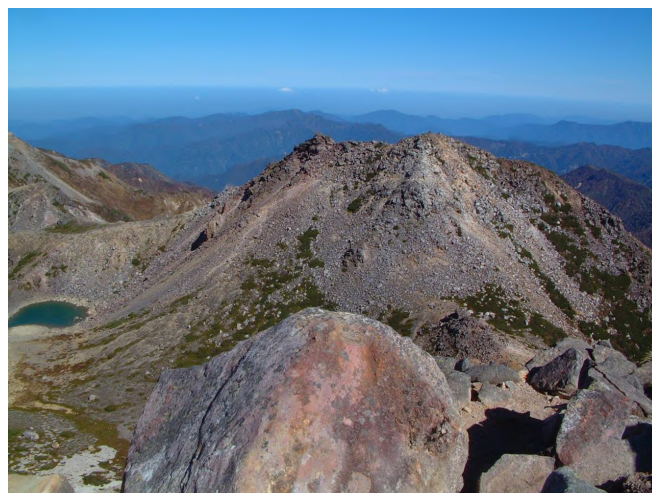
Photos



Kengamine (at left), Gozengamine (at right) and Midorigaike crater (on the left side), taken from Onanijgamine, facing southeast on July 28, 2005. Courtesy of Y.Hiramatsu.



Onanijgamine at the back, taken from Gozengamine, facing northwest on October 13, 2005 by the Japan Meteorological Agency



Kengamine, taken from Gozengamine, facing north on October 13, 2005 by the Japan Meteorological Agency

