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GLOBAL SUMMARY OF VOLCANO-DEFORMATION MONITORING

by

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Introduction

Observation and measurement of surface deformation at volcanoes have been used for many years to monitor volcanic activity. Surface deformation from vertical and horizontal stresses can be manifested as horizontal and vertical movements in the form of strain, tilt, cracks, bulges, slumps, and changes in the gravitational field. Measured inflation and/or deflation of a volcanic edifice is interpreted to result from changes of pressure or volume within a volcano resulting from movement of magma under or into the volcano. Volcanoes may inflate weeks to months before an eruption and then deflate immediately before, during, or after the eruption. Analysis of these changes is used in conjunction with studies of other precursory activity to forecast and in some cases predict eruptions.

Current techniques to measure deformation changes at volcanoes include visual observations, electronic distance meter (EDM) measurements, water-tube tilt, single-setup leveling (formerly referred to as dry tilt or spirit-level tilt), electronic tilt, precise leveling, volumetric strain, triangulation, gravimetry, tide gauges, lake level, and Global Positioning System (GPS) measurements. Studies at individual volcanoes have been designed to collect baseline data, but more often than not the studies are initiated in response to elevated levels of volcanic unrest and baseline data do not exist. The current interest in volcanology and advances in technology have led to a diversification of methods since the first half of this century accompanied by an increase in the number of volcanoes that are being monitored.

The following database is a compilation of the current status of deformation monitoring at active volcanoes of the world. It is intended to provide a reference source for case studies. Data are drawn from published and unpublished papers and personal communication with various workers in the field of volcano-deformation monitoring. In many cases the scientific literature only partially answers the questions posed in the database even though efforts have been made to confirm the information presented in the following tables. Caution should be used in the interpretation of the data set.

Explanation of symbols used in the database tables

Volcano #

The volcanoes in this listing are arranged geographically, using the regional numbering system of the Catalog of Active Volcanoes of the World (CAVW), later modified and expanded by the Smithsonian Institution's Volcanoes of the World (Simkin and others, 1981). The first 4 digits identify the volcanic subregion, the remaining 2 or 3 digits identify the individual volcano within the subregion.

Latitude and Longitude

Latitude and longitude are expressed as decimal fractions of degrees.

Rock type

The predominant or most recently erupted rock type is included for each volcano. For simplicity, rock type is categorized by silica content. Symbols and associated silica ranges are as follows:

B: basalt, < 52% SiO_2
A: andesite, 52-62% SiO_2
D: dacite, 62-70% SiO_2
R: rhyolite, > 70% SiO_2
U: unknown

Types of deformation monitoring (methods have been discussed elsewhere)

E: EDM (electronic distance meter)
T: tilt - single-setup leveling (dry tilt, spirit-level tilt, tilt-leveling, water-tube tilt, and electronic tilt)
L: leveling - includes precise leveling and short level lines
S: volumetric strainmeter
R: triangulation
I: tide gauge
A: lake level
G: gravity
C: crack measurement
V: visual, air photos
P: GPS (global positioning system)

Year that monitoring was initiated

The year that a particular monitoring technique was initiated is included to give the reader an idea of the size of the data set. For any kind of analysis, a large data set spanning periods of quiescence and unrest is preferable. A question mark is used when the year that monitoring was initiated is unknown.

Frequency of measurements

T: temporary, measurements were taken for a finite period and have been since discontinued
0: continuous measurements (telemetered)
1: remeasured more than once a month
2: remeasured every 1 to 6 months
3: remeasured every 6 months to 1 year
4: remeasured less often than once a year
?: frequency of measurement unknown

Has there been deformation?

Y: yes, there has been significant deformation, larger than the measurement error estimated for that particular technique.
N: no, there has not been any significant deformation larger than the measurement error estimated for that particular technique.
U: unknown, there is not enough information in the cited references to determine whether there has or has not been significant deformation.

Other signs of unrest

S: seismicity
G: gas emissions
T: increased fumarole, hot-spring, or lake temperatures
R: reduction in the magnetic field
N: none
U: unknown

Dates of unrest

This column is intended to note the most recent episode of unrest regardless of whether the unrest culminated in an eruption. In the absence of an episode of unrest the most recent eruption was noted.

Explosivity (largest known VEI)

The Volcanic Explosivity Index (VEI) attempts to quantify the magnitude of historic eruptions. It is a scale of 0 to 8 with the value of 0 representing the least explosive eruption and the value of 8 representing the most explosive eruption. A question mark (?) in this category indicates that there is either no historic record for a particular volcano or that the activity and resulting deposits have not been documented well enough to assign a number. The criteria used to define the assignment of these numbers to a specific eruption are detailed in Newhall and Self (1980). This information was included to give the reader an indication of the possible magnitude of an eruption from a specific volcano.

Acknowledgements

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References

In addition to the specific references noted for each volcano, details concerning individual volcanoes and recent dates of unrest were obtained from the Smithsonian Institution's monthly Bulletin of the Global Volcanism Network (formerly the Scientific Event Alert Network) and the Volcanological Society of Japan's yearly Bulletin of Volcanic Eruptions.

Additional references used but not cited in the tabular listing include:

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Newhall, C.G., and Self, S., 1982, The Volcanic Explosivity Index (VEI): an estimate of explosive magnitude for historical volcanism: Journal of Geophysical Research, v. 87, p. 1231-1238.

Simkin, T., Siebert, L., McClelland, L., Bridge, D., Newhall, C., and Latter, J.H., 1981, Volcanoes of the World: Smithsonian Institution, Stroudsburg, Pa., Hutchinson Ross Publishing, 232 p.

Region: Italy									
Phlegraean Fields									
VOLCANO #	LATITUDE LONGITUDE	ROCK TYPE	TYPE OF MONITOR	YEAR MEASUREMENTS INITIATED	FREQUENCY OF MEASUREMENTS	HAS THERE BEEN DEFORMATION?	OTHER SIGNS OF UNREST	DATES OF UNREST	EXPLOSIVITY (LARGEST KNOWN VEI)
0101-01	40.827N	A	E	1970	?	Y	S,G	Deformation since 70 AD;	3
	014.139E		T	1970	?	Y		Current period of unrest	
			L	1906	?	Y		began in 1970	
			G	1981	?	Y			
			I	1970	?	Y			
			V	1538	?	Y			

Comments: The Phlegraean Fields is a caldera complex 12 km in diameter in southern Italy. The last eruption occurred in 1538 producing the Monte Nuovo pyroclastic cone. Deformation has been occurring slowly and continuously for at least 2000 years. Deformation of the caldera complex oscillates between inflation and deflation but has been dominated by deflation until this century. Some Roman buildings have been submerged by as much as 14 m below sea level. One area uplifted 150 mm between 1969 and 1972. Activity increased in summer 1982 and included uplift, seismicity, fumarolic activity, and microgravity changes.

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Vesuvius									
VOLCANO #	LATITUDE LONGITUDE	ROCK TYPE	TYPE OF MONITOR	YEAR MEASUREMENTS INITIATED	FREQUENCY OF MEASUREMENTS	HAS THERE BEEN DEFORMATION?	OTHER SIGNS OF UNREST	DATES OF UNREST	EXPLOSIVITY (LARGEST KNOWN VEI)
0101-02	40.821N	B	E	1975	2	Y	N	None	5
	014.426E		T	1974	?	N			
			L	1974	?	N			
			G	?	?	N			
			R	1974	?	N			

Comments: Vesuvius is a composite volcano. It last erupted in 1944. Zenithal distance between the crater rim and a point on the crater bottom shortened slightly since 1974. This trend may be due to the compacting of loose material on the crater bottom. There has been no precursory unrest at Vesuvius since deformation monitoring began.

References

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Ischia Caldera									
VOLCANO #	LATITUDE LONGITUDE	ROCK TYPE	TYPE OF MONITOR	YEAR MEASUREMENTS INITIATED	FREQUENCY OF MEASUREMENTS	HAS THERE BEEN DEFORMATION?	OTHER SIGNS OF UNREST	DATES OF UNREST	EXPLOSIVITY (LARGEST KNOWN VEI)
0101-03	40.73 N	A	T	1974	?	U		M=4.6 earthquake occurred	3
	013.90 E		L	1913	?	Y		in 1961	
			V	1835	?	Y			

Comments: Alternating uplift and subsidence have been occurring for several years.

References

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Stromboli									
VOLCANO #	LATITUDE LONGITUDE	ROCK TYPE	TYPE OF MONITOR	YEAR MEASUREMENTS INITIATED	FREQUENCY OF MEASUREMENTS	HAS THERE BEEN DEFORMATION?	OTHER SIGNS OF UNREST	DATES OF UNREST	EXPLOSIVITY (LARGEST KNOWN VEI)
0101-04	38.789N	B	E	1975	?	Y	S,G,T	Constant	3
	015.213E		T	1975	?	Y			

Comments: Stromboli has been in almost constant eruption for the past 2000 years.

