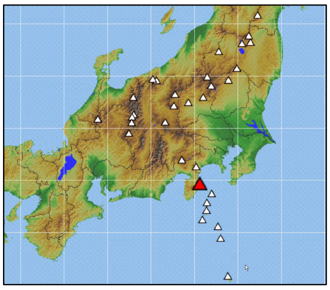


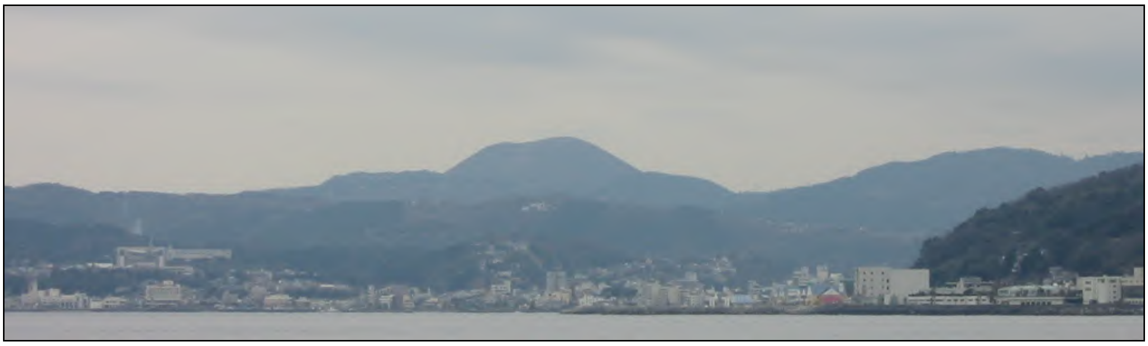
57. Izu-Tobu Volcanoes

Continuously Monitored by JMA

Latitude: 34°54'11" N, Longitude: 139°05'41" E, Elevation: 580 m (Omuroyama) (Triangulation Point)

Latitude: 34°59'37" N, Longitude: 139°07'48" E, Depth: -118 m (Teishi Knoll (Deepest Point of Crater))

Eruption at Teishi Knoll taken at the sea from southwest side on July 13, 1989. Courtesy of Japan Coast Gurard.



Omuroyama taken from Osaki, Ito (Omuroyama at Center) on March 3, 2004 by the Japan Meteorological Agency

Summary

Izu-Tobu volcanoes is a generic term of a large number of small, densely arranged basalt-rhyolite volcanic edifices in the eastern part of Izu peninsula (Higashi-Izu monogenetic volcanoes) and a large number of densely arranged submarine volcanoes to their east (Higashi-Izu submarine volcanoes). They consisnt of scoria cones, tuff rings, maars, and lava domes, deposits from lava flows, air-fall pyroclastic materials, pyroclastic flows, pyroclastic surges, and lahars. On the land, the largest of the basalt-andesitic volcanoes is Omuroyama, and the largest of the dacite-rhyolitic volcanoes is Kawagodaira. Many details are lacking concerning the number of submarine volcanoes, their rock composition, and when they were active. Several chains of volcanoes stretch from northwest to southeast, reflecting the stress field in the area. The basalt-rhyolite is between 48.3 and 73.0 %.

After the earthquake swarms of 1930 the area was calm for some time, but from around the mid-1970s earthquake swarm activity resumed. In July, 1989, earthquake swarms occurred, accompanied by the first recorded eruption at the Teishi Knoll, located off the coast of Ito.

Red Relief Image Map

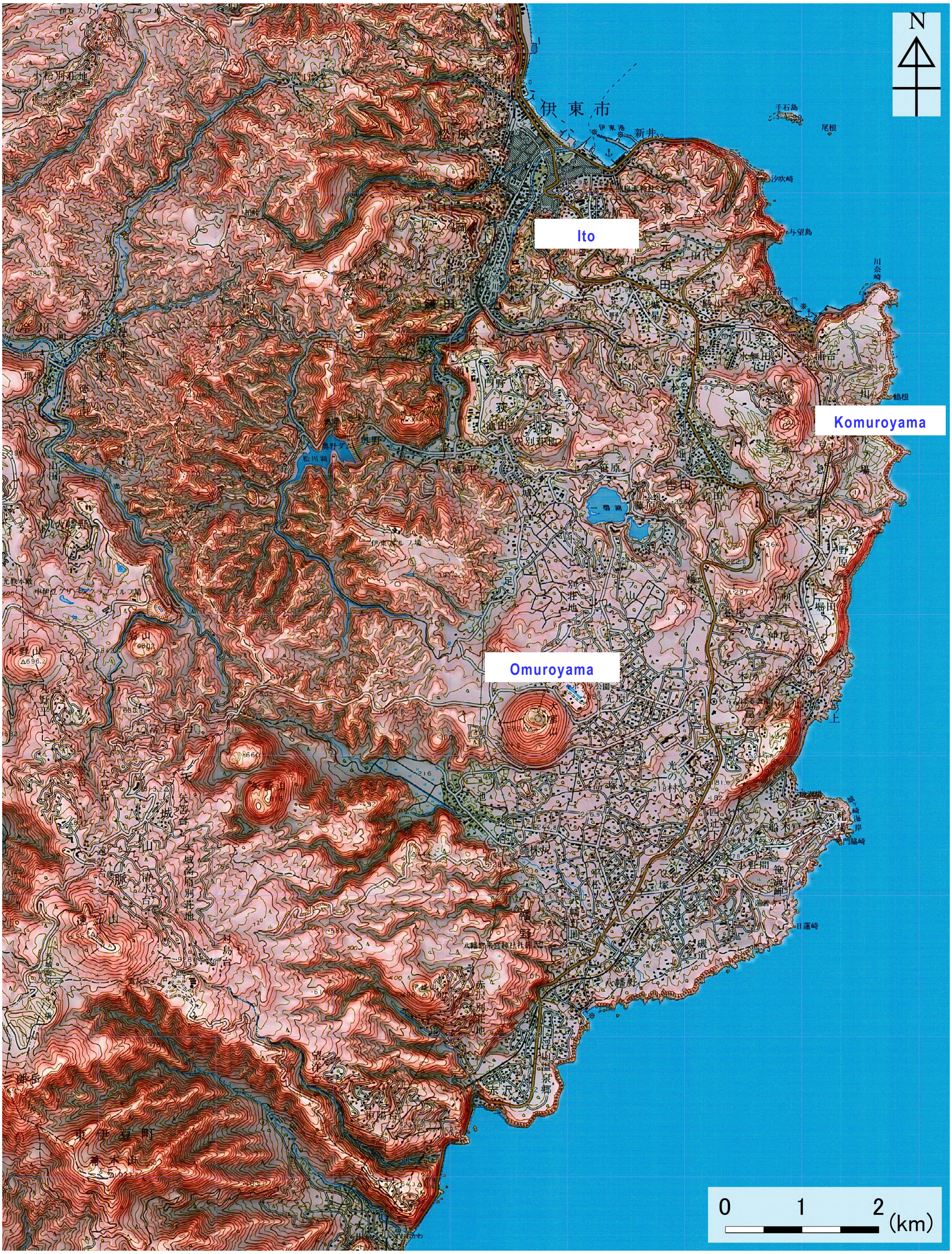


Figure 57-1 Topography of the Izu-Tobu volcanoes.

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

Distribution of Craters

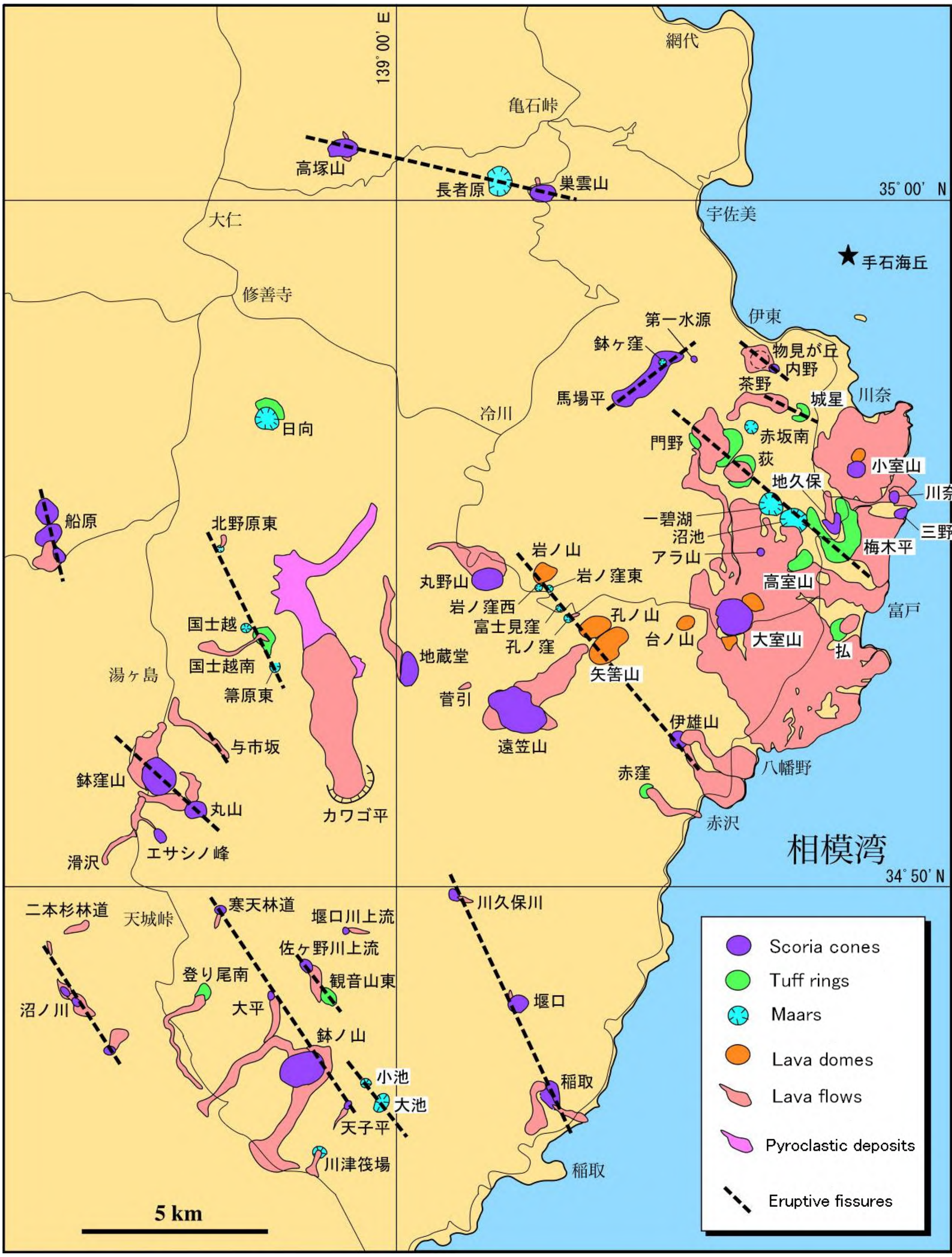
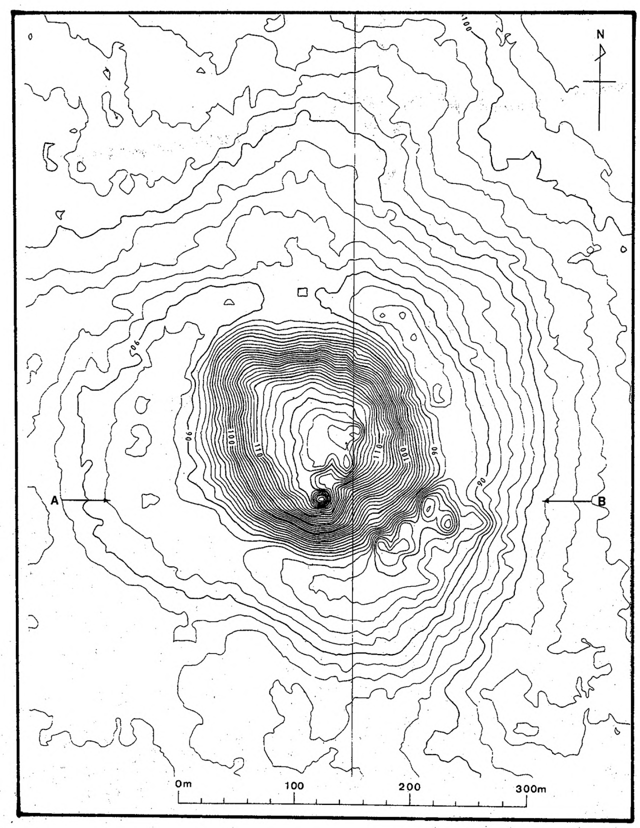