Red Relief Image Map

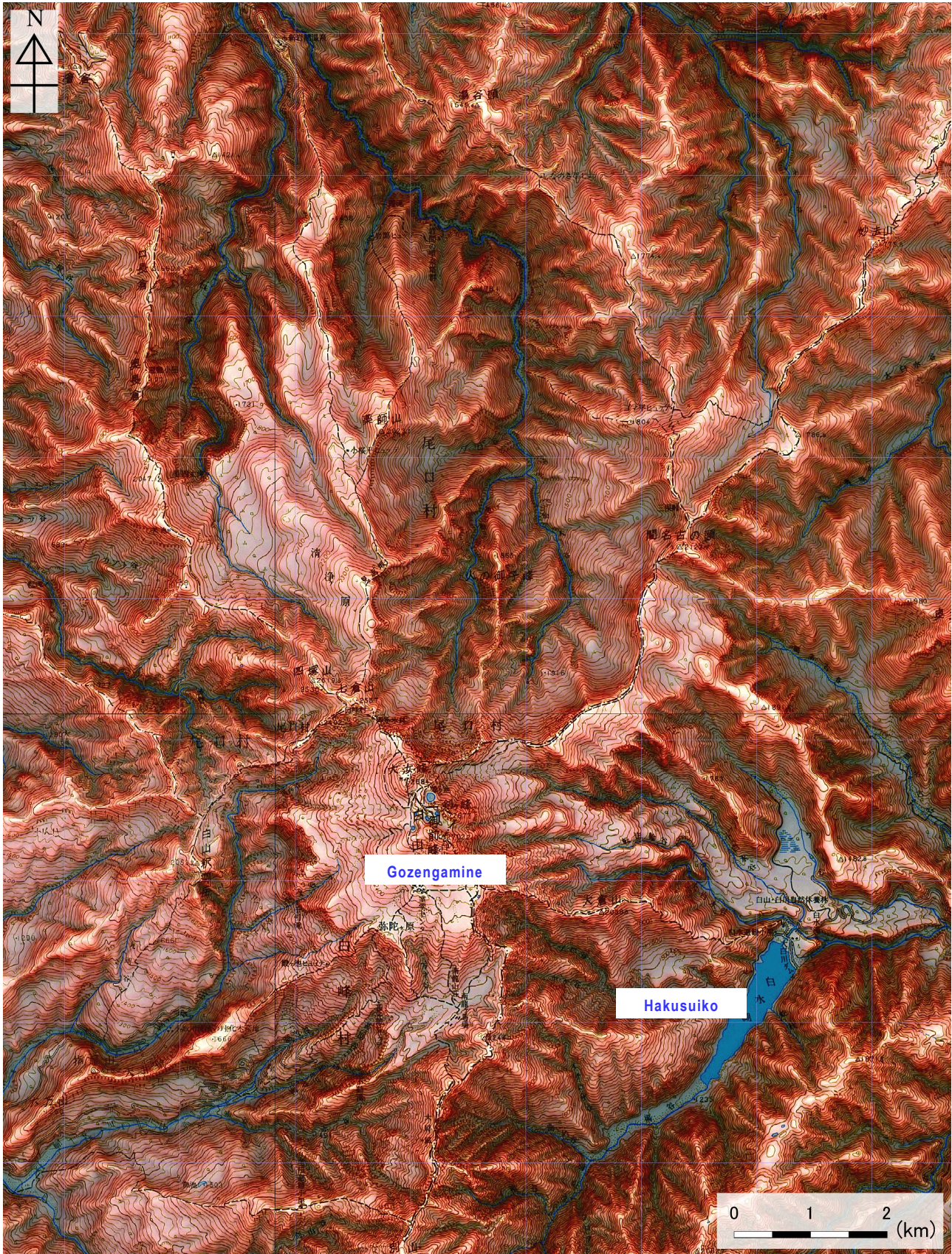


Figure 54-1 Topography of Hakusan.

1:50,000 scale topographic maps (Echizenkatsuyama, Hakusan, Shiramine and Shirakawa) and digital map 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

Volcanic Activity during the past 10,000 years has generated mainly tephra fall eruptions, as well as a few lava flows and lava dome eruptions. Between approximately 5,400 and 4,900 years ago a sector collapse destroyed the east side of the Shi-Hakusan volcanic edifice. There were eruptions from the sector collapse depression roughly 2,200 years ago, forming the Kengamine lava dome and producing the Shiramizunotaki lava. These were followed by the formation of small craters such as Midorigaike at the summit.

Period	Area of Activity	Eruption Type	Main Phenomena / Volume of Magma
9.6←→9.5 ka	Shin-Hakusan volcano summit	?	Tephra fall (Hm-1).
9.6←→8.5 ka	Shin-Hakusan volcano summit	?	Tephra fall (Hm-3).
8.6←→8.5 ka	Shin-Hakusan volcano summit	Magmatic eruption?	Tephra fall (Midagahara volcanic ash (Hm-4)).
7 ka	Shin-Hakusan volcano summit	?	Tephra fall (Hm-5).
6.1←→5.7 ka	Shin-Hakusan volcano summit	?	Tephra fall (Hm-7).
6.1←→5 ka	Shin-Hakusan volcano summit	?	Tephra fall (Hm-8).
5.4←→4.9 ka	(Shin-Hakusan volcano summit)	(Sector collapse)	Debris avalanche (volume of deposits: 0.13 km ³).
4.7←→4.4 ka	Shin-Hakusan volcano summit	?	Tephra fall (Hm-9).
2.2 ka	Kengamine	Magmatic eruption	Lava flow, lava dome, tephra fall (Shiramizunotaki lava, Kengamine lava dome, Nanryu volcanic ash (Hm-10)). Magma eruption volume = 0.1 to 1.0 km ³ DRE.
2.2←→1.4 ka	Summit small crater group	?	Tephra fall (Hm-11).
2.2←→1.4 ka	Summit small crater group	?	Tephra fall (Hm-12).
1.6←→1.4 ka	Summit small crater group	?	Tephra fall (Hm-13).
1.2←→1 ka	Summit small crater group	?	Tephra fall (Hm-14).