References

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Vulcano									
VOLCANO #	LATITUDE LONGITUDE	ROCK TYPE	TYPE OF MONITOR	YEAR MEASUREMENTS INITIATED	FREQUENCY OF MEASUREMENTS	HAS THERE BEEN DEFORMATION?	OTHER SIGNS OF UNREST	DATES OF UNREST	EXPLOSIVITY (LARGEST KNOWN VEI)
0101-05	38.404N	A	E	1974	?	Y	S,T	Unrest began with an	4
	014.962E		L	1976	?	Y		earthquake in 1978	
			T	1975	?	Y			
			G	?	?	U			

Comments: A magnitude 5.5 earthquake beneath Vulcano on April 15, 1978, initiated subsidence and opened fractures. High-temperature fluids rose along these conduits and increased activity at the fumaroles. The increased fluid flow at depth temporarily raised pressures and caused uplift. Subsequent leakage of fluids at the surface relieved the pressure at depth and subsidence soon followed.

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Etna									
VOLCANO #	LATITUDE LONGITUDE	ROCK TYPE	TYPE OF MONITOR	YEAR MEASUREMENTS INITIATED	FREQUENCY OF MEASUREMENTS	HAS THERE BEEN DEFORMATION?	OTHER SIGNS OF UNREST	DATES OF UNREST	EXPLOSIVITY (LARGEST KNOWN VEI)
0101-06	37.734N	A	T	1975	2	Y	S,G	Activity is continuous	3
	015.004E		E	1976	?	Y			
			L	1975	2	Y			
			G	1974	?	Y			
			I	?	?	U			

Comments: Mt. Etna typically deforms asymmetrically. The north side of the mountain appears to subside as a result of loading of lava. The south side displays a small amount of local inflation before eruptions.

References

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Region: Africa									
Nyamuragira									
VOLCANO #	LATITUDE LONGITUDE	ROCK TYPE	TYPE OF MONITOR	YEAR MEASUREMENTS INITIATED	FREQUENCY OF MEASUREMENTS	HAS THERE BEEN DEFORMATION?	OTHER SIGNS OF UNREST	DATES OF UNREST	EXPLOSIVITY (LARGEST KNOWN VEI)
0203-02	01.38 S	B	E	1977	4	Y	S	Eruptions in 1976-77,	3
	029.20 E		T	1982	4	Y		1980, 1981-82, 1984,	
			G	1982	Temporary	U		1986, 1988, and 1989	

References

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Region: Reunion Island									
Piton de la Fournaise									
VOLCANO #	LATITUDE LONGITUDE	ROCK TYPE	TYPE OF MONITOR	YEAR MEASUREMENTS INITIATED	FREQUENCY OF MEASUREMENTS	HAS THERE BEEN DEFORMATION?	OTHER SIGNS OF UNREST	DATES OF UNREST	EXPLOSIVITY (LARGEST KNOWN VEI)
0303-02	21.229S	B	T	1982	0	Y	S	Activity almost constant	2
	055.713E		E	1981	?	Y			
			L	?	?	U			
			R	1981	?	U			
			G	?	?	U			
			V	1981	4	Y			

Comments: Piton de la Fournaise has been erupting olivine-basalt on the average of once per year for the last 50 years. No long-term inflation has been observed. No precursory deformation was observed before the 1983 eruption but inflation was measured 2 weeks before the second phase of that eruption and before the June, 1985 eruption.

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Region: New Zealand									
Egmont									
VOLCANO #	LATITUDE LONGITUDE	ROCK TYPE	TYPE OF MONITOR	YEAR MEASUREMENTS INITIATED	FREQUENCY OF MEASUREMENTS	HAS THERE BEEN DEFORMATION?	OTHER SIGNS OF UNREST	DATES OF UNREST	EXPLOSIVITY (LARGEST KNOWN VEI)
0401-03	39.30 S 174.08 E	A	T	1983	4	N	N	Eruption in 1750	?

Comments: Tilt up to 10 microradians has been recorded. Inconsistent data patterns suggest benchmark instability is the likely cause.

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White Island									
VOLCANO #	LATITUDE LONGITUDE	ROCK TYPE	TYPE OF MONITOR	YEAR MEASUREMENTS INITIATED	FREQUENCY OF MEASUREMENTS	HAS THERE BEEN DEFORMATION?	OTHER SIGNS OF UNREST	DATES OF UNREST	EXPLOSIVITY (LARGEST KNOWN VEI)
0401-04	37.52 S 177.18 E	A,D	L	1967	2	Y	S,G,R,T	11 major eruptions from 1967 to 1983	3

Comments: The rate of deformation at White Island is much higher than the highest tectonic rates in New Zealand. The vertical movements observed at the volcano are typically oscillatory. A bulge developed in the crater of White Island prior to the 29 January 1968 eruption and disappeared following it. Many tephra eruptive episodes since 1967 have been preceded by this style of uplift.

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Haroharo Caldera									
VOLCANO #	LATITUDE LONGITUDE	ROCK TYPE	TYPE OF MONITOR	YEAR MEASUREMENTS INITIATED	FREQUENCY OF MEASUREMENTS	HAS THERE BEEN DEFORMATION?	OTHER SIGNS OF UNREST	DATES OF UNREST	EXPLOSIVITY (LARGEST KNOWN VEI)
0401-05	38.092S	R	A	1976	0	N	S	No historic eruptions;	6
	176.508E		T	1978	4	N		seismic swarm in 1982	

Comments: In the past 300,000 years, Haroharo caldera has been the site of repeated large silicic eruptions producing thick pyroclastic deposits. Deformation monitoring has not detected any significant changes.

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Tarawera									
VOLCANO #	LATITUDE LONGITUDE	ROCK TYPE	TYPE OF MONITOR	YEAR MEASUREMENTS INITIATED	FREQUENCY OF MEASUREMENTS	HAS THERE BEEN DEFORMATION?	OTHER SIGNS OF UNREST	DATES OF UNREST	EXPLOSIVITY (LARGEST KNOWN VEI)
0401-06	38.229S	R,B	E	1983	4	N	S	Last large eruption	5
	176.508E		A	1976	0	Y		in 1886	
			T	1975	3	N			

Comments: Tarawera is a rhyolite dome complex located on the south margin of Haroharo Caldera. Phreatic eruptions occurred in the Waimangu region in 1973 and 1981.

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Taupo Caldera									
VOLCANO #	LATITUDE LONGITUDE	ROCK TYPE	TYPE OF MONITOR	YEAR MEASUREMENTS INITIATED	FREQUENCY OF MEASUREMENTS	HAS THERE BEEN DEFORMATION?	OTHER SIGNS OF UNREST	DATES OF UNREST	EXPLOSIVITY (LARGEST KNOWN VEI)
0401-07	38.78 S	R	E	1964	4	N	S	Seismic swarm in 1983	6
	176.12 E		T	1977	4	Y			
			A	1979	2	Y			
			L	1956	4	Y			
			R	1956	4	Y			

Comments: In 1983, two earthquake swarms affected northern Lake Taupo and were accompanied by tilt changes. Observed displacement was 5.7 cm of uplift of the northern end of the lake. This activity was followed by another seismic swarm. Within days 5 cm of subsidence occurred along the Kaiapo Fault. Earthquake swarms occur regularly, and horizontal and vertical deformation surveys suggest the widening of the fault zone and emplacement of magma at deeper levels. Lake-level monitoring has proved to be an effective tool for measuring deformation at Lake Taupo. Since 1979 five periods of deformation have been detected with this method.

References

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New Zealand Volcanological Record Nos. 1-16 (1973-1988).

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Otway, P.M., 1989, Vertical deformation monitoring by periodic water level observations, Lake Taupo, New Zealand, in Latter, J.H., ed., Volcanic Hazards: Berlin, Springer-Verlag, p. 561-574.

Otway, P.M., Grindley, G.W., and Hull, A.G., 1984, Earthquakes, active fault displacement, and associated vertical deformation near Lake Taupo, Taupo Volcanic Zone: New Zealand Geological Survey, Report 110, 73 p.

Wilson, C.J.N., Rogan, A.M., Smith, I.E.M., Northey, D.J., Nairn, I.A., and Houghton, B.F., 1984, Caldera volcanoes of the Taupo Volcanic Zone, New Zealand: Journal of Geophysical Research, v. 89, no. 10, 8463-8484.

Tongariro									
VOLCANO #	LATITUDE LONGITUDE	ROCK TYPE	TYPE OF MONITOR	YEAR MEASUREMENTS INITIATED	FREQUENCY OF MEASUREMENTS	HAS THERE BEEN DEFORMATION?	OTHER SIGNS OF UNREST	DATES OF UNREST	EXPLOSIVITY (LARGEST KNOWN VEI)
0401-08	39.13 S 175.642E	A	T	1978	3	N	S	Last erupted in 1927	2

Comments: Tongariro is located in the northern portion of the "Tongariro Volcanic Center." The volcano last erupted in 1927 but fumaroles and thermal springs continue to be active.