Figure 57-2 Map shopwing volcanoes in the Higashi Izu monogenetic volcano field (Koyama., 2010a) .

Star shows the location of the Teishi Kaikyu submarine volcano, which erupted on July 13, 1989. Coast line and main roads are shown with thin line.

Submarine Topographic Map



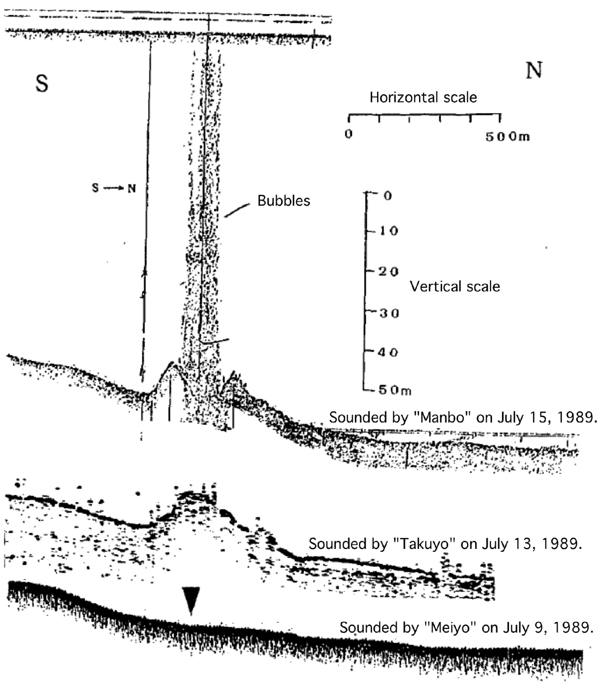


Figure 57-3 Ultrasound image of the Teishi Knoll (Hydrographic Department, Maritime Safety Agency, 1989).
Measurement was performed by the Tenyo survey ship in October, 1989.

i.

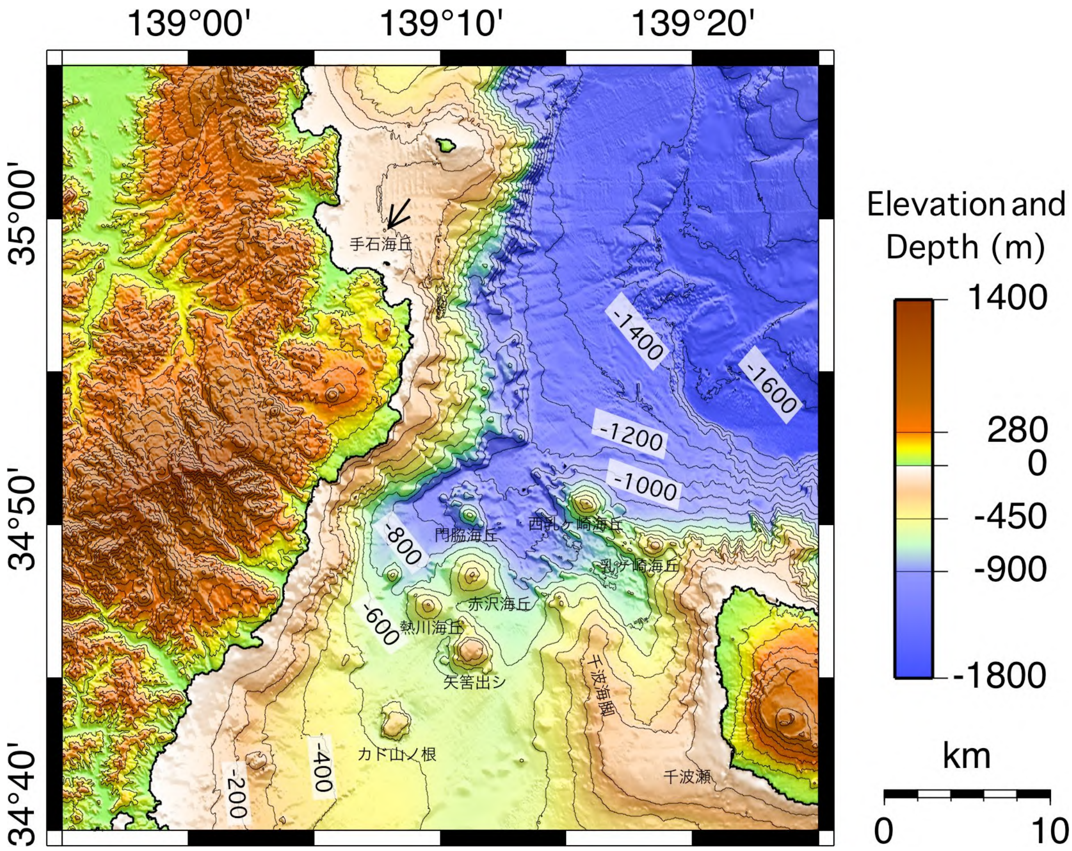


Figure 57-4 Submarine topographic map of the Izu-Tobu volcanoes (Japan Coast Guard).

Chronology of Eruptions

・Volcanic Activity in the Past 10,000 Years

Omuroyama was formed by an eruption which occurred approximately 4,000 years ago. Then, roughly 3,200 years ago, the first rhyolitic magma eruption in the area occurred at Kawagodaira, resulting in a pyroclastic flow to the north and producing pumice and volcanic ash fall to the west. Approximately 2,700 years ago a fissure eruption occurred on the Iwanoyama-Ioyama volcano line, but no eruptions are considered to have occurred in the area until the submarineeruption off the coast of Ito on July 13, 1989 (Koyama, 2010a,b).

Period	Area of Activity	Eruption Type	Main Phenomena / Volume of Magma
4.4 ka	Dainoyama	Magmatic eruption	Lava dome
4.2←→4 ka	Omuroyama, foot of Omuroyama	Magmatic eruption → phreatomagmatic eruption, (lahar production) → magmatic eruption	Tephra fall → lava flow, tephra fall → tephra fall, lahar → lava flow, lava dome → tephra fall. Magma eruption volume = 0.2 km^3 DRE. (VEI 3)
3.2←→3.1 ka	Kawagodaira	Phreatomagmatic eruption → magmatic eruption → (lahar production)	Pyroclastic surge → tephra fall → pyroclastic flow → lava flow → lahar. Magma eruption volume = 0.52 km^3 DRE. (VEI 4)
2.7 ka	Iwanoyama, Iwanokubo, Fujimikubo, Ananokubo, Ananoyama, Yahazuyama, Ioyama	Phreatic eruption, phreatomagmatic eruption, magmatic eruption	Tephra fall, lava flow, lava dome. Magma eruption volume = 0.14 km^3 DRE. (VEI 3)

* Reference have been appended with reference to the Active Volcano Database of Japan, AIST (Kudou and Hoshizumi, 2006) for volcanic periods, areas of activity, eruption types, and eruption events. All years are noted incalendar year. "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.
1816 to 1817 (Bunka 13)	Earthquake	Earthquake swarms occurred in and around Kawana from the end of 1816 to early 1817.
1870 (Meiji 3)	Earthquake	Earthquake swarms continued for 2 to 3 months (possibly happened in 1868 (Meiji 1)).
1930 (Showa 5)	Earthquake, crustal deformation	February to May. Earthquake swarms with hypocenters distributed off the coast of Ito occurred (over 3,600 felt-earthquakes). An uplift of up to roughly 10 cm was observed on the coast around Ito. (On November 26 the North Izu earthquake (M7.3) occurred, with its hypocenter in the north of the Izu Peninsula.)
1978 to 1989 (Showa 53 to Heisei 1)	Earthquake	See Table 57-1.
1989 (Heisei 1)	Small-scale: Phreatomagmatic eruption	Earthquake swarms began on June 30. A submarine eruption occurred on the Teishi Knoll in the bay of Ito on July 13. (Pumice and scoria drifted ashore.) The resulting landform was named the Teishi Knoll. Magma eruption volume = 0.00004 km^3 DRE. (VEI 1)
1991 (Heisei 3) to 2011 (Heisei 23)	Earthquake	See Table 57-1.
March, 2011 (Heisei 23)	Earthquake	After the 2011 off the Pacific coast of Tohoku Earthquake (March 11, 2011) seismic activity became high in that areas from the north to the northwest of Omuroyama, and approximately 15 km to the east-southeast. March 19, 01:49 - M4.4 (JMA scale seismic intensity of 3).

* Reference have been 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.