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

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

▪ Historical Activity

Year	Phenomenon	Activity Sequence, Damages, etc.
1042 (Chokyu 3)	Phreatic eruption (lahar)	Tephra fall. Kagamuro(wooden huts at the summit) was buried. The eruptive activity took place at the Midorigaike crater or the Senjagaike crater.
1177 (Jisho 1)	Eruption?	May 11. Details unknown.
1239 (En'ō 1)	Eruption?	Details unknown.
1547 (Tenbun 16)	Eruption	From June. Tephra fall. Harvests were poor in Shirakawa-go.
1548 (Tenbun 17)	Eruption?	Details unknown.
1554 to 1556 (Tenbun 23 to Kōji 2)	Magmatic eruption	From May. Tephra fall, small pyroclastic flow (eruptive activity took place at the Midorigaike crater and the nearby crater group). A temple hall was destroyed. The Tedorī River grew clouded, and fish in the river were killed.
1579 (Tenshō 7)	Eruption	September 16 or September 18. Tephra fall. A temple hall was destroyed.
1659 (Manji 2)	Eruption	April 21, July 27, August 6 to August 8. Tephra fall.
1935 (Shōwa 10)	Fume	March. Fumaroles appeared near Senjingataki (approximately 2 km southwest of the summit of Hakusan), and there were discharges at several locations (reaching heights of 100 m when there was no wind), accompanied by rumbling. The fumarolic activity stopped shortly thereafter.
2005 (Heisei 17)	Earthquake	Earthquake swarm activity occurred directly below the summit in February, April, August, and October. On October 3, at 13:59, there was an earthquake with a magnitude of M4.5 according to the Japan Meteorological Agency (M4.2 according to Kyoto University).
2011 (Heisei 23)	Earthquake	March. Since the 2011 Tohoku Earthquake (March 11, 2011) there has been a great deal of minor seismic activity directly below the summit.

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

Recent Volcanic Activity

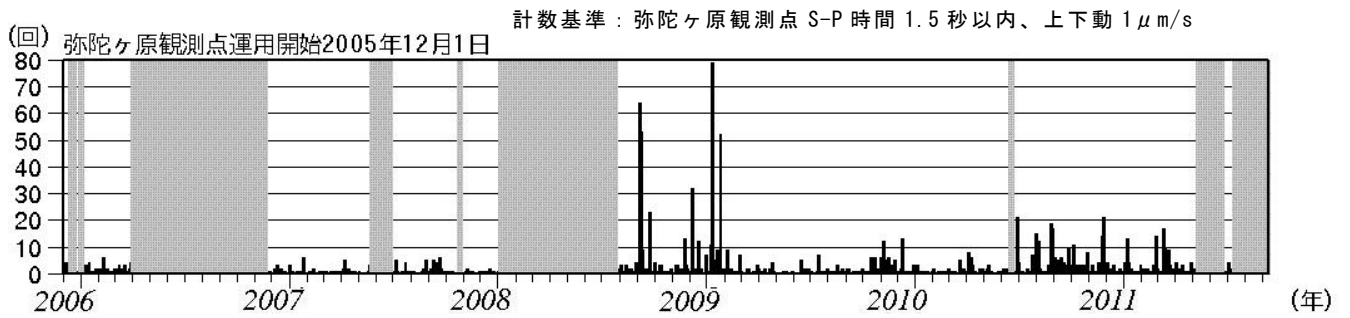


Figure 54-2 Number of earthquakes per day (December 1, 2005, to September 10, 2011).

Data for the Midagahara observation point is unavailable due to an equipment fault (areas shown in gray in the figure).

Since the 2011 off the Pacific coast of Tohoku Earthquake, seismic activity slightly increased in and around Hakusan, but this seismic activity has now ceased.