References

Latter, J.H., 1987, Volcanic Hazard Map of Tongariro National Park Region, 1:100,000: New Zealand Geological Survey, Department of Scientific and Industrial Research.

New Zealand Volcanological Record Nos. 1-16 (1973-1988).

Ngauruhoe									
VOLCANO #	LATITUDE LONGITUDE	ROCK TYPE	TYPE OF MONITOR	YEAR MEASUREMENTS INITIATED	FREQUENCY OF MEASUREMENTS	HAS THERE BEEN DEFORMATION?	OTHER SIGNS OF UNREST	DATES OF UNREST	EXPLOSIVITY (LARGEST KNOWN VEI)
0401-09	39.158S	A	T	1978	3	N	S	Last eruption in 1975; low	3
	175.63 E		E	1983	3	N		activity throughout the 1980s	

Comments: No significant deformation changes have been recorded.

References

Latter, J.H., 1987, Volcanic Hazard Map of Tongariro National Park Region, 1:100,000: New Zealand Geological Survey, Department of Scientific and Industrial Research.

New Zealand Volcanological Record Nos. 1-16 (1973-1988).

Ruapehu									
VOLCANO #	LATITUDE LONGITUDE	ROCK TYPE	TYPE OF MONITOR	YEAR MEASUREMENTS INITIATED	FREQUENCY OF MEASUREMENTS	HAS THERE BEEN DEFORMATION?	OTHER SIGNS OF UNREST	DATES OF UNREST	EXPLOSIVITY (LARGEST KNOWN VEI)
0401-10	39.32 S	A	E	1970	2	Y	S,G,T	Frequently active, most recent	4
	175.57 E		T	1978	3	Y		major eruption in 1977,	
			R	1970	4	Y		minor activity continues	

Comments: Ruapehu experiences frequent phreatic explosions through its crater lake. Significant deformation has been observed. Some correlation has been recognized between EDM changes and seismic activity.

References

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Rotorua									
VOLCANO #	LATITUDE LONGITUDE	ROCK TYPE	TYPE OF MONITOR	YEAR MEASUREMENTS INITIATED	FREQUENCY OF MEASUREMENTS	HAS THERE BEEN DEFORMATION?	OTHER SIGNS OF UNREST	DATES OF UNREST	EXPLOSIVITY (LARGEST KNOWN VEI)
0401-16	38.10 S	R	L	1924	4	Y	S	No historical activity;	?
	176.20 E		A	1970	1	Y		seismic swarm in 1983-84	

Comments: Rotorua has not erupted in the past 10,000 years although there have been steam explosions in the active geyser fields.

References

Newhall, C.G., and Dzurisin, D., 1988, Historical unrest at large calderas of the world: U.S. Geological Survey Bulletin 1855, v. 1, p. 186-189.

New Zealand Volcanological Record Nos. 1-16 (1973-1988).

Wilson, C.J.N., Rogan, A.M., Smith, I.E.M., Northey, D.J., Nairn, I.A., and Houghton, B.F., 1984, Caldera volcanoes of the Taupo Volcanic Zone, New Zealand: Journal of Geophysical Research, v. 89, no. 10, 8463-8484.

Region: Papua New Guinea									
Tuluman Caldera (St. Andrews Strait)									
VOLCANO #	LATITUDE LONGITUDE	ROCK TYPE	TYPE OF MONITOR	YEAR MEASUREMENTS INITIATED	FREQUENCY OF MEASUREMENTS	HAS THERE BEEN DEFORMATION?	OTHER SIGNS OF UNREST	DATES OF UNREST	EXPLOSIVITY (LARGEST KNOWN VEI)
0500-01	02.447S 147.32 E	D	T	1955	?	Y	S	Last eruption began in 1953	3

Comments: Tuluman Caldera is a rhyolitic volcanic complex and is located in the northern Bismark Sea. Prior to the 1953-57 eruption, Tuluman was a submarine volcano. No anomalous seismic activity preceded this eruption; however, the eruption was accompanied by considerable tilt, localized uplift, and subsidence.

References

Newhall, C.G., and Dzurisin, D., 1988, Historical unrest at large calderas of the world: U.S. Geological Survey Bulletin 1855, v. 1, p. 198-200.

Manam									
VOLCANO #	LATITUDE LONGITUDE	ROCK TYPE	TYPE OF MONITOR	YEAR MEASUREMENTS INITIATED	FREQUENCY OF MEASUREMENTS	HAS THERE BEEN DEFORMATION?	OTHER SIGNS OF UNREST	DATES OF UNREST	EXPLOSIVITY (LARGEST KNOWN VEI)
0501-02	04.10 S	B	E	1987	?	U	S	Eruption in 1977, activity has	3
	145.061E		T	1957	?	Y		continued	
			G	?	?	U			
			V	1983	?	U			

Comments: Manam has been intermittently active since December, 1956. Activity includes lava flows and pyroclastic flows. Precursors include tectonic earthquakes, elevated levels of local seismicity, and ground tilt. Eruption timing is tied to the influences of earthtides.

References

Lowenstein, P.L., 1982, Problems of volcanic hazards in Papua New Guinea: Geological Survey of Papua New Guinea Report 82/7, 62 p.

Mori, J., McKee, C., Talai, B., and Itikarai, I., 1989, A summary of precursors to volcanic eruptions in Papua New Guinea, in Latter, J.H., ed., Volcanic Hazards: Berlin, Springer-Verlag, p. 260-291.

Taylor, G. A., 1963, Seismic and tilt phenomena preceding a Pelean type eruption from a basaltic volcano: Bulletin Volcanologique, Tome 26, p. 5-11.

Karkar Caldera									
VOLCANO #	LATITUDE LONGITUDE	ROCK TYPE	TYPE OF MONITOR	YEAR MEASUREMENTS INITIATED	FREQUENCY OF MEASUREMENTS	HAS THERE BEEN DEFORMATION?	OTHER SIGNS OF UNREST	DATES OF UNREST	EXPLOSIVITY (LARGEST KNOWN VEI)
0501-03	04.649S	B,A	E	1986	?	U	S,F	Eruption in 1979	3
	145.964E		T	1979	2	Y			
			G	1979	2	Y			
			L	1984	3	U			

Comments: Tilt and gravity measurements began in April 1979 at Karkar after the eruption was already in progress. A small amount of uplift and tilting was observed at the summit.

References

Lowenstein, P.L., 1982, Problems of volcanic hazards in Papua New Guinea: Geological Survey of Papua New Guinea Report 82/7, 62 p.

McKee, C.O., Wallace, D.A., Almond, R.A., and Talai, B., 1981, Fatal hydro-eruption of Karkar volcano in 1979: development of a Maar-like crater, in Johnson, R.W., ed., Cooke-Ravian Volume of Volcanological Papers: Geological Survey of Papua New Guinea Memoir 10, p. 63-84.

Newhall, C.G., and Dzurisin, D., 1988, Historical unrest at large calderas of the world: U.S. Geological Survey Bulletin 1855, v. 1, p. 201-205.

Ulawun									
VOLCANO #	LATITUDE LONGITUDE	ROCK TYPE	TYPE OF MONITOR	YEAR MEASUREMENTS INITIATED	FREQUENCY OF MEASUREMENTS	HAS THERE BEEN DEFORMATION?	OTHER SIGNS OF UNREST	DATES OF UNREST	EXPLOSIVITY (LARGEST KNOWN VEI)
0502-12	05.044S		E	1986	?	U	T	Eruption in 1960, eruptive	3
	151.338E		T	1985	3	U		activity has continued to	
			G	1986	?	U		present	

Comments: After a 20 year hiatus, Ulawun has erupted 7 times since 1960.

References

Lowenstein, P.L., 1982, Problems of volcanic hazards in Papua New Guinea: Geological Survey of Papua New Guinea Report 82/7, 62 p.

Rabaul									
VOLCANO #	LATITUDE LONGITUDE	ROCK TYPE	TYPE OF MONITOR	YEAR MEASUREMENTS INITIATED	FREQUENCY OF MEASUREMENTS	HAS THERE BEEN DEFORMATION?	OTHER SIGNS OF UNREST	DATES OF UNREST	EXPLOSIVITY (LARGEST KNOWN VEI)
0502-14	04.271S	A	E	1983	1	Y	S,G	Deformation increased since	6
	152.203E		T	1963	?	Y		1971	
			L	1973	?	Y			
			G	1973	?	Y			
			I	1969	?	Y			
			V	1985	?	Y			

Comments: The present cycle of uplift at Rabaul began soon after the 1937 eruption and continued until July 1971, when 2 earthquakes were associated with subsidence of up to 80 cm. When seismicity declined, uplift resumed again. Net uplift amounted to a maximum of 2.5 m by 1971 and 4.5 m by 1985. Modeling of the data indicates that there are 2 magma reservoirs beneath the caldera.