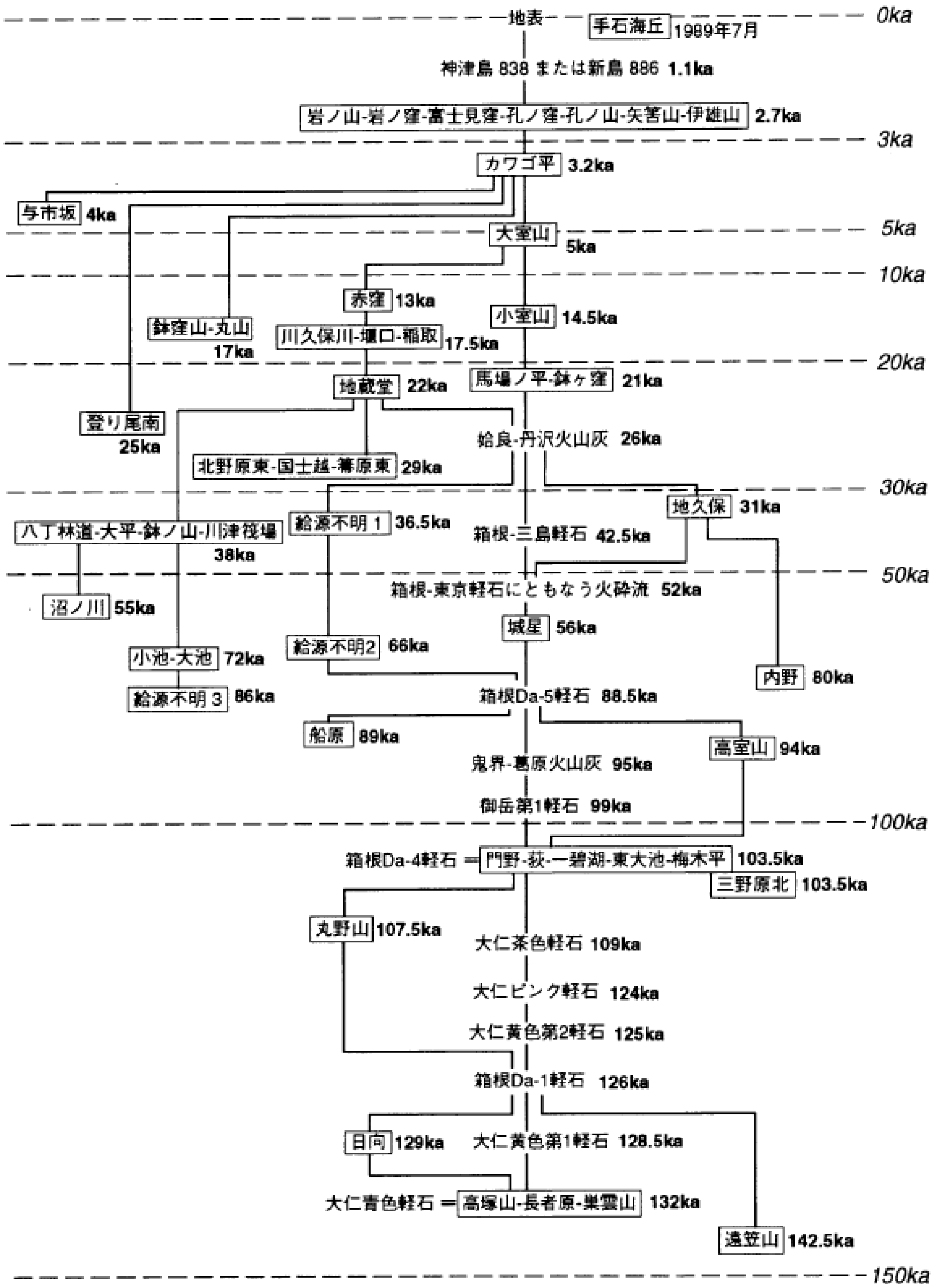


Figure 57-5 Tephra stratigraphy and chronology in the Higashi Izu monogenetic volcano field (Koyama et al., 1995) Tephra in boxes are of the Higashi Izu monogenetic volcanoes origin. Other tephra are derived from the volcanoes outside the izu Peninsula. Equal and hyphen mean the simultaneity of eruptions at two or more volcanoes.

Whole Rock Chemical Composition

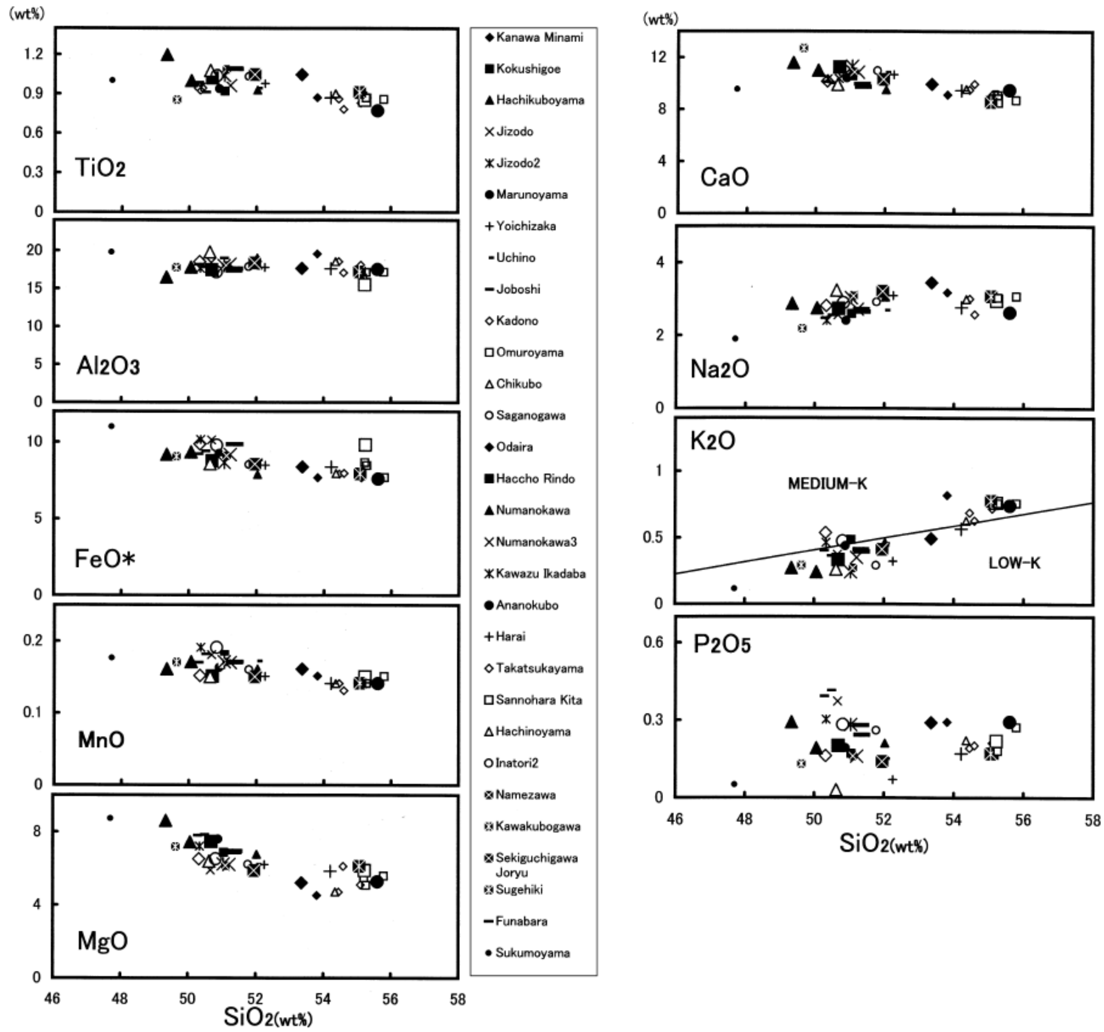


Figure 57-6 Whole rock chemical composition (Takahashi, et al., 2002).

Period - Cumulative Magma Volume

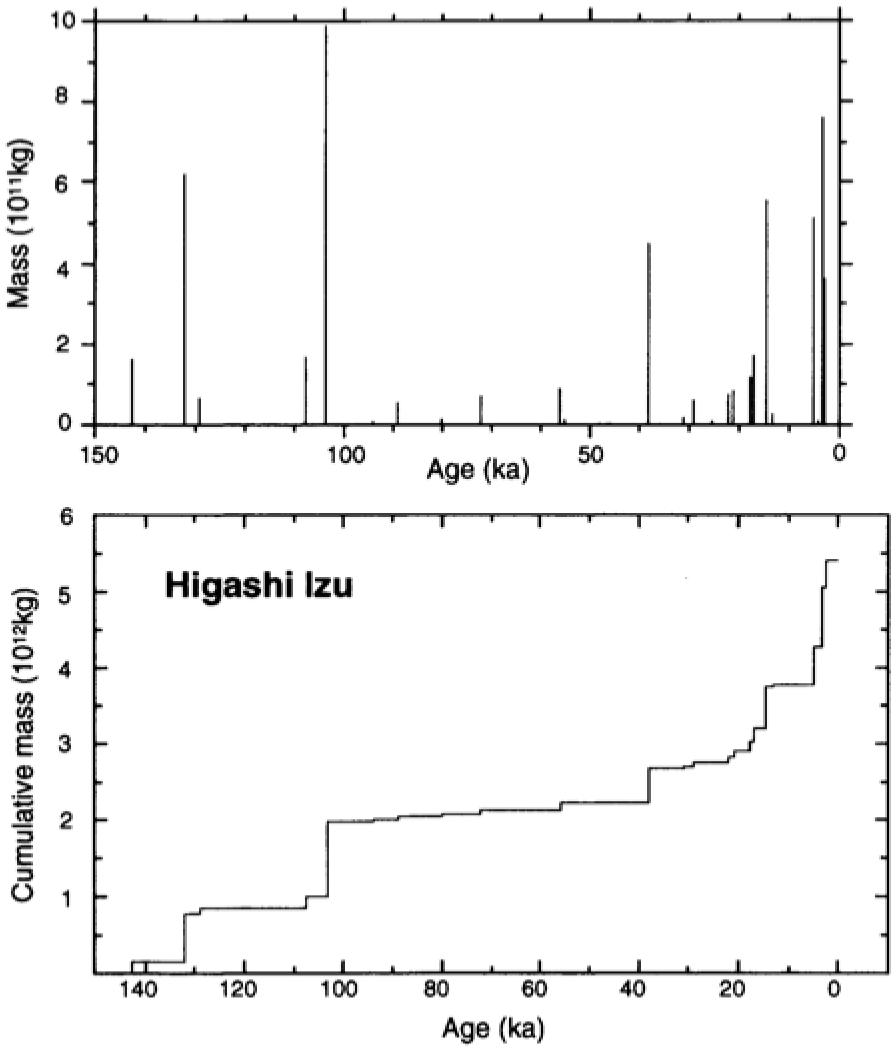
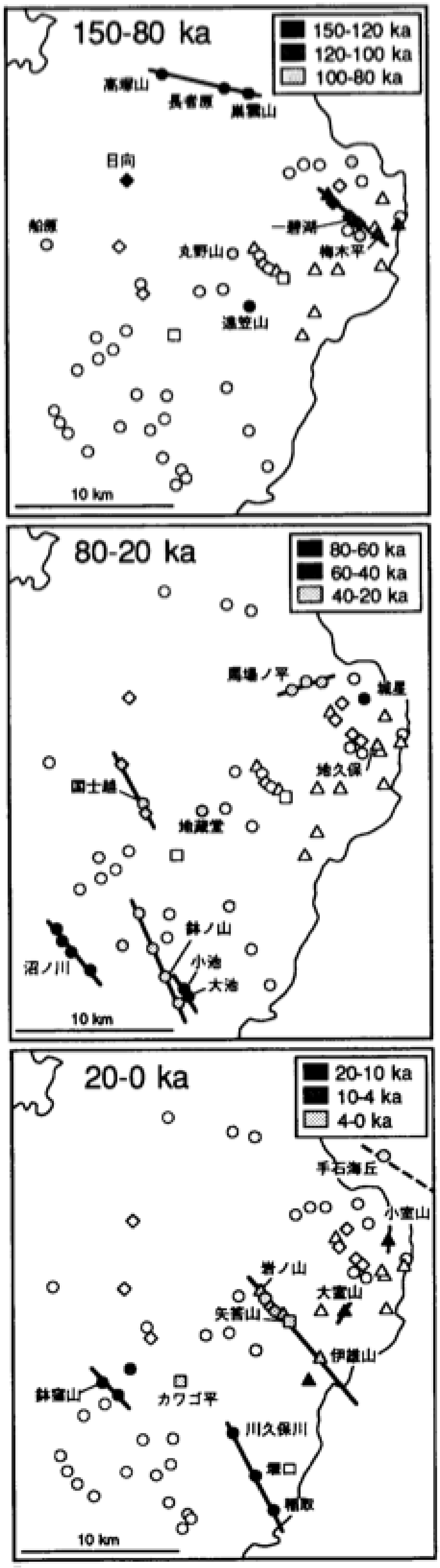


Figure 57-7 Temporal change in magma eruption mass in Hiagshi izu monogenetic volcanoes (Koyama et al., 1995).