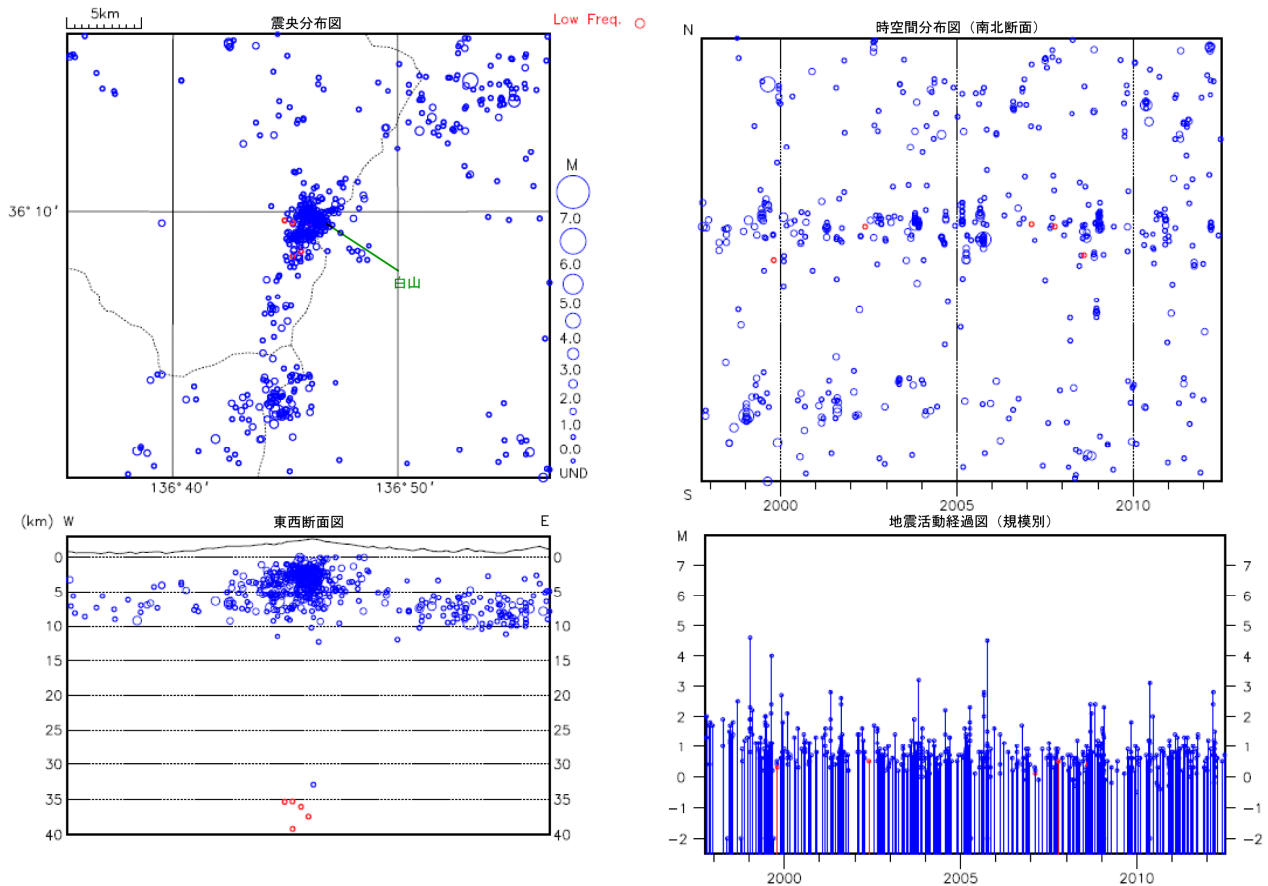


Figure 54-3 Activity of shallow VT earthquakes (blue circles) and deep low-frequency earthquakes (red circles) observed by a regional seismometer network (October 1, 1997, to June 30, 2012). Epicenter distribution (upper left), space-time plot (N-S cross-section) (upper right), E-W cross-section (lower left) and magnitude-time diagram (by scale) (lower right).