References

Archbold, M.J., McKee, C.O., Talai, B., Mori, J., and de Saint Ours, P., 1988, Electronic distance measuring network monitoring during the Rabaul seismicity/deformational crisis of 1983-1985: Journal of Geophysical Research, v. 93, no. B10, p. 12,123-12,136.

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McKee, C., Mori, J., and Talai, B., 1989, Microgravity changes and ground deformation at Rabaul Caldera, 1973-1985, in Latter, J.H., ed., Volcanic Hazards: Berlin, Springer-Verlag, p. 399-428.

Mori, J., McKee, C., Talai, B., and Itikarai, I., 1989, A summary of precursors to volcanic eruptions in Papua New Guinea, in Latter, J.H., ed., Volcanic Hazards: Berlin, Springer-Verlag, p. 260-291.

Newhall, C.G., and Dzurisin, D., 1988, Historical unrest at large calderas of the world: U.S. Geological Survey Bulletin 1855, v. 1, p. 219-230.

Talai, B., 1989, Volcano monitoring in Papua New Guinea: IAVCEI Continental Magmatism, Abstract, p. 264.

Scott, B.J., 1982, Tiltmeter recordings at Rabaul Caldera, Papua New Guinea: 1963-1979: Geological Survey of Papua New Guinea Report 80/13, 12 p.

Lamington									
VOLCANO #	LATITUDE LONGITUDE	ROCK TYPE	TYPE OF MONITOR	YEAR MEASUREMENTS INITIATED	FREQUENCY OF MEASUREMENTS	HAS THERE BEEN DEFORMATION?	OTHER SIGNS OF UNREST	DATES OF UNREST	EXPLOSIVITY (LARGEST KNOWN VEI)
0503-01	08.942S 148.171E	A	T	1951	?	Y	?	Eruption in 1951	4

Comments: Tilt measurements at Lamington were initiated after the 1951 eruption. Results have been ambiguous.

References

Lowenstein, P.L., 1982, Problems of volcanic hazards in Papua New Guinea: Geological Survey of Papua New Guinea Report 82/7, 62 p.

Taylor, G.A.M., 1983, The 1951 eruption of Mount Lamington, Papua New Guinea: Dept. of Resources and Energy, Bureau of Mineral Resources, Geology and Geophysics, 129 p.

Dobu									
VOLCANO #	LATITUDE LONGITUDE	ROCK TYPE	TYPE OF MONITOR	YEAR MEASUREMENTS INITIATED	FREQUENCY OF MEASUREMENTS	HAS THERE BEEN DEFORMATION?	OTHER SIGNS OF UNREST	DATES OF UNREST	EXPLOSIVITY (LARGEST KNOWN VEI)
0503-07	09.821S 150.872E	U	T	?	?	U	U	Unknown	U

References

Lowenstein, P.L., 1982, Problems of volcanic hazards in Papua New Guinea: Geological Survey of Papua New Guinea Report 82/7, 62 p.

Bagana									
VOLCANO #	LATITUDE LONGITUDE	ROCK TYPE	TYPE OF MONITOR	YEAR MEASUREMENTS INITIATED	FREQUENCY OF MEASUREMENTS	HAS THERE BEEN DEFORMATION?	OTHER SIGNS OF UNREST	DATES OF UNREST	EXPLOSIVITY (LARGEST KNOWN VEI)
0505-02	06.144S 155.189E		T	1972	?	U	U	There have been frequent explosions since 1972	4

Comments: Although Bagana is monitored for tilt, the instrumentation is located 17 km from the summit and is therefore not very sensitive to small changes.

References

Lowenstein, P.L., 1982, Problems of volcanic hazards in Papua New Guinea: Geological Survey of Papua New Guinea Report 82/7, 62 p.

Region: Indonesia									
Toba Caldera (Pusukbukit)									
VOLCANO #	LATITUDE LONGITUDE	ROCK TYPE	TYPE OF MONITOR	YEAR MEASUREMENTS INITIATED	FREQUENCY OF MEASUREMENTS	HAS THERE BEEN DEFORMATION?	OTHER SIGNS OF UNREST	DATES OF UNREST	EXPLOSIVITY (LARGEST KNOWN VEI)
0601-09	02.60 N 098.80 E	R	A	?	?	U	S	No historic eruptions	?

Comments: Toba Caldera's active volcanic cone is Pusukbukit, which is located on the west margin of the caldera.

References

Newhall, C.G., and Dzurisin, D., 1988, Historical unrest at large calderas of the world: U.S. Geological Survey Bulletin 1855, v. 1, p. 256-266.

Krakatau									
VOLCANO #	LATITUDE LONGITUDE	ROCK TYPE	TYPE OF MONITOR	YEAR MEASUREMENTS INITIATED	FREQUENCY OF MEASUREMENTS	HAS THERE BEEN DEFORMATION?	OTHER SIGNS OF UNREST	DATES OF UNREST	EXPLOSIVITY (LARGEST KNOWN VEI)
0602-00	06.102S 105.423E	B,A,D	G	1968	?	U	S,G	Activity increased in 1988; previous eruptive activity occurred in 1981	6

Comments: Anak Krakatau is a small cone that has been growing in the caldera of Krakatau since 1927. In February 1988, activity of this cone intensified. The plume increased in volume and height, and glow at the summit was visible. Earthquakes were felt 55 km to the east of the volcano.

References

Newhall, C.G., and Dzurisin, D., 1988, Historical unrest at large calderas of the world: U.S. Geological Survey Bulletin 1855, v. 1, p. 285-298.

Yokoyama, I., and Hadikusumo, D., 1969, A gravity survey of the Krakatau islands, Indonesia: Bulletin of the Earthquake Research Institute, v. 47, p. 991-1001.

Tangkubanparhu (Sunda)									
VOLCANO #	LATITUDE LONGITUDE	ROCK TYPE	TYPE OF MONITOR	YEAR MEASUREMENTS INITIATED	FREQUENCY OF MEASUREMENTS	HAS THERE BEEN DEFORMATION?	OTHER SIGNS OF UNREST	DATES OF UNREST	EXPLOSIVITY (LARGEST KNOWN VEI)
0603-09	06.77 S	B,A	E	1981	4	Y	S,T	Eruption in 1969;	2
	107.60 E		L	?	?	U		Activity has increased since	
			T	1965	2	Y		1983	

Comments: Tangkubanparahu is located within the Sunda Caldera. Inflation of the volcano was recorded between 1981 and 1986.

References

Casadevall, T.J., 1986, Progress Report for the Project "Volcano monitoring and research in Indonesia": July 1, 1986 - September 30, 1986: U.S. Geological Survey administrative report prepared for Office of Foreign Disaster Assistance, Washington, D.C., 19 p.

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Dvorak, J.J., Said, H., Hadisantono, R.D., Rahardja, N., Mulyadi, D., Reksowirogo, D., and Restikadjaja, K., 1987, Geodetic measurements at Indonesian volcanoes: U.S. Geological Survey Open-File Report 87-130, 21 p.

Dvorak, J.J., Matahelumual, J., Okamura, A.T., Said, H., and Casadevall, T.J., 1990, Recent uplift and hydrothermal activity at Tangkubanparahu volcano, West Java, Indonesia: Manuscript submitted to Bulletin of Volcanology, 16 p.

Dzurisin, D., and Yamashita, K., 1980, Indonesia Dry-Tilt Program: U.S. Geological Survey Project Report Indonesian Investigations (IR)ID-48, p. 30.

Murray, T.L., 1986, Establishment of a telemetered tiltmeter network at Tangkubanparahu: Cooperative studies in volcanology between the Volcanological Survey of Indonesia and the U.S. Geological Survey (Informal Report) 7 p.

Matahelumual, J., Mulyady, D., Rahardja, N., Reksowirogo, L., Restikadjaja, K., and Said, H., 1987, Analysis of tilt measurements at Tangkubanparahu Volcano, West Java, Indonesia: Abstract Volume, Hawaii Symposium on How Volcanoes Work, Hilo, Jan, 1987, p. 167.

Newhall, C.G., and Dzurisin, D., 1988, Historical unrest at large calderas of the world: U.S. Geological Survey Bulletin 1855, v. 1, p. 292-298.