Discharge mass of magma at each eruption (upper) and cumulative discharge mass of magma (l ower) are shown..



○ basaltic △andesitic □dacitic-rhyolotic ◇unknown

Figure 57-8 Spatial and temporal distribution of vent locations in the Higashi Izu monogenetic volcano field for the period of 80-150 ka (upper), 20-80 ka (middle), and 0-20 ka (lower) (Koyama et al., 1995)

Thick solid line shows the location of an eruptive fissure. Thick broken line shows the location of the dike, which caused the eruption of the Teishi kaikyu submarine volcano on July 13, 1989.

Precursory Phenomena

The 1989 submarine eruption was preceded by 3 days by a high number of low-frequency earthquakes, and 2 days before the eruption noticeable volcanic tremor activity was observed, although crustal deformation and seismic activity caused by magma intrusion decreased.

Since roughly 1980, earthquake swarms and crustal deformations have repeatedly occurred as a result of magma intrusions, but the activity has not culminated in an eruption.

Recent Volcanic Activity

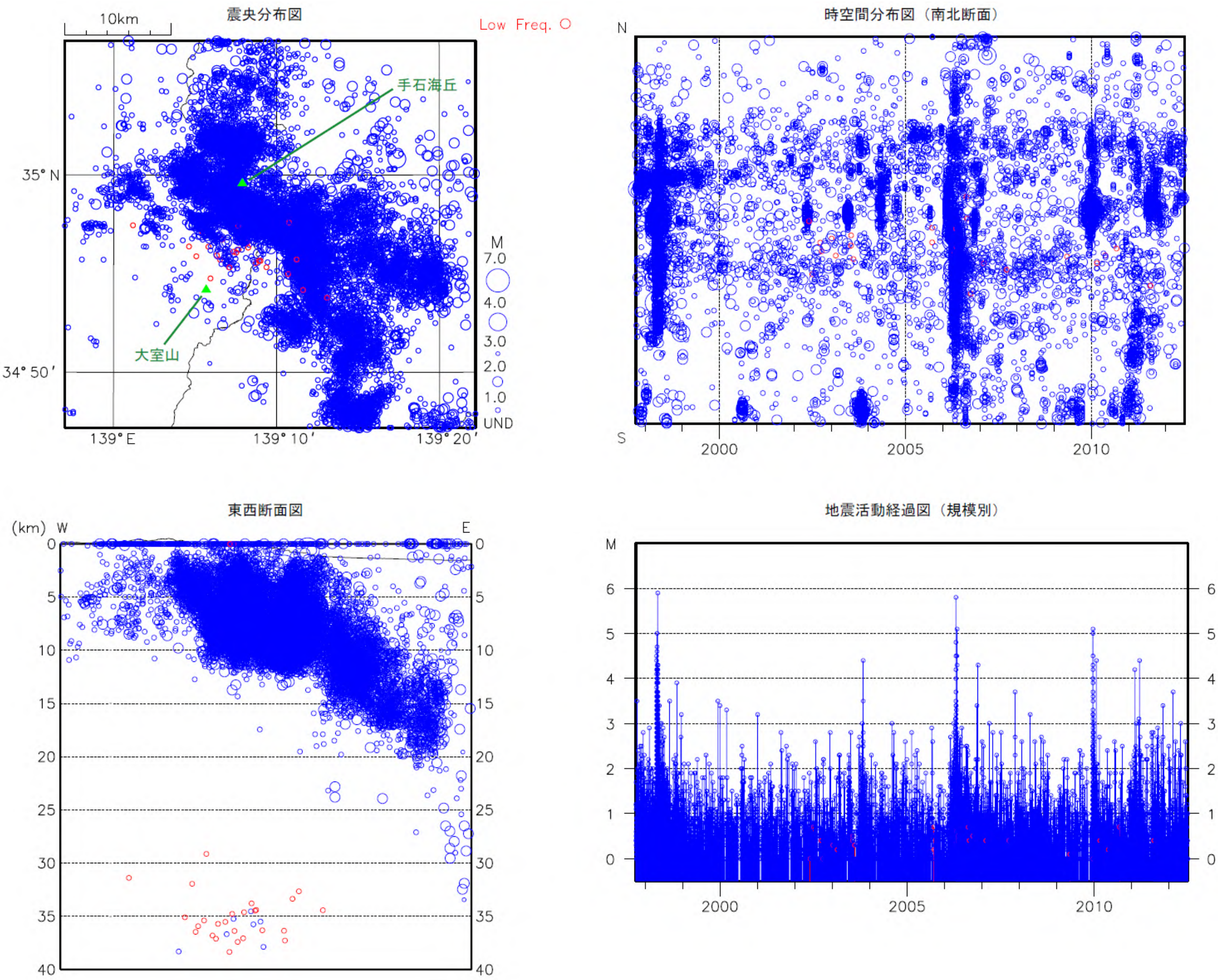


Figure 57-9 Activity of shallow VT earthquakes (blue circles) and deep low-frequency earthquakes (red circles) observed by a regional seismometer network (October 1, 1997, to October 31, 2011). Epicenter distribution (upper left), space-time plot (N-S cross-section) (upper right), E-W cross-section (lower left) and magnitude-time diagram (by scale) (lower right).

Table 57-1 List of Earthquake Swarms in and around the Izu-Tobu Volcanoes (Headquarters for Earthquake Research Promotion Earthquake Research Committee (2010))

2010.07.07版

伊豆東部の群発地震活動一覧表

ゴシックは主な地震活動（総エネルギーが10E11以上及び最大震度が3以上）

番	開始日	終了日	期間	間隔	鎌田回数	最多日回数		M別回数						最大地震		有感地震				最大震度（地点別・（ ）内回数）			歪変化開始日	歪変化終了日		体積歪計	傾斜計		
号	年/月/日	年/月/日	日	日	回	回	年/月/日	1	2	3	4	5	6～	M	年/月/日	回数	震度3	震度4	5以上	網代	伊東	大島				気)東伊豆	防)伊東	防)徳永	防)岡
1	78/11/23	79/02/03	73		11433	1011	78/12/01	27	47	19	1	2		5.5	78/12/03	26	0	1		4(1)		3(1)							
2	79/03/12	79/04/09	29	37	2593	374	79/03/17	11	7	3				3.5	79/03/15	4				1(3)		1(1)							
3	79/05/18	79/06/08	22	39	1905	481	79/05/20	9	8	5	1			4.0	79/05/20	7				2(2)		2(1)							
4	80/06/23	80/10/01	101	381	14081	1486	80/06/29	103	180	182	13	3	1	6.7	80/06/29	234	13	2	1	5(1)		5(1)							
5	82/03/10	82/03/30	21	525	392	100	82/03/16	1						1.6	82/03/15	0				0		0				—			
6	82/05/07	82/05/21	15	38	1310	643	82/05/11	0						—	82/05/11	0				0		0				—			
7	82/09/07	82/09/14	8	109	676	510	82/09/09	1	0	1				3.9	82/09/09	2				2(2)		2(2)				—			
8	83/01/14	83/02/05	23	122	2183	377	83/01/16	30	148	22	6			4.6	83/01/20	49	7			3(1)		3(7)				—			
9	84/08/30	84/10/11	43	572	5976	790	84/09/05	65	164	44	8			4.7	84/09/05	101	9			3(2)		3(9)				—			
10	85/03/16	85/05/09	55	156	2745	459	85/04/17	3	3					2.7	85/04/15	0				0		0				—			
11	85/10/13	85/11/11	30	157	4207	1109	85/10/20	152	42	3	1			4.1	85/10/29	12	2			3(2)		1(3)	85/10/13 20:00	85/10/25 19:00	*	-540			
12	85/12/18	86/01/08	22	37	978	490	85/12/20	3	7	2				3.3	85/12/21	4				1(1)		1(4)				—			
13	86/10/10	86/11/01	23	275	6125	2436	86/10/12	249	110	10	3			4.8	86/10/13	16	2			3(2)		3(1)	86/10/10 06:00	86/10/17 09:00		-580			
14	87/05/06	87/06/07	33	186	2645	895	87/05/11	138	264	38	7	1		5.1	87/05/11	90	8			3(4)		3(8)				—			
15	88/02/14	88/03/02	18	252	579	203	88/02/20	41	16	8	1			4.7	88/02/20	8	1			2(1)		3(1)				—			
16	88/04/25	88/05/01	7	54	204	89	88/04/26	2	1					2.1	88/04/30	0				0		0				—			
17	88/05/30	88/06/04	6	29	80	42	88/05/31	9	5	1				3.0	88/06/01	1				0		2(1)				—			
18	88/07/26	88/09/15	52	52	17171	3292	88/07/31	1156	506	178	39	3		5.2	88/07/31	293	27	4		4(4)		3(17)	88/07/26 07:00	88/08/08 01:00	*	-1050			
19	89/05/21	89/06/03	14	248	1173	542	89/05/25	39	1					2.3	89/05/24	0				0		0	89/05/21 12:00	89/05/27 17:00		-530	○		
20	89/06/30	89/09/06	69	27	24989	4419	89/07/04	589	594	135	33	3		5.5	89/07/09	494	40	5		4(5)		4(1)	89/06/30 10:00	89/07/10 02:00	*	-840	○		
21	91/08/20	91/08/23	4	713	61	53	91/08/21	1						1.5	91/08/20	0				0		0				—	?		
22	91/12/25	92/01/01	8	124	353	161	91/12/26	29	10					2.7	91/12/26	3				1(3)		0	91/12/25 02:00	91/12/28 15:00		-90	○		
23	93/01/10	93/01/18	9	375	2064	995	93/01/11	341	61	17	1			4.2	93/01/10	38	2			3(2)		2(3)	93/01/09 14:00	93/01/17 11:00		-260	○		
24	93/05/26	93/06/15	21	128	9567	2609	93/05/31	1020	301	67	14			4.8	93/05/31	174	25	7		4(2)	4(7)	3(1)	93/05/26 13:00	93/06/04 13:00	*	-590	○		
25	94/01/03	94/01/09	7	202	55	25	94/01/03	0	2					2.1	94/01/03	0				0		0				—	?		
26	94/02/27	94/03/12	14	49	300	53	94/02/28	42	10	0	1			4.2	94/02/27	1				1(1)		2(1)	94/02/27 17:00	94/02/28 19:00		-20	—		
27	94/11/14	94/11/20	7	247	66	17	94/11/16	17	4	1	1			4.0	94/11/16	1				2(1)		2(1)				—	?		
28	95/09/11	95/09/15	5	295	201	125	95/09/12	36	1					2.1	95/09/12	0				0		0	95/09/10 11:00	95/09/14 02:00		-100	?	?	
29	95/09/18	95/09/23	6	3	190	107	95/09/18	49	1					2.4	95/09/21	0				0		0	95/09/18 10:00	95/09/20 13:00		-110	?	?	
30	95/09/29	95/10/28	30	6	9078	1626	95/09/29	1264	454	58	11	1		5.0	95/10/01	149	18	5		4(1)	4(5)	3(2)	95/09/28 14:00	95/10/07 03:00	*	-790	○	○	
31	96/07/02	96/07/28	27	248	315	61	96/07/15	22						1.9	96/07/12	0				0		0				—	○	—	
32	96/10/15	96/11/10	27	79	6005	2172	96/10/16	763	131	21	1			4.3	96/10/16	44	1	1		3(1)	4(1)	2(2)	96/10/15 12:00	96/10/21 17:00		-460	○	○	
33	96/12/17	96/12/24	8	37	75	21	96/12/18	29	10	6	1			4.1	96/12/17	9				1(2)	1(3)	2(1)				—	?	?	
34	97/03/03	97/03/26	24	69	9334	2001	97/03/07	806	614	120	14	4		5.9	97/03/04	450	32	7	3	4(5)	5-(1)	4(1)	97/03/02 17:00	97/03/11 22:00		-600	○	○	○
35	97/06/20	97/06/26	7	86	57	29	97/06/21	11	1					2.6	97/06/21	1				1(1)	1(1)	0				—	?	?	?
36	97/06/27	97/07/15	19	1	439	132	97/06/30	31	1					2.0	97/07/04	0				0	0	0	97/06/28 10:00	97/07/01 10:00		-90	○	○	○
37	98/04/20	98/06/02	44	279	11038	1687	98/04/22	2018	961	133	16	2		5.9	98/05/03	210	11	5		4(3)	4(5)	4(1)	98/04/19 21:00	98/05/10 00:00	*	-1130	○	○	○
38	02/05/08	02/05/15	8	1436	399	146	02/05/09	34						1.5	02/05/09	0				0	0	0	02/05/07 11:00	02/05/14 01:00		-280	○	○	○
39	03/06/13	03/06/21	9	394	641	574	03/06/14	109	5					2.3	03/06/14	0				0	0	0	03/06/13 16:00	03/06/16 01:00		-130	○	○	○
40	04/04/24	04/05/02	9	308	323	140	04/04/25	41						1.9	04/04/25	0				0	0	0	04/04/24 17:00	04/04/30 22:00		-130	○	○	○
41	06/01/25	06/01/31	7	633	63	52	06/01/26	3						1.4	06/01/28	0				0	0	0	06/01/25 18:00	06/01/27 21:00		-50	○	○	○
42	06/02/21	06/03/02	10	21	199	83	06/02/23	30	4					2.7	06/02/25	2				2(2)	1(1)	0	06/02/21 10:00	06/02/25 20:00		-60	○	○	○
43	06/03/30	06/04/10	12	28	565	281	06/03/30	114	9	1				3.0	06/03/31	2				1(2)	0	1(1)	06/03/30 13:00	06/04/02 02:00		-170	○	○	○
44	06/04/17	06/05/12	26	7	3008	954	06/04/18	1554	268	13	7	2		5.8	06/04/21	49	4	2	1	5-(1)	4(1)	4(1)	06/04/17 09:00	06/04/24 09:00		-400	○	○	○
45	06/11/10	06/11/12	3	182	54	42	06/11/10	10	1	1				3.4	06/11/12	1				1(1)	0	0	06/11/09 15:00	06/11/12 20:00		-80	○	○	○
46	09/12/16	10/01/12	28	1130	6526	2583	09/12/18	1964	319	36	6	2		5.1	09/12/18	259	17	4	2	3(2)	5-(2)	2(1)	09/12/16 22:00	09/12/20 23:00		-210	○	○	○