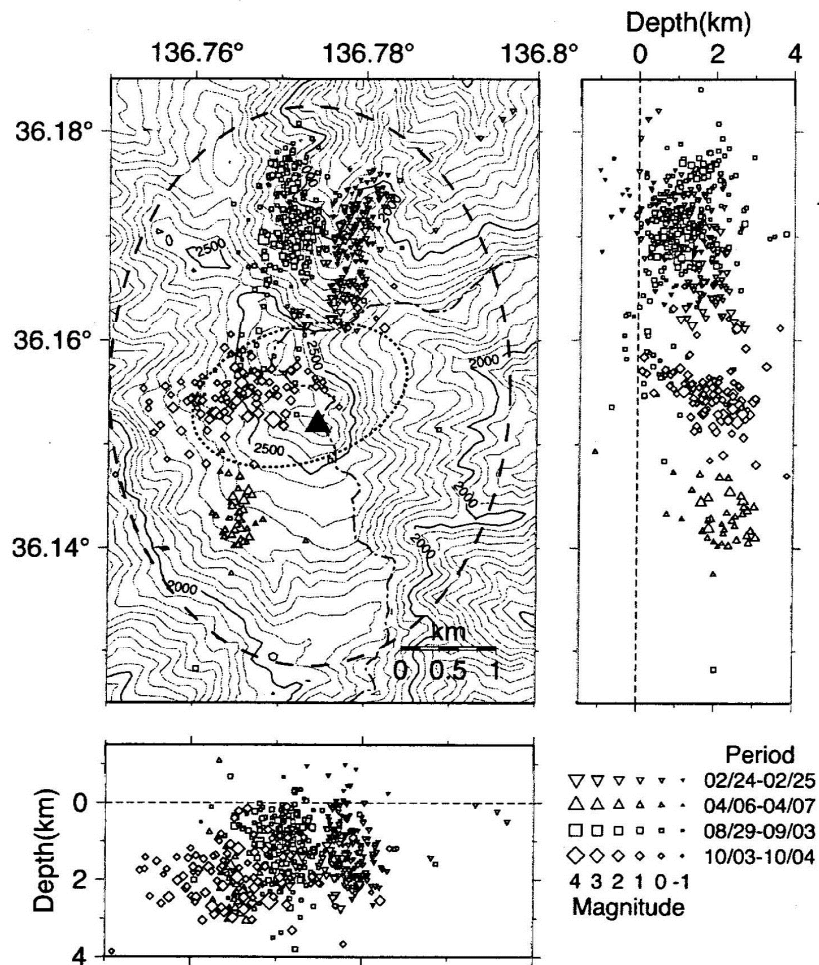


Figure 54-4 Distribution of volcanic earthquake swarms in 2005 (Hiramatsu and Wada, 2008).

The ▲ symbol indicates the summit of Hakusan. The figures at right and below show the north-south and east-west cross-sections, respectively.

The hypocenters of the four earthquake swarms which occurred in 2005 (February, April, August, and October) gradually shifted, but was concentrated in a small area (at a depth of 0 to 3 km). No volcanic tremors or low-frequency earthquakes were observed.