Galunggung									
VOLCANO #	LATITUDE LONGITUDE	ROCK TYPE	TYPE OF MONITOR	YEAR MEASUREMENTS INITIATED	FREQUENCY OF MEASUREMENTS	HAS THERE BEEN DEFORMATION?	OTHER SIGNS OF UNREST	DATES OF UNREST	EXPLOSIVITY (LARGEST KNOWN VEI)
0603-14	07.25 S	B,A	E	1982	?	Y	S,T	Eruption in April 1982,	5
	108.05 E		T	1982	?	U		continued until January 1983	

Comments: Measurements were initiated within days of the beginning of the 1982 eruption. Poor results were obtained from single-setup leveling measurements, which were subsequently discontinued; stations were located too far from the crater region. Horizontal-distance changes, however, apparently to correlate with eruptive activity.

References

Casadevall, T.J., 1987, Progress Report for the Project "Volcano monitoring and research in Indonesia": January 1, 1987 - March 31, 1987: U.S. Geological Survey administrative report prepared for Office of Foreign Disaster Assistance, Washington, D.C., 18 p.

Dvorak, J.J., Said, H., Hadisantono, R.D., Rahardja, N., Mulyadi, D., Reksowirogo, D., and Restikadjaja, K., 1987, Geodetic measurements at Indonesian volcanoes: U.S. Geological Survey Open-File Report 87-130, 21 p.

Katili, J.A., and Sudradjat, A., 1984, Galunggung, the 1982-1983 eruption: Volcanological Survey of Indonesia, 102 p.

Merapi (Central Java)									
VOLCANO #	LATITUDE LONGITUDE	ROCK TYPE	TYPE OF MONITOR	YEAR MEASUREMENTS INITIATED	FREQUENCY OF MEASUREMENTS	HAS THERE BEEN DEFORMATION?	OTHER SIGNS OF UNREST	DATES OF UNREST	EXPLOSIVITY (LARGEST KNOWN VEI)
0603-25	07.542S	B,A	E	1983	?	U	S,T	Intermittent activity since	4
	110.442E		T	1979	?	Y		1969	

Comments: Merapi began extruding a lava dome in 1969. Intermittent activity has continued up to the time of this report.

References

Casadevall, T.J., 1987, Progress Report for the Project "Volcano monitoring and research in Indonesia": January 1, 1987 - March 31, 1987: U.S. Geological Survey administrative report prepared for Office of Foreign Disaster Assistance, Washington, D.C., 18 p.

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Kelut									
VOLCANO #	LATITUDE LONGITUDE	ROCK TYPE	TYPE OF MONITOR	YEAR MEASUREMENTS INITIATED	FREQUENCY OF MEASUREMENTS	HAS THERE BEEN DEFORMATION?	OTHER SIGNS OF UNREST	DATES OF UNREST	EXPLOSIVITY (LARGEST KNOWN VEI)
0603-28	07.93 S	A	E	?	?	U	S,T	Eruption in 1990	4
	112.308E		T	1979	?	U			
			A	?	?	U			

Comments: The tilt measurements have shown no consistent patterns since they were begun.

References

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Lamongan									
VOLCANO #	LATITUDE LONGITUDE	ROCK TYPE	TYPE OF MONITOR	YEAR MEASUREMENTS INITIATED	FREQUENCY OF MEASUREMENTS	HAS THERE BEEN DEFORMATION?	OTHER SIGNS OF UNREST	DATES OF UNREST	EXPLOSIVITY (LARGEST KNOWN VEI)
0603-32	08.00 S	B	E	1985	?	U	S	Seismic swarms in 1978 and	2
	113.342E		T	1985	?	U		1985; last eruption	
			A	1985	?	U		in 1898	
			G	?	?	U			
			V	?	?	U			

Comments: Lamongan had 42 eruptions during the 19th century but none have occurred since 1898. Ground breakage accompanied seismic swarms in 1985.

References

Casadevall, T.J., 1987, Progress Report for the Project "Volcano monitoring and research in Indonesia": January 1, 1987 - March 31, 1987, U.S. Geological Survey administrative report prepared for Office of Foreign Disaster Assistance, Washington, D.C., 18 p.

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Batur (Bali)									
VOLCANO #	LATITUDE LONGITUDE	ROCK TYPE	TYPE OF MONITOR	YEAR MEASUREMENTS INITIATED	FREQUENCY OF MEASUREMENTS	HAS THERE BEEN DEFORMATION?	OTHER SIGNS OF UNREST	DATES OF UNREST	EXPLOSIVITY (LARGEST KNOWN VEI)
0604-01	08.242S 115.375E	B,A	G	1968	?	U	U	Eruptive activity from 1965 to 1974	3

Comments: Batur is located in the center of 2 nested calderas referred to as Batur Caldera.

References

Newhall, C.G., and Dzurisin, D., 1988, Historical unrest at large calderas of the world: U.S. Geological Survey Bulletin 1855, v. 1, p. 292-3298.

Yokoyama, I., and Suparto, S., 1970, Volcanological survey of Indonesian volcanoes, Part 5. A gravity survey on and around Batur Caldera, Bali: Bulletin of the Earthquake Research Institute, v. 48, p. 317-329.

Sangeang Api									
VOLCANO #	LATITUDE LONGITUDE	ROCK TYPE	TYPE OF MONITOR	YEAR MEASUREMENTS INITIATED	FREQUENCY OF MEASUREMENTS	HAS THERE BEEN DEFORMATION?	OTHER SIGNS OF UNREST	DATES OF UNREST	EXPLOSIVITY (LARGEST KNOWN VEI)
0604-05	08.18 S 119.058E	B,A	E	?	?	U	U	Eruption in 1985	3

Comments: Sangeang Api erupted July, 1985. Activity including small gas explosions and elevated seismicity continued through March, 1987.

References

Casadevall, T.J., 1988, Final Report for the Project "Volcano monitoring and research in Indonesia": U.S. Geological Survey administrative report prepared for Office of Foreign Disaster Assistance, Washington, D.C., 18 p.

Region: Philippines									
Hibok-Hibok									
VOLCANO #	LATITUDE LONGITUDE	ROCK TYPE	TYPE OF MONITOR	YEAR MEASUREMENTS INITIATED	FREQUENCY OF MEASUREMENTS	HAS THERE BEEN DEFORMATION?	OTHER SIGNS OF UNREST	DATES OF UNREST	EXPLOSIVITY (LARGEST KNOWN VEI)
0701-08	09.20 N	A	T	1958	1	N	U	Eruption in 1948	3
	124.675E		E	1985	?	U			
			L	1988	?	U			

Comments: Abnormal tilting was detected from mid-1985 through early 1986.

References

Alcaraz, A., 1960, Tilt measurements in Philippine volcanic areas: Bulletin Volcanologique, v. 23, p. 161-180.

1985, Philippine Institute of Volcanology and Seismology Annual Report 1985, 22 p.

1986, Philippine Institute of Volcanology and Seismology Annual Report 1986, 28 p.

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Canlaon									
VOLCANO #	LATITUDE LONGITUDE	ROCK TYPE	TYPE OF MONITOR	YEAR MEASUREMENTS INITIATED	FREQUENCY OF MEASUREMENTS	HAS THERE BEEN DEFORMATION?	OTHER SIGNS OF UNREST	DATES OF UNREST	EXPLOSIVITY (LARGEST KNOWN VEI)
0702-02	10.410N	A	E	1985	?	U	S,G	Unrest in 1985 and 1987	2
	123.13 E		T	1985	?	U			
			L	1985	?	Y			
			G	?	?	U			

Comments: Canlaon has been frequently active since 1969.

References

Almontero, R.E., 1977, Report on the magnetic and gravity survey of Canlaon volcano: COMVOL Technical Report, p. 55.

Bautista, L.P., 1987, Volcano Update, Phivolcs Observer, v. 3, no. 2, p. 5.

Cruz, J.B., 1986, EDM monitoring results at Canlaon Volcano for January, 1986: Report to the Director of the Volcano Monitoring Division, Philippine Institute of Volcanology and Seismology, 7 p.

1985, Philippine Institute of Volcanology and Seismology Annual Report 1985, 22 p.

1987, Philippine Institute of Volcanology and Seismology Annual Report 1987, 21 p.

1987, Volcano and seismicity update: Phivolcs Observer, v. 3, no. 4, p. 5-8.

Bulusan									
VOLCANO #	LATITUDE LONGITUDE	ROCK TYPE	TYPE OF MONITOR	YEAR MEASUREMENTS INITIATED	FREQUENCY OF MEASUREMENTS	HAS THERE BEEN DEFORMATION?	OTHER SIGNS OF UNREST	DATES OF UNREST	EXPLOSIVITY (LARGEST KNOWN VEI)
0703-01	12.77 N	B	E	?	?	Y	S	Eruption in 1988	3
	124.05 E		L	?	?	U			
			A	?	?	U			
			G	?	?	U			

Comments: Bulusan erupted in February 1988 after 5 years of quiescence. The leveling network showed an inflationary trend throughout the eruption. Slight deflation imposed on the overall trend was associated with individual emission events. EDM readings for several hours preceding the eruption showed an inflationary trend changeing to a deflationary trend at the onset of the eruption.