・間 隔：前回の活動の終了日からの日数（休止期間）
・鎌田回数：伊東市鎌田地震観測点で観測された地震回数
・M別回数：「1」は、1.0～1.9、以下同様
「6～」は、6.0以上

・5－：震度5弱
・網代：網代測候所（熱海市網代：2003年10月1日特地化）
・伊東：93年5月26日と95年9月29日は臨時観測
96年10月15日以降は伊東市大原
・大島：大島測候所（大島町元町字津倍付、
92年1月に大島町元町字家の上に移転。2009年10月1日に特地化。
ただし、96年10月15日と97年3月3日は大島町元町字津倍付）

・歪・傾斜変化：歪は地震時の段差状の歪変化を除いている
値はnstrain、○は変化有り、－は変化なし、△は不明、？は報告なし
・歪変化開始日：東伊豆の歪変化の始まった日時
・歪変化終了日：東伊豆の歪変化量が10nstrain/day以下となった日時
＊は期間中に複数回の歪変化がみられた活動

Major Volcanic Activity

・1989 Volcanic Activity

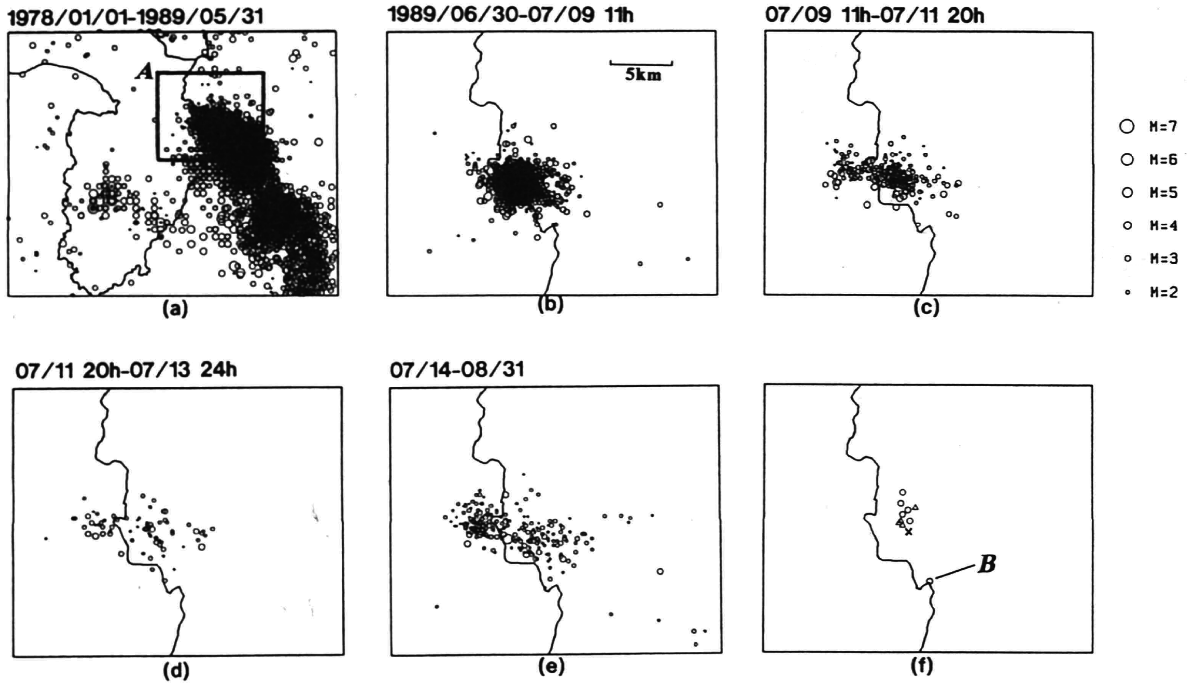


Figure 57-10 Distribution of volcanic earthquakes before and after the July 13, 1989 eruption (Yamasato et al., 1991).

(a) 1978 to May, 1989 (until start of earthquake swarm activity relating to the eruption)

(b) to (e) Epicenter distribution in the periods from June 30,1989, to August 31, 1989

(f) ○: Epicenters of low-frequency earthquakes occurring on or after July 5,

△: Epicenter of isolated event between 19:03 and 19:05 on July 13,

x: Location of the Teishi Knoll

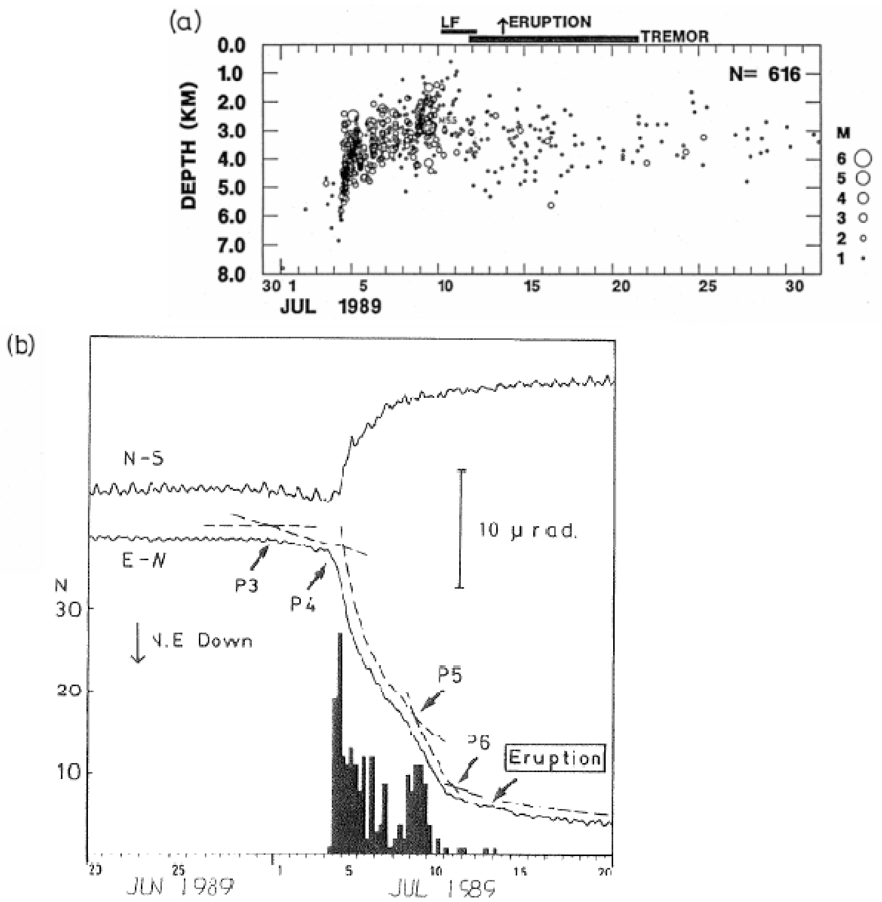


Figure 57-11
(a) Time series of depth of earthquakes which occurred on July, 1989 (Ueki, 1992).
(b) Changes in tilt observed at the National Research Institute for Earth Science and Disaster Prevention (then known as the National Research Center for Disaster Prevention) Ito observation point (Kana) (May 1, 1989, to July 31, 1989) (National Research Center for Disaster Prevention, 1989). The seismicity is synchronized with the tilt change, it strongly support that the earthquakes are generated by the stress change caused by the magma intrusion.