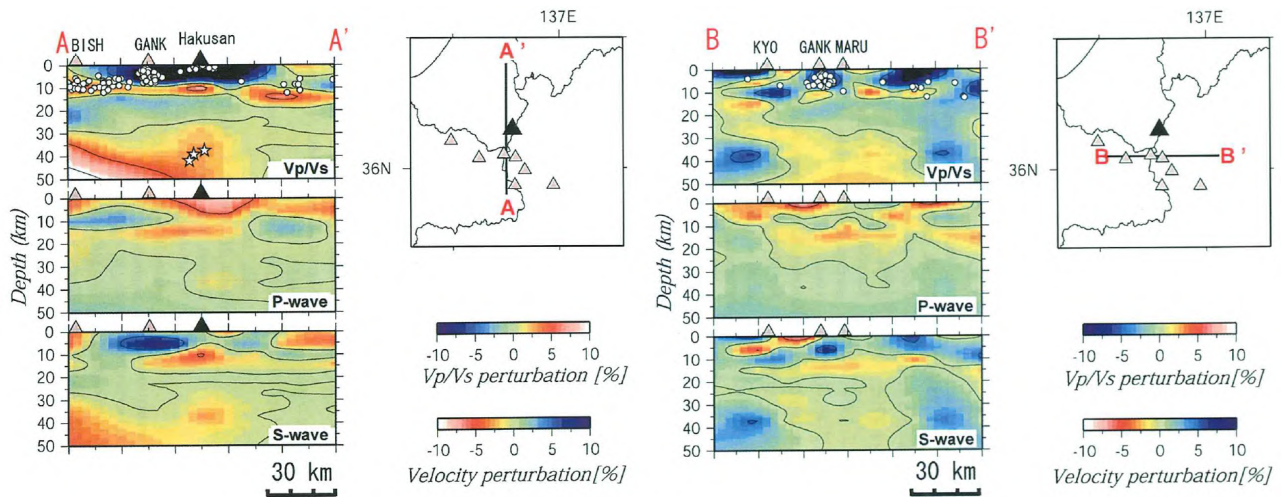


Figure 54-5 P- and S-wave velocity structure, and Vp/Vs structure (Takahashi et al., 2004).

A-A' and B-B' are the north-south and east-west cross-sections, respectively. The \blacktriangle symbol indicates the summit of Hakusan. The \circ symbols indicate shallow seismic activity. The \star symbols indicate deep low-frequency earthquakes. Red areas and blue areas show low seismic velocities or large Vp/Vs ratios and high seismic velocities or small Vp/Vs ratios, respectively.

The area with low seismic wave velocities and high Vp/Vs ratios at a depth of 10 to 14 km directly below Hakusan corresponds to magma produced by volcanic activity.

Information on Disaster Prevention

① Hazard Map

None

Social Circumstances

① Populations

- Shirakawa Village, Ono District, Gifu Prefecture: 1,768 people, 569 households (as of May 1, 2012)
- Hakusan City, Ishikawa Prefecture: 112,717 people, 39,660 households (as of June 30, 2012)

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

- Hakusan National Park (average figures for 2003 to 2010 (according to Ministry of the Environment materials))

Hakusan Tedoru River was certified as "Japanese Geopark" in September, 2011.