References

Magalit, C.T., 1988, Deformation model for Bulusan: Phivolcs Observer, v. 4, no. 1, p. 8.

Newhall, C.G., and Dzurisin, D., 1988, Historical unrest at large calderas of the world: U.S. Geological Survey Bulletin 1855, v. 1, p. 352-357.

Sincioco, J.S., 1978, Gravity survey of Bulusan Volcano: COMVOL Technical Report, p. 35-40.

1985, Philippine Institute of Volcanology and Seismology Annual Report 1985, 22 p.

1987, Philippine Institute of Volcanology and Seismology Annual Report 1987, 21 p.

Mayon									
VOLCANO #	LATITUDE LONGITUDE	ROCK TYPE	TYPE OF MONITOR	YEAR MEASUREMENTS INITIATED	FREQUENCY OF MEASUREMENTS	HAS THERE BEEN DEFORMATION?	OTHER SIGNS OF UNREST	DATES OF UNREST	EXPLOSIVITY (LARGEST KNOWN VEI)
0703-03	13.258N	B,A	E	?	?	N	S	Frequently active;	4
	123.68 E		T	1957	1	U		eruptions in 1978 and 1984	
			L	?	?	U			

Comments: Swelling of the crater floor was visually observed 3 months before the 1984 eruption.

References

Alcaraz, A., 1960, Tilt measurements in Philippine volcanic areas: Bulletin Volcanologique, v. 23, p. 161-180.

Corpuz, E.G., Chronology of the September-October 1984 eruption of Mayon volcano, Philippines: Philippine Journal of Volcanology, v. 2, no. 1, 36-67.

1985, Philippine Institute of Volcanology and Seismology Annual Report 1985, 22 p.

1986, Philippine Institute of Volcanology and Seismology Annual Report 1986, 28 p.

1987, Philippine Institute of Volcanology and Seismology Annual Report 1987, 21 p.

1987, Taal Lake tilt system expanded: Phivolcs Observer, v. 3, no. 3, p. 3-5.

1987, Volcano and seismicity update: Phivolcs Observer, v. 3, no. 4, p. 5-8.

Taal									
VOLCANO #	LATITUDE LONGITUDE	ROCK TYPE	TYPE OF MONITOR	YEAR MEASUREMENTS INITIATED	FREQUENCY OF MEASUREMENTS	HAS THERE BEEN DEFORMATION?	OTHER SIGNS OF UNREST	DATES OF UNREST	EXPLOSIVITY (LARGEST KNOWN VEI)
0703-07	14.00 N	B,A	E	1985	?	U	S	Unrest since 1986	4
	121.00 E		T	1967	?	Y			
			L	1965	?	U			
			I	1988	?	U			
			A	1985	?	Y			
			G	1938	?	U			

Comments: Taal is located in a 15x22 km caldera lake. Since 1986 activity has included seismic swarms and tilt events.

References

Newhall, C.G., and Dzurisin, D., 1988, Historical unrest at large calderas of the world: U.S. Geological Survey Bulletin 1855, v. 1, p. 352-357.

Yokoyama, I., Alcaraz, A., and Pena, O., 1975, Gravimetric studies of Taal Volcano, Philippines: Bulletin Volcanologique, v. 39, p. 1-11.

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1987, Volcano and seismicity update: Phivolcs Observer, v. 3, no. 4, p. 5-8.

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Region: Japan									
Sakurajima									
VOLCANO #	LATITUDE LONGITUDE	ROCK TYPE	TYPE OF MONITOR	YEAR MEASUREMENTS INITIATED	FREQUENCY OF MEASUREMENTS	HAS THERE BEEN DEFORMATION?	OTHER SIGNS OF UNREST	DATES OF UNREST	EXPLOSIVITY (LARGEST KNOWN VEI)
0802-08	31.58 N	A	E	1968	3	Y	S,G,T	Frequent explosions since	3
	130.67 E		L	1957	4	Y		1955	
			T	1957	0	Y			
			R	1895	4	U			
			G	1963	3	Y			
			I	1958	0	Y			

Comments: Sakurajima is located on the southern margin of Aira caldera. After the 1914 eruption, contraction of the Aira caldera and extension along newly formed craters were observed. Present summit activity began in 1955. The volcano has been continuously active and more than 5,800 eruptions have been recorded since then. Eruptions are usually preceded by micro-earthquake swarms and tilt changes.

References

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Kamo, K., and Ishihara, K., 1989, A preliminary experience on automated judgement of the stages of eruptive activity using tiltmeter records at Sakurajima, Japan, in Latter, J.H., ed., Volcanic Hazards: Berlin, Springer-Verlag, p. 585-598.

Kubotera, A., and Yoshikawa, K., 1963, Prediction of volcanic eruption Aso and Sakurajima and some related geophysical problems: Bulletin Volcanologique, v. 26, no. 1, p. 297-317.

Mogi, K., 1958, Relations between the eruptions of various volcanoes and the deformations of the ground surfaces around them: Bulletin of the Earthquake Research Institute, v. 36, p. 99-13.

Newhall, C.G., and Dzurisin, D., 1988, Historical unrest at large calderas of the world: U.S. Geological Survey Bulletin 1855, v. 1, p. 386-415.

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Sakurajima Volcanological Observatory, Disaster Prevention Research Institute, Kyoto University, Japan, 1988, Ground deformation at Sakurajima and around Aira caldera associated with the volcanic activity: Kagoshima International Conference on Volcanism, Proceedings, p. 292-295.

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Yokoyama, I., 1989, Microgravity and height changes caused by volcanic activity: Four Japanese examples: Bulletin of Volcanology, v. 51, p. 333-345.

Kirishima									
VOLCANO #	LATITUDE LONGITUDE	ROCK TYPE	TYPE OF MONITOR	YEAR MEASUREMENTS INITIATED	FREQUENCY OF MEASUREMENTS	HAS THERE BEEN DEFORMATION?	OTHER SIGNS OF UNREST	DATES OF UNREST	EXPLOSIVITY (LARGEST KNOWN VEI)
0802-09	31.93 N	A	E	1968	4	Y	S,G,T	Seismic swarms in the early	3
	130.87 E		T	1967	0	Y		1980s	
			L	1967	4	Y			
			G	?	4	Y			

Comments: Kirishima is located in the Kakuto Caldera. Vertical displacements occurred as a result of earthquake swarms in 1968 and 1975.

References

Kobayashi, T., Aramaki, S., Watanabe, T., and Kamada, M., 1981, Kirishima Volcano, in Kubotera, A., ed., Field Excursion Guide to Sakurajima, Kirishima and Aso volcanoes, Symposium on Arc Volcanism: Volcanological Society of Japan, p. 17-32.

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Sawada, Y., 1989, Pers. comm.

Aso Caldera (Naka-dake)									
VOLCANO #	LATITUDE LONGITUDE	ROCK TYPE	TYPE OF MONITOR	YEAR MEASUREMENTS INITIATED	FREQUENCY OF MEASUREMENTS	HAS THERE BEEN DEFORMATION?	OTHER SIGNS OF UNREST	DATES OF UNREST	EXPLOSIVITY (LARGEST KNOWN VEI)
0802-11	32.88 N	A	E	1977	4	Y	S,T,G	Almost constant activity	3
	131.10 E		T	1931	0	Y			
			L	1937	4	U			
			G	1964	3	N			

Comments: Numerous small cones lie within this 20 km-diameter caldera. A negative gravity anomaly has been observed at Aso Caldera.

References

Kubotera, A., and Yoshikawa, K., 1963, Prediction of volcanic eruption Aso and Sakurajima and some related geophysical problems: Bulletin Volcanologique, v. 26, no. 1, p. 297-317.

Newhall, C.G., and Dzurisin, D., 1988, Historical unrest at large calderas of the world, v. 1: U.S. Geological Survey Bulletin 1855, p. 429-453.

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Sawada, Y., 1989, Pers. comm.

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1974, List of dangerous volcanoes and associated information: Bulletin of Volcanology Supplement to Volume 38, p. 9-40.

Omuroyama-Amagi Group									
VOLCANO #	LATITUDE LONGITUDE	ROCK TYPE	TYPE OF MONITOR	YEAR MEASUREMENTS INITIATED	FREQUENCY OF MEASUREMENTS	HAS THERE BEEN DEFORMATION?	OTHER SIGNS OF UNREST	DATES OF UNREST	EXPLOSIVITY (LARGEST KNOWN VEI)
0803-01	34.92 N	B	E	?	4	Y	S	Last eruption occurred	?
	139.12 E		T	?	0	Y		around 1090 B.C.	
			L	?	4	Y			
			R	?	4	Y			
			I	?	0	Y			
			G	?	4	Y			

References

Sawada, Y., 1989, Pers. comm.