On July 4 the number of earthquake swarms increased, and many M>3 earthquakes occurred. At the same time, a large tilt-change was observed from P4. Seismic activity increased again from July 8, accompanied by accelerated and large tilt-changes.

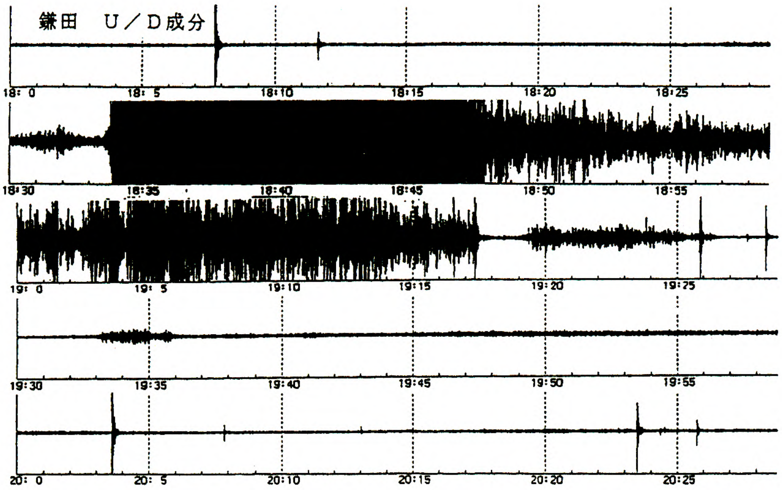


図45—10　1989年７月13日海底噴火の大きな微動の地震計記録（鎌田の地震計，上下動成分）
13日18時29分から始まり33分頃から48分頃まで振り切れとなった。
横軸の長さは30分。なお，海底噴火は13日18時33分頃～45分頃まで続いた。

Figure 57-12 Short-period seismogram that records a large amplitude of tremor which occurred on a submarine volcano on July 13, 1989 (vertical movement component at Kamata) (Japan Meteorological Agency, 1990).

It began at 18:29 on July 13, and tailed off from 18:33 to 18:48. Each horizontal line is drawn 30 minutes interval. The submarine eruption continued from roughly 18:33 to 18:45 on July 13.

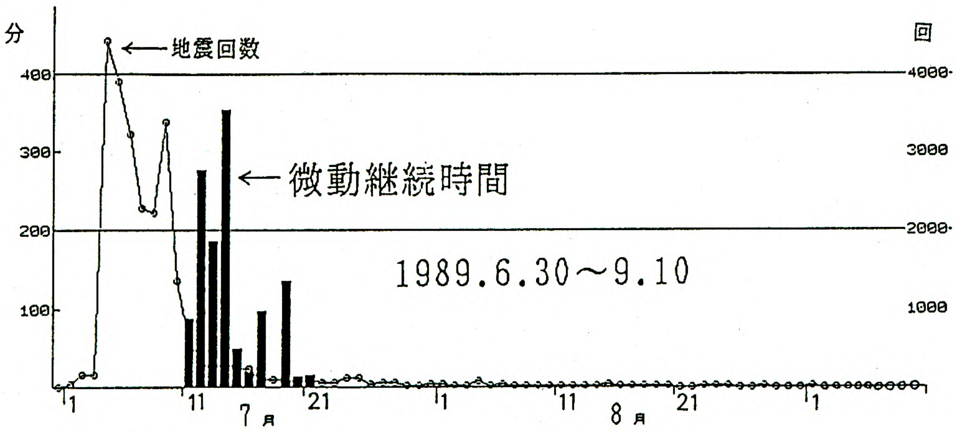


図45—9　伊豆東部火山群微動継続時間日別合計（1989年 6月30日～1989年 9月10日）
7月11日夜初めて微動が観測され，13日に噴火があった。微動は14日をピークに次第に減少し，21日を最後に観測されなくなった。折れ線グラフは伊東市鎌田での地震回数。
（気象庁1990，伊豆半島東方沖の群発地震及び海底火山噴火に関する調査）

Figure 57-13 Total duration of tremors per day at Izu-Tobu volcanoes (June 30, 1989, to September 10, 1989) (Japan Meteorological Agency, 1990).

Tremors were first observed on the night of July 11, and the eruption occurred on July 13. The volcanic tremor activity peaked on July 14, gradually decreasing thereafter. No more tremors were observed after August 1.

The line graph indicates the number of earthquakes at Kamata, Ito.

・Earthquake and Crustal Activity Since 1990

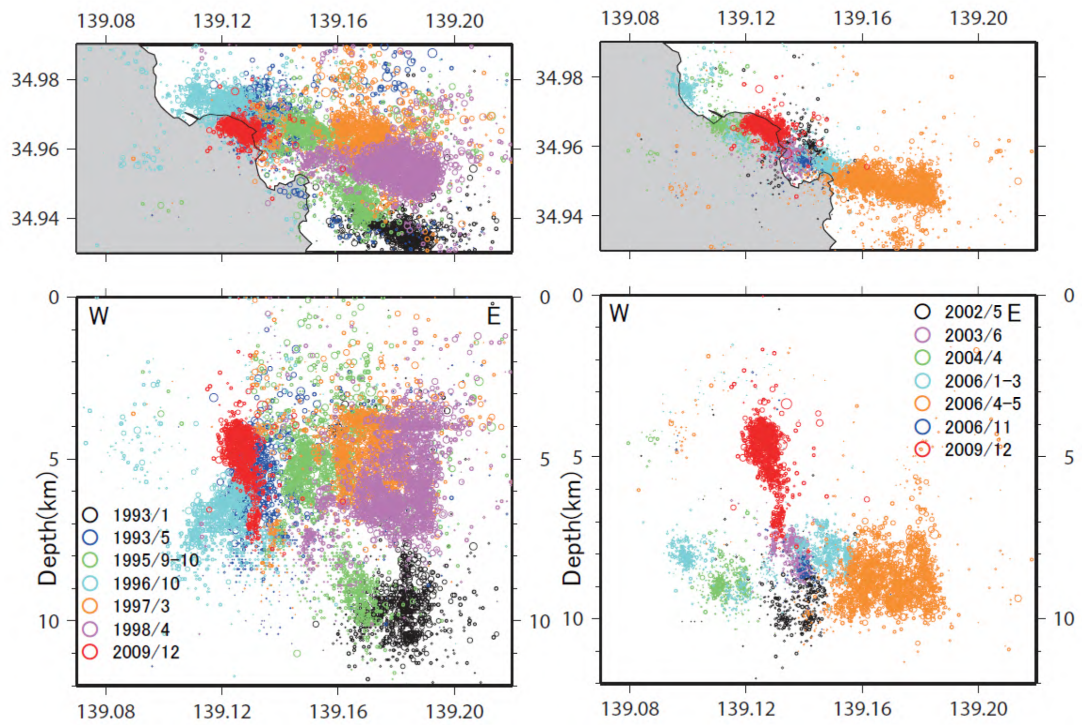


Figure 57-14

(Left)Epicenter map and its cross section for the earthquake swarm during the 1990's and activity in December, 2009.

(Right) Those during the 2000's and activity in December, 2009 (Earthquake Research Institute, Univ. of Tokyo, 2010).

The all hypocenters distributes uniformly on a sub-vertical plane. Hypocenters for each swarm occupied the place where no previous earthquake swarm occurred.

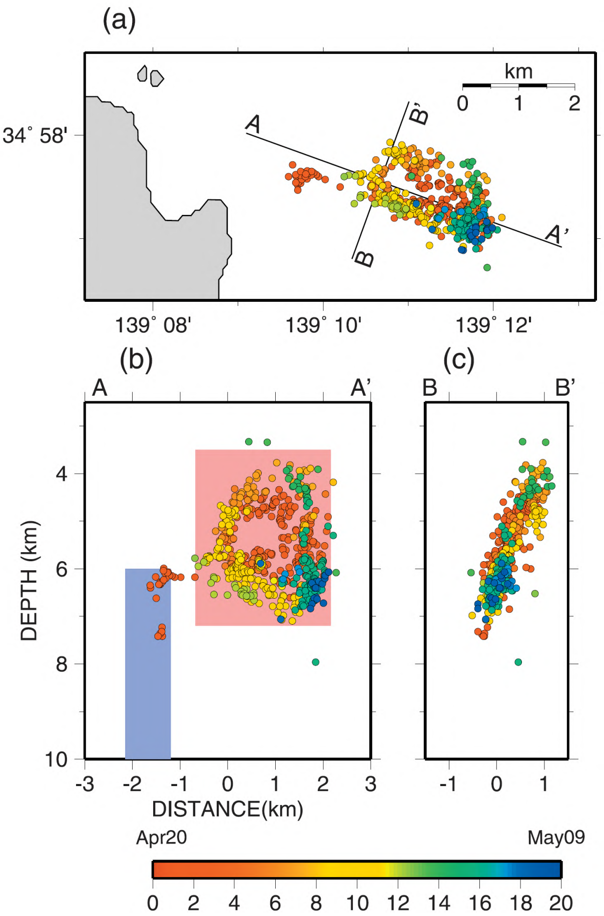


Figure 57-15

Epicenter map and cross sections of the precisely relocated hypocenters for the 1989 swarm activity. (Morita et al. 2006). Colors indicate the lapse time since the activity began.

The earthquakes are aligned on a sub-vertical plane. On the first day of the activity, earthquakes occurred only in the region shown by blue rectangle in the figure. One day after of the beginning, earthquakes migrated outward of the region to the center of the main part of the hypocenter distribution (red rectangle in the figure).

GPS analyses indicated that the dike located in the blue rectangle opened on the first day of the activity and the dike in the red rectangle opened afterward. The volume in the dike increased with the area of hypocenter distribution.