<http://hakusan-geo.main.jp/>

Number of sightseers per year

Gifu Prefecture: Approx. 16,000

Ishikawa Prefecture: Approx. 45,000

Fukui Prefecture: Approx. 8,000

Number of mountain-climbers per year

Gifu Prefecture: Approx. 5,000

Ishikawa Prefecture: Approx. 39,000

Fukui Prefecture: Approx. 1,000

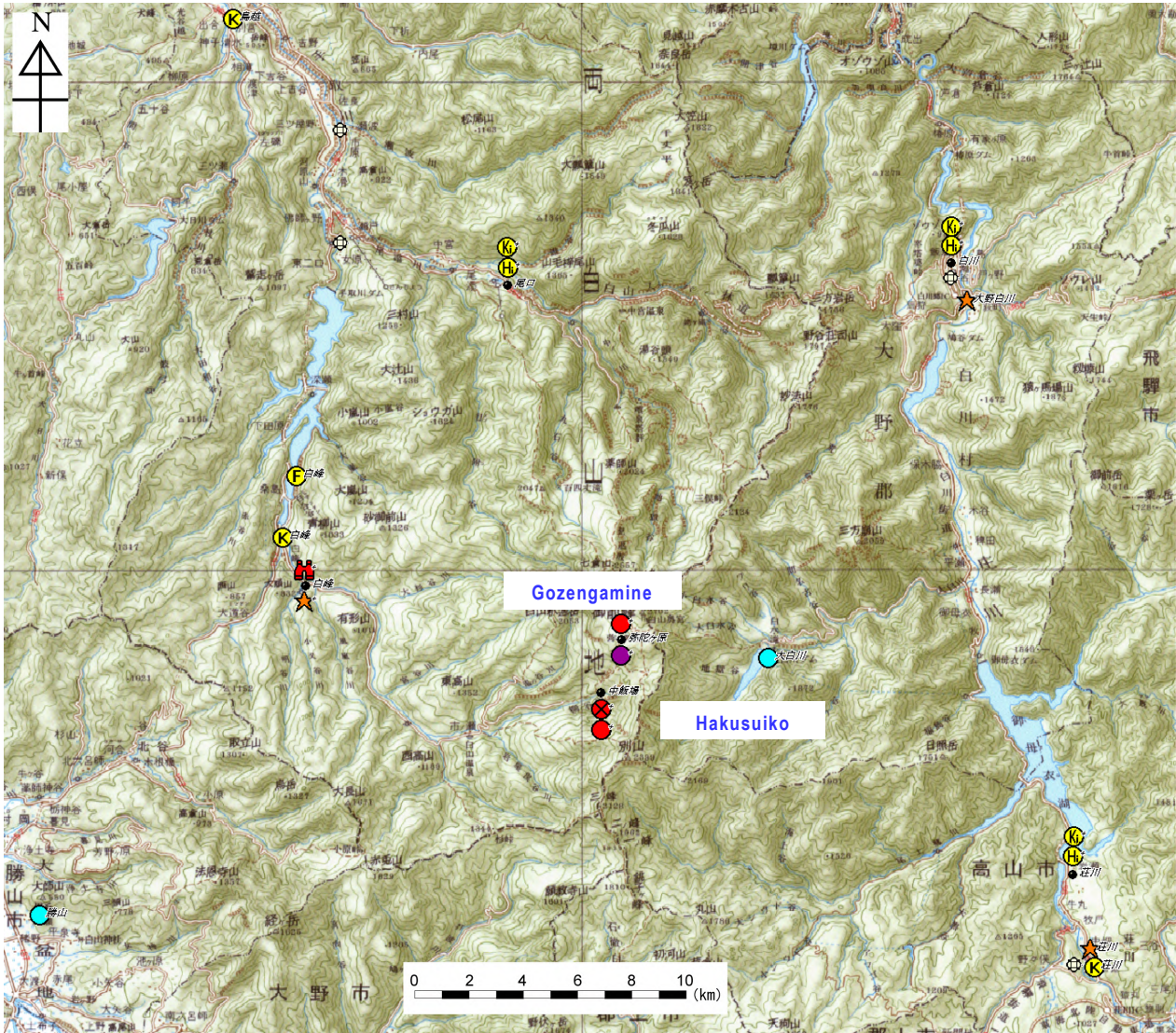
⑤ Facilities

- Hakusan City
 - Hakusan Sabo Museum
 - Hakusan National Park Center
 - Hakusan Nature Conservation Center - Chugu Exhibition Hall
 - Murodo Visitor Center

Monitoring Network

Wide Area

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



1:200,000 scale regional map (Kanazawa) published by the Geospatial Information Authority of Japan was used.

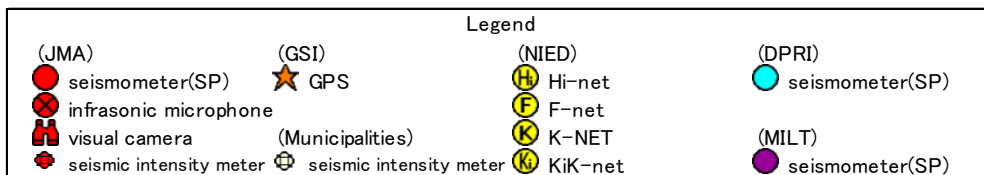


Figure 54-6 Regional monitoring network.

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(Higashino, T., Hiramatsu, H., and Tajima, Y.)