Hakone Caldera									
VOLCANO #	LATITUDE LONGITUDE	ROCK TYPE	TYPE OF MONITOR	YEAR MEASUREMENTS INITIATED	FREQUENCY OF MEASUREMENTS	HAS THERE BEEN DEFORMATION?	OTHER SIGNS OF UNREST	DATES OF UNREST	EXPLOSIVITY (LARGEST KNOWN VEI)
0803-02	35.22 N	B,A	G	1968	4	U	S	No historic eruptions	?
	139.02 E		E	?	4	Y			

Comments: A positive gravity anomaly has been observed at Hakone.

References

Sawada, Y., 1989, Pers. comm.

Yokoyama, I., 1983, Gravimetric studies and drilling results at the four calderas in Japan in Arc Volcanism: Physics and Tectonics: Tokyo, Terra Scientific, p. 29-41.

Fuji									
VOLCANO #	LATITUDE LONGITUDE	ROCK TYPE	TYPE OF MONITOR	YEAR MEASUREMENTS INITIATED	FREQUENCY OF MEASUREMENTS	HAS THERE BEEN DEFORMATION?	OTHER SIGNS OF UNREST	DATES OF UNREST	EXPLOSIVITY (LARGEST KNOWN VEI)
0803-03	35.35 N	B,A	G	1957	4	U	S	Eruption in 1707	4
	138.73 E		T	?	0	Y			

Comments: Fuji is a composite of 3 superposed cones with numerous smaller parasitic cones and flank fissures.

References

Sawada, Y., 1989, Pers. comm.

Tsuya, H., Machida, H., and Shimozuru, D., 1981, Fuji Volcano, in Aramaki, S., ed., Field Excursion Guide to Fuji, Asama, Kusatsu-shirane, and Nantai volcanoes: Symposium on Arc Volcanism, Volcanological Society of Japan, p. 1-22.

On-take									
VOLCANO #	LATITUDE LONGITUDE	ROCK TYPE	TYPE OF MONITOR	YEAR MEASUREMENTS INITIATED	FREQUENCY OF MEASUREMENTS	HAS THERE BEEN DEFORMATION?	OTHER SIGNS OF UNREST	DATES OF UNREST	EXPLOSIVITY (LARGEST KNOWN VEI)
0803-04	35.90 N	A	E	1979	4	N	S	Eruption in 1979	4
	136.78 E		L	1951	4	N			

Comments: The 1979 eruption followed several centuries of repose and was preceded by seismic swarms.

References

Newhall, C.G., and Dzurisin, D., 1988, Historical unrest at large calderas of the world: U.S. Geological Survey Bulletin 1855, v. 1, p. 466-477.

Sawada, Y., 1989, Pers. comm.

Yakedake									
VOLCANO #	LATITUDE LONGITUDE	ROCK TYPE	TYPE OF MONITOR	YEAR MEASUREMENTS INITIATED	FREQUENCY OF MEASUREMENTS	HAS THERE BEEN DEFORMATION?	OTHER SIGNS OF UNREST	DATES OF UNREST	EXPLOSIVITY (LARGEST KNOWN VEI)
0803-07	36.22 N	A	E	1973	4	Y	S	Fissure opened in 1962	3
	137.58 E		L	1977	4	Y			

Comments: Yaketake erupted in 1915 and explosive activity continued through 1939. In 1962 a 500 m long fissure appeared at the summit. Currently, occasional earthquake swarms are the only activity. Slight uplift has been detected since 1973.

References

Kimata, F., Nakamura, M., Miyajima, R., Okuda, T., Fujii, I., Aoki, H., 1988, Measurement of deformation at Yakadake volcano, central Japan (1977-987): Kagoshima International Conference on Volcanism, Proceedings, p. 370-372.

Sawada, Y., 1989, Pers. comm.

Asama									
VOLCANO #	LATITUDE LONGITUDE	ROCK TYPE	TYPE OF MONITOR	YEAR MEASUREMENTS INITIATED	FREQUENCY OF MEASUREMENTS	HAS THERE BEEN DEFORMATION?	OTHER SIGNS OF UNREST	DATES OF UNREST	EXPLOSIVITY (LARGEST KNOWN VEI)
0803-11	36.40 N	A	L	1934	3	Y	S,G,T	Frequently active; seismicity	4
	138.53 E		G	?	3	U		increased in 1980; erupted in	
			E	?	3	U		1982; activity has continued	
			T	1933	0	Y			
			R	?	?	U			

Comments: Minakami found that abnormal tilt occurs 1 to 1.5 months before the first explosion of most eruptions. Leveling surveys have detected three inflationary events prior to 3 out of 4 major eruptions since 1935. Asama Volcano has two pressure sources, and Miyazaki has postulated the exsistance of two magma reserviors with a conduit connecting them.

References

Aramaki, S., Shimozuru, D., Ossaka, J., 1981, Asama Volcano, in Aramaki, S., Field Excursion Guide to Fuji, Asama, Kusatsu-shirane, and Nantai volcanoes: Symposium on Arc Volcanism, Volcanological Society of Japan, p. 23-48.

Minakami, T., 1960, Fundamental research for predicting volcanic eruptions: Bulletin of the Earthquake Research Institute, v. 38, p. 497-544.

Miyazaki, T., 1990, Two reservoir system beneath Asama Volcano, central Japan, as revealed by leveling survey: EOS, Transactions of the American Geophysical Union, v. 71, no. 28, p. 965.

Sawada, Y., 1989, Pers. comm.

Kusatsu-shirane									
VOLCANO #	LATITUDE LONGITUDE	ROCK TYPE	TYPE OF MONITOR	YEAR MEASUREMENTS INITIATED	FREQUENCY OF MEASUREMENTS	HAS THERE BEEN DEFORMATION?	OTHER SIGNS OF UNREST	DATES OF UNREST	EXPLOSIVITY (LARGEST KNOWN VEI)
0803-12	36.62 N	A	G	?	4	U	S,G,T	Frequently active; high	2
	138.55 E		E	?	4	U		seismicity in 1983	
			L	?	4	U			

Comments: Kusatsu-shirane is frequently active, and phreatic explosions are common.

References

Sawada, Y., 1989, Pers. comm.

Bandai									
VOLCANO #	LATITUDE LONGITUDE	ROCK TYPE	TYPE OF MONITOR	YEAR MEASUREMENTS INITIATED	FREQUENCY OF MEASUREMENTS	HAS THERE BEEN DEFORMATION?	OTHER SIGNS OF UNREST	DATES OF UNREST	EXPLOSIVITY (LARGEST KNOWN VEI)
0803-16	37.60 N	A	G	1987	4	N	S	Seismic swarm in 1988	4
	140.12 E		E	1988	4	N			
			P	1988	4	N			

References

Tohoku University, 1989, Gravity measurements in and around Bandai volcano (1987-1988: Report of Coordinating Committee for Prediction of Volcanic Eruptions, v. 42, p. 56-57.

Ueki, S., Miura, S., Tachibana, K., Nakao, S., Yoshida, K., Hashimoto, K., Hamaguchi, H., 1988, Geodetic survey at Bandai volcano using EDM and GPS: Programme and Abstracts, Volcanlogical Society of Japan, v. 33, no. 2, p. 60.

Azuma									
VOLCANO #	LATITUDE LONGITUDE	ROCK TYPE	TYPE OF MONITOR	YEAR MEASUREMENTS INITIATED	FREQUENCY OF MEASUREMENTS	HAS THERE BEEN DEFORMATION?	OTHER SIGNS OF UNREST	DATES OF UNREST	EXPLOSIVITY (LARGEST KNOWN VEI)
0803-18	37.73 N	B,A	G	1979	4	U	S,G,T	Eruption in 1978	2
	140.25 E		E	1979	4	U			

Comments: The 1978 eruption of Azuma was preceded by elevated levels of seismicity.

References

Ishihara, K., Harada, T., Kirino, Y., Maekawa, T., and Yokoyama, I., 1981, Precise gravity measurements on and around Azuma volcano: Report of the Joint Geophysical and Geochemical Observations of the Azuma Volcano, p. 87-91.

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Izu-oshima (O-sima, Mihara)									
VOLCANO #	LATITUDE LONGITUDE	ROCK TYPE	TYPE OF MONITOR	YEAR MEASUREMENTS INITIATED	FREQUENCY OF MEASUREMENTS	HAS THERE BEEN DEFORMATION?	OTHER SIGNS OF UNREST	DATES OF UNREST	EXPLOSIVITY (LARGEST KNOWN VEI)
0804-01	34.73 N	B	E	1978	2	Y	S,T	Eruption in 1986	4
	139.38 E		T	1983	0	Y			
			L	1954	?	Y			
			G	1950	3	Y			
			I	1974	0	Y			
			L	1982	3	U			
			R	?	4	U			
			C	?	0	U			
			S	1986	?	U			

Comments: Precise leveling at Izu-oshima has been repeated annually since 1982. The inner caldera is continuously subsiding relative to the flanks of the volcano. This may be caused by loading and the compaction of erupted materials. Prior to the 1986 eruption, the central cone did not inflate. Rapid deflation occurred after the eruption due to the increased load of the newly erupted material.