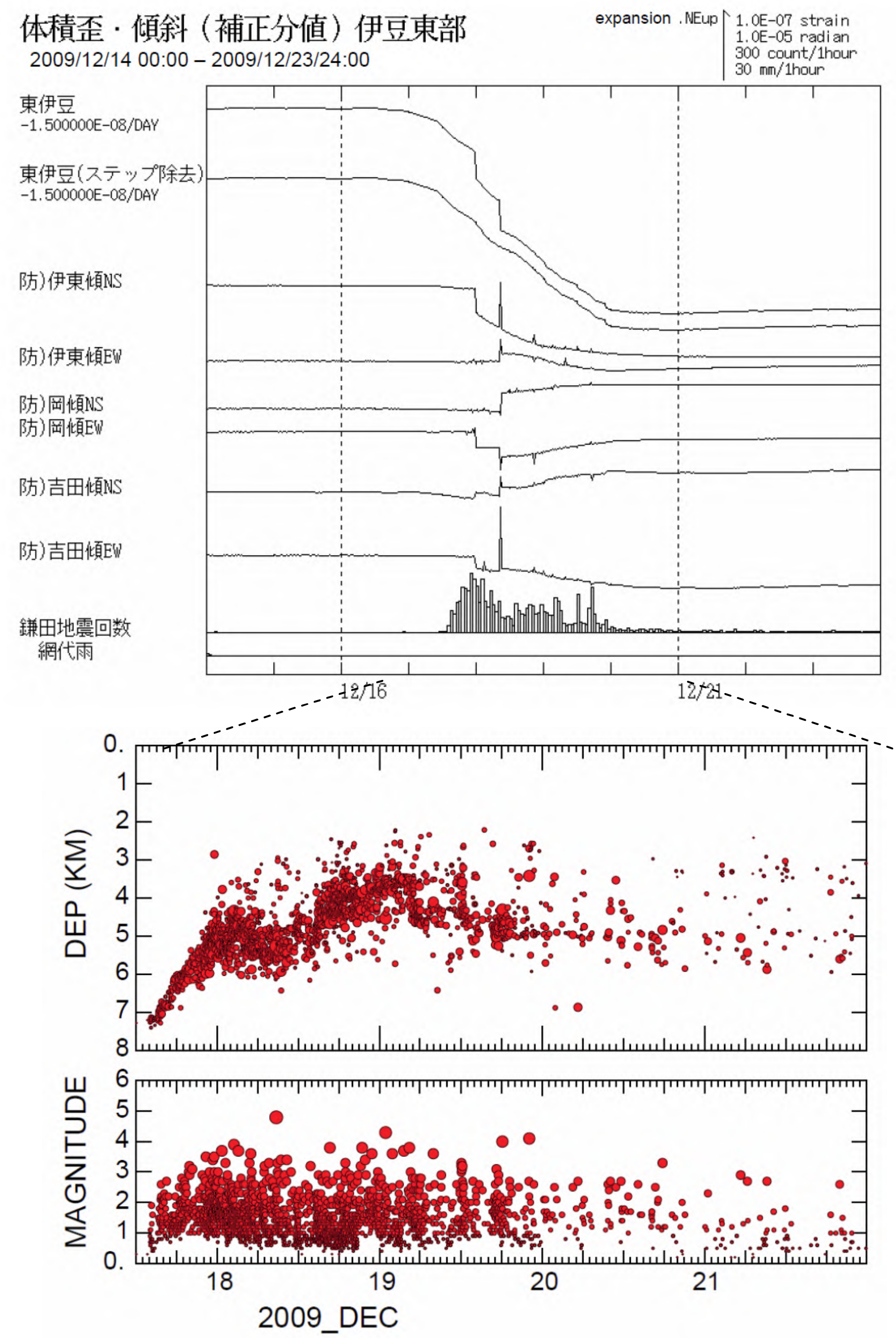


Figure 57-16 (a) Time series of crustal deformation at Izu-Tobu volcanoes from December 14 to December 23, 2009 (Japan Meteorological Agency, 2010). (b) Temporal changes of hypocenter depth of the swarm activity in December, 2009 (Tokyo University Earthquake Research Institute, 2010)

・ During the first day of the activity, the hypocenters rise up to the depth of approximately 5km bsl and they migrated upward and downward. Given that earthquakes are generated at the tip of the dike, it is likely that hypocenter migration represents the magma emplaces up and downward from the level of the neutral buoyancy, at a depth of roughly 5km. When the magma is observed to rise further, an eruption is anticipated.

・The ground deformation prior to earthquake swarms were observed by volumetric strain-meter operated by Japan Meteorological Agency.

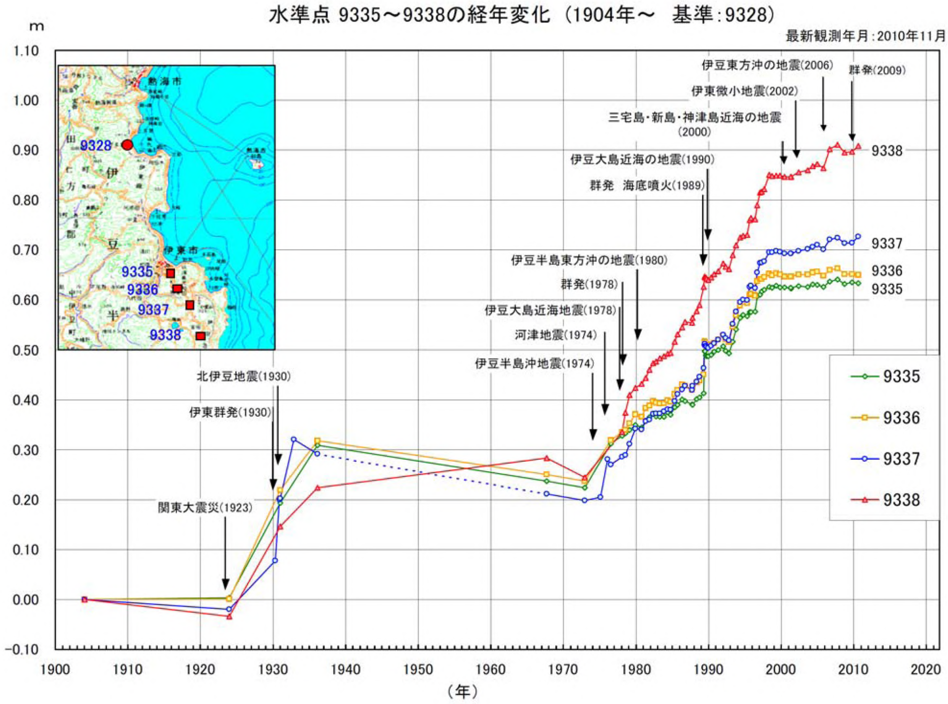


Figure 57-17 Long-term change in vertical displacement at a bench mark (BM9328) on the east coast of the Izu Peninsula measured by precise leveling (Geospatial Information Authority of Japan, 2012).

The chart shows a period of uplift during the 1930s, which corresponds to roughly the time of the Kanto earthquake in 1923 and the North Izu earthquake in1930., After the period of dormancy leading up to the early 1970s, seismic swam activity increased again with the earthquake off the coast of the Izu Peninsula in 1974, calming over the next quarter century up to the late 1990s.

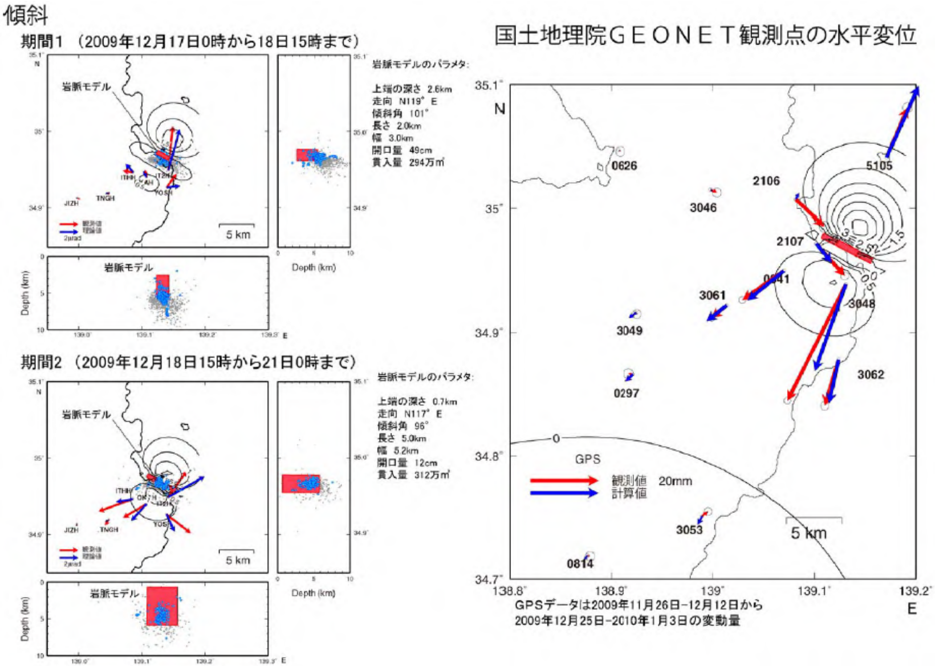


Figure 57-18 Crustal deformation model associated with the December, 2009 earthquake swarms (National Research Institute for Earth Science and Disaster Prevention, 2010).

These figures show the results obtained from the analysis using the tilt data of National Research Institute for Earth Science and Disaster Prevention and GPS data of Geospatial Information Authority of Japan. In the analysis existence of two dikes are assumed.

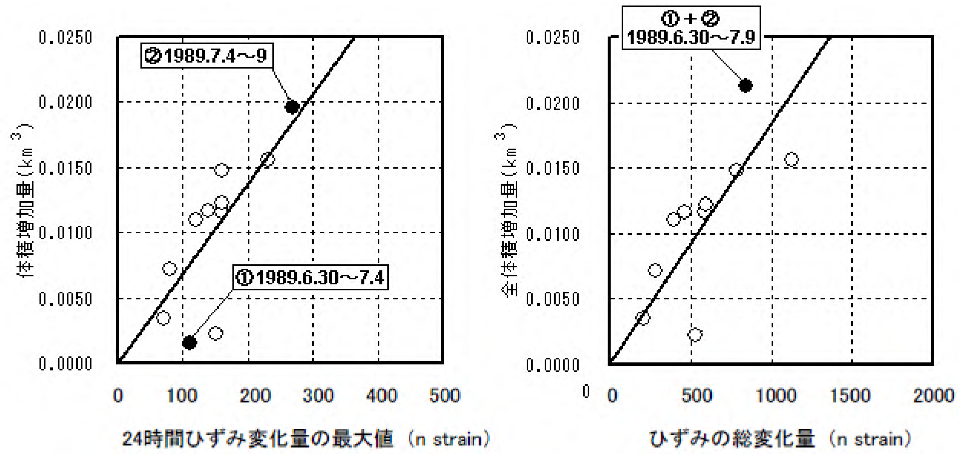


Figure 57-19 Relationship between the volume increase of magmatic dike and the strain change during the earthquake swarms in Higashi Izu (Miyamura et al., 2010).

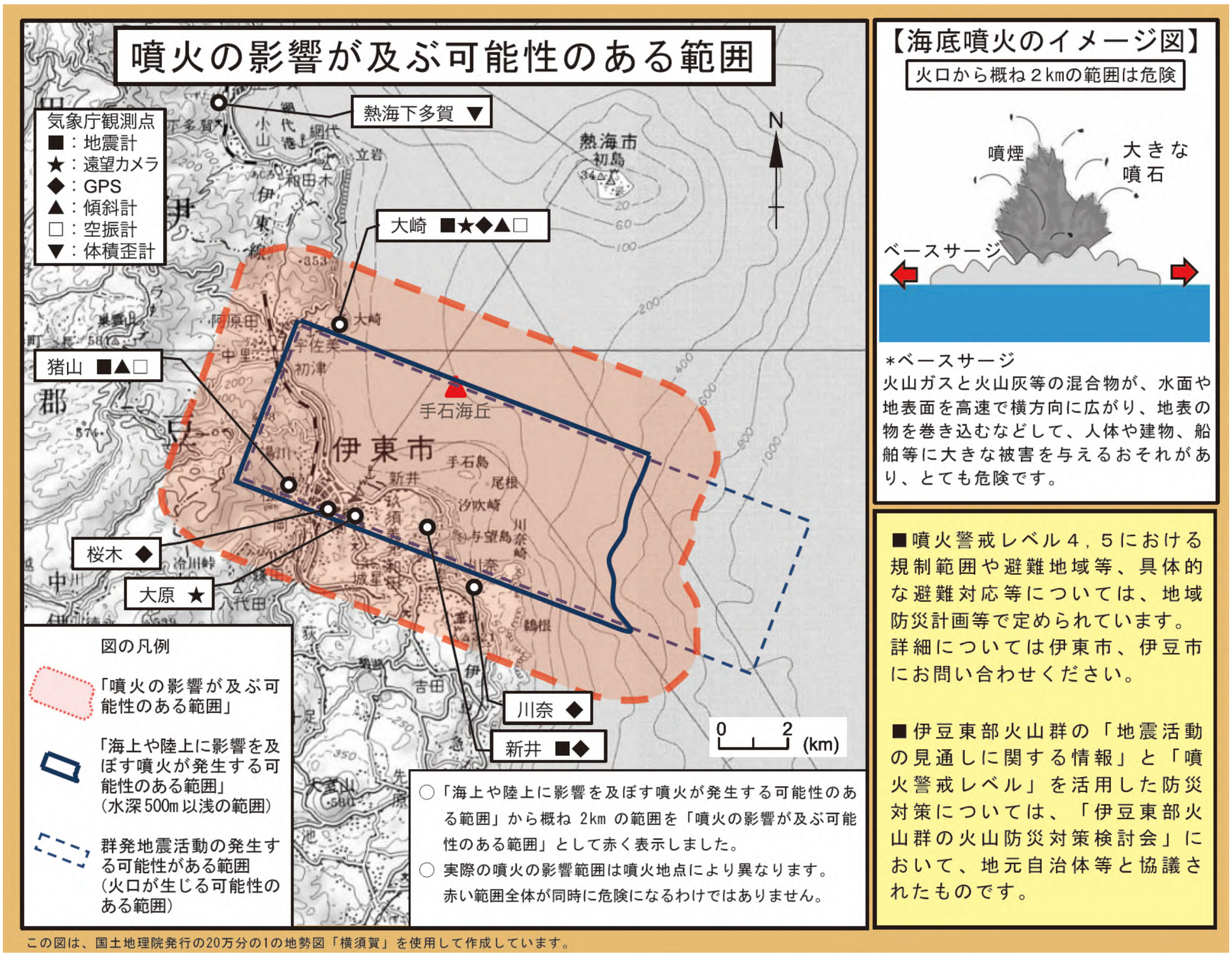
Both the total contraction strain change and the maximum amount of change over 24 hours at the Higashi Izu observation point corresponds very well with the amount of underground magma intrusion.

Information on Disaster Prevention

①Hazard Map

The "Potential Range of Eruption Damage" contained in the " Volcano Disaster Prevention Measure Deliberation Committee Report at Izu-Tobu Volcanoes (currently being drafted)" is being used as a volcano disaster prevention map.

②Volcanic Alert Levels (Used since March 31, 2011)



Volcanic Alert Levels for the Izu-Tobu Volcanoes

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	● Volcanic blocks[Note)] and/or base surge reach residential areas due to a phreatomagmatic eruption ● Low frequency earthquake swarms and volcanic tremors occur. Past Examples July 11, Heisei 1 (1989): Low frequency earthquake swarms and volcanic tremors occurred, followed by an submarine eruption on July 13
		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.	● Low frequency seismic activity is high. Past Examples July 10, Heisei 1 (1989): The low-frequency seismic activity which began on July 10 intensified.
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.	[Level 2 and Level 3 Announcements] ○ When activity is high When the possibility of eruption is heightened, no level 2 or level 3 announcements are made. Instead, a level 4 or level 5 announcement is made. ○ When activity is high When volcanic activity is calm, and the level is lowered from level 5, levels 2 or 3 may be announced depending on the state of volcanic activity.
	Crater area	2 Do not approach the crater	Eruption or prediction of eruption affecting area around crater (entering area is life threatening).	Residents can go about daily activity as normal. Access to crater area restricted, etc.	
Eruption Forecast	Inside the crater	1 Normal	Little or no volcanic activity. Volcanic earthquake swarms may occur due to magma activity deep underground.	Residents can go about daily activity as normal. Residents must avoid dangerous areas, secure furniture, and take other countermeasures against strong swaying.	● Little or no volcanic activity. ● High volcanic earthquake swarm activity may result in strong shaking, with JMA scale seismic intensities of 5-lower to 6-lower. Past Examples This has occurred in recent years with the earthquake swarm activity of April, 2006 (Heisei 18) and December, 2009 (Heisei 21)

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

- Ito City: 73,117 (As of June 1, 2012)
- Izu City: 34,176 (As of July 1, 2012)
- Atami City: 39,407 (as of the end of May, 2012)
- Izunokuni City: 49,709 (As of July 1, 2012)
- Higashi Izu Town: 13,769 (As of June 30, 2012)

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

- Fuji-Hakone-Izu National Park (Izu Peninsula area)
- Izu Peninsula area, including the Izu-Tobu volcanoes, was certified as a "Japanese Geopark" in September, 2012.

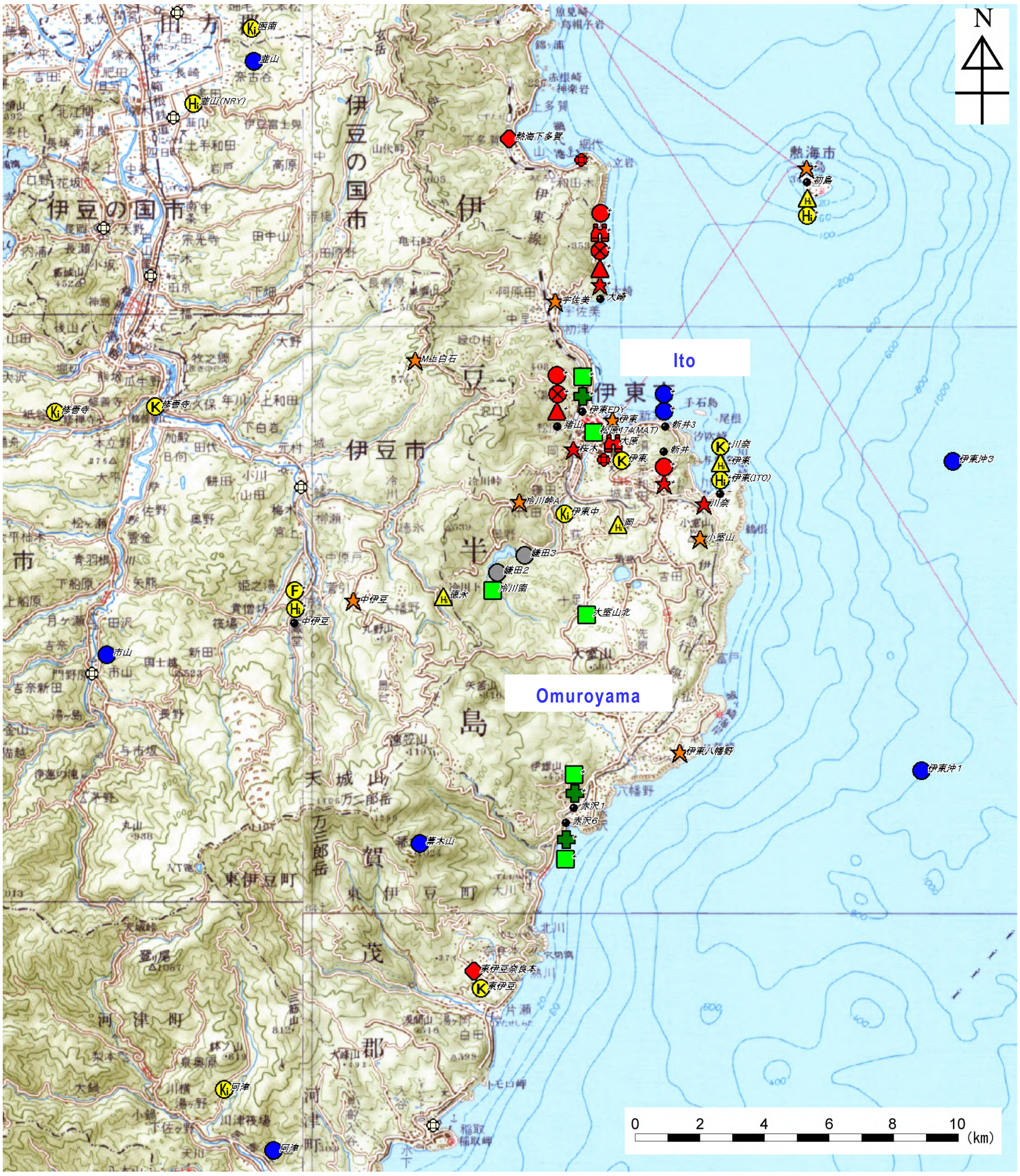
⑤Facilities

None

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 (Shizuoka, Yokosuka, Omaezaki and Miyakejima) published by the Geospatial Information Authority of Japan were used.

Legend

(JMA)
- seismometer(SP)
- GPS
- tiltmeter
- strainmeter
- infrasonic microphone
- visual camera
- seismic intensity meter
- seismometer(SP) (For earthquakes and tsunamis)

(GSI)
- GPS

(NIED)
- Hi-net
- Hi-net(tiltmeter)
- F-net
- K-NET
- KiK-net

(AIST)
- water thermometer
- waterlevel gauge

(ERI)
- seismometer(SP)

(Municipalities)
- seismic intensity meter

Figure 57-20 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 (Ito and Atami) published by the Geospatial Information Authority of Japan were used.

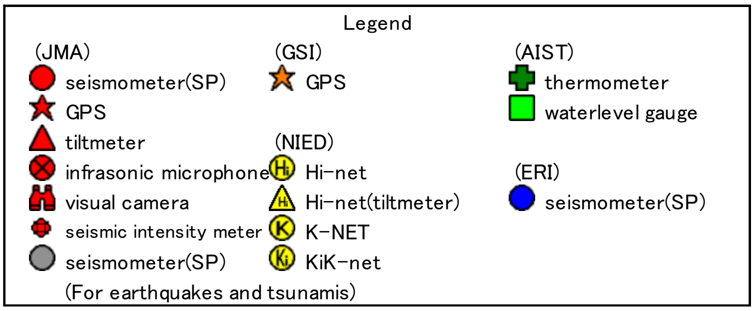


Figure 57-21 Local monitoring network.

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