References

Aramaki, S., ed., 1988, The 1986-1987 eruption of Izu-oshima Volcano: Earthquake Research Institute, University of Tokyo, Special Publication, 62 p.

Fukuyama, E., 1988, Saw-teeth-shaped tilt change observed at Izu-Oshima volcano, Japan: Kagoshima International Conference on Volcanism, Proceedings, p. 312-315.

Miyazaki, T., 1988, Vertical ground deformation in the summit caldera related to the 1986 eruption of Izu-Oshima volcano: Kagoshima International Conference on Volcanism, Proceedings, p. 324-326.

Newhall, C.G., and Dzurisin, D., 1988, Historical unrest at large calderas of the world: U.S. Geological Survey Bulletin 1855, v. 1, p. 483-505.

Sawada, Y., 1989, Pers. comm.

Yamamoto, E., and Kumagai, T., 1988, Precursory tilt changes of the 1986-1987 volcanic eruption of the Izu-Oshima volcano obtained by continuous crustal tilt observations: Kagoshima International Conference on Volcanism, Proceedings. p. 308-311.

Yamamoto, E., 1990, Tilt changes associated with recent volcanic eruptions around the Izu Peninsula, central Japan: EOS, Transactions of the American Geophysical Union, v. 71, no. 28, p. 960.

Yokoyama, I., 1989, Microgravity and height changes caused by volcanic activity: Four Japanese examples: Bulletin of Volcanology, v. 51, p. 333-345.

Miyake-jima									
VOLCANO #	LATITUDE LONGITUDE	ROCK TYPE	TYPE OF MONITOR	YEAR MEASUREMENTS INITIATED	FREQUENCY OF MEASUREMENTS	HAS THERE BEEN DEFORMATION?	OTHER SIGNS OF UNREST	DATES OF UNREST	EXPLOSIVITY (LARGEST KNOWN VEI)
0804-04	34.08 N	B,A	E	?	4	Y	S	Eruption in 1983	3
	139.53 E		R	1940	4	U			
			L	1979	4	U			
			G	1980	4	Y			

Comments: After 21 years of quiescence, Miyake-jima erupted in November 1983 producing basaltic lavas and scoria. Vertical displacements and tilt occurred during this eruption.

References

Mogi, K., 1958, Relations between the eruptions of various volcanoes and the deformations of the ground surfaces around them: Bulletin of the Earthquake Research Institute, v. 36, p. 99-13.

Sawada, Y., 1989, Pers. comm.

Yamashina, K., and Tada, T., 1987, Crustal deformation associated with fissure eruptions: Abstract Volume, Hawaii Symposium on How Volcanoes Work, Hilo, Jan. 1987, p. 275.

Yokoyama, I., 1989, Microgravity and height changes caused by volcanic activity: Four Japanese examples: Bulletin of Volcanology, v. 51, p. 333-345.

Nisino-sima									
VOLCANO #	LATITUDE LONGITUDE	ROCK TYPE	TYPE OF MONITOR	YEAR MEASUREMENTS INITIATED	FREQUENCY OF MEASUREMENTS	HAS THERE BEEN DEFORMATION?	OTHER SIGNS OF UNREST	DATES OF UNREST	EXPLOSIVITY (LARGEST KNOWN VEI)
0804-092	27.243N 140.877E	A	E L	1973 ?	T ?	U U	U	Eruptive activity in 1973 and 1979 originated near Nisino-sima	2

Comments: Nisino-sima is a volcanic island. During the eruption of 1973 several newly formed islands were joined to the larger island.

References

Sawada, Y., 1989, Pers. comm.

Iwo-jima									
VOLCANO #	LATITUDE LONGITUDE	ROCK TYPE	TYPE OF MONITOR	YEAR MEASUREMENTS INITIATED	FREQUENCY OF MEASUREMENTS	HAS THERE BEEN DEFORMATION?	OTHER SIGNS OF UNREST	DATES OF UNREST	EXPLOSIVITY (LARGEST KNOWN VEI)
0804-12	24.75 N	A	T	1976	0	Y	S,T	Uplift since 1300	2
	141.33 E		L	1968	4	Y			
			I	?	0	U			
			G	?	4	U			
			E	?	4	Y			
			C	?	0	Y			
			V	?	?	Y			

Comments: Iwo-jima Island, lying within a submarine caldera, consists of 2 volcanoes, Moto-yama and Suribachi-yama. The island has been uplifting at an average rate of 15-20 cm/yr for at least the past 700 years. The rate and pattern of uplift is not constant but it is in the broad form of domal uplift. High temperature fumaroles occur on Iwo-jima, and elevated levels of seismicity have been recorded since 1976. Fifteen phreatic eruptions have occurred since 1889. Some of the more recent eruptions were preceded by seismic swarms.

References

Kaizura, S., Newhall, C., Oyagi, N., and Yagi, H., 1989, Remarkable unrest at Iwo-Jima Caldera, Volcano Islands, Japan: IAVCEI Continental Magmatism, Abstract, p. 146.

Kumagai, T., Takahashi, H., and Oyagi, N., 1988, Precursor of volcanism observed by crustal movement in Iwo-Jima: Kagoshima International Conference on Volcanism, Proceedings, p. 366-367.

Newhall, C.G., and Dzurisin, D., 1988, Historical unrest at large calderas of the world: U.S. Geological Survey Bulletin 1855, v. 1, p. 509-520.

Sawada, Y., 1989, Pers. comm.

Nigorikawa									
VOLCANO #	LATITUDE LONGITUDE	ROCK TYPE	TYPE OF MONITOR	YEAR MEASUREMENTS INITIATED	FREQUENCY OF MEASUREMENTS	HAS THERE BEEN DEFORMATION?	OTHER SIGNS OF UNREST	DATES OF UNREST	EXPLOSIVITY (LARGEST KNOWN VEI)
0805-011	42.12 N 140.45 E	A	G	?	T	U	U	No historic eruptions	?

Comments: An eruption at Nigorikawa, about 12,000 B.P., produced a caldera about 2.5 km in diameter. A negative gravity anomaly has been observed beneath the volcano.

References

Sawada, Y., 1989, Pers. comm.

Yokoyama, I., 1983, Gravimetric studies and drilling results at the four calderas in Japan: Arc Volcanism: Physics and Tectonics, Tokyo, Terra Scientific, p. 29-41.

Komagatake									
VOLCANO #	LATITUDE LONGITUDE	ROCK TYPE	TYPE OF MONITOR	YEAR MEASUREMENTS INITIATED	FREQUENCY OF MEASUREMENTS	HAS THERE BEEN DEFORMATION?	OTHER SIGNS OF UNREST	DATES OF UNREST	EXPLOSIVITY (LARGEST KNOWN VEI)
0805-02	42.07 N	A	E	1976	4	Y	S	Eruption in 1942	4
	140.68 E		L	1904	4	Y			
			G	1987	4	Y			
			R	1931	4	U			
			A	1914	4	Y			
			C	1984	4	Y			
			P	1988	4	Y			

Comments: EDM measurements have revealed expansion of the summit area since 1976 .

References

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Mogi, K., 1958, Relations between the eruptions of various volcanoes and the deformations of the ground surfaces around them: Bulletin of the Earthquake Research Institute, v. 36, p. 99-113.

Mori, H., Miyamachi, H., Suzuki, A., Maekawa, T., and Okada, H., 1988, Geodetic research at volcanoes in Hokkaido, Japan: Kagoshima International Conference on Volcanism, Proceedings, p. 342-345.

Sawada, Y., 1989, Pers. comm.

Usu									
VOLCANO #	LATITUDE LONGITUDE	ROCK TYPE	TYPE OF MONITOR	YEAR MEASUREMENTS INITIATED	FREQUENCY OF MEASUREMENTS	HAS THERE BEEN DEFORMATION?	OTHER SIGNS OF UNREST	DATES OF UNREST	EXPLOSIVITY (LARGEST KNOWN VEI)
0805-03	42.53 N	D	E	1971	1-4	Y	S,G,T	Eruption in 1977-79	5
	140.83 E		T	1977	0	Y			
			L	1905	4	Y			
			G	1972	3	Y			
			R	1913	3	Y			
			C	1943	2	Y			
			V	1944	2	Y			

Comments: Usu Volcano, located within the Toya Caldera, is dacitic in composition. Eruptions are characterized by extreme ground deformation and intense seismicity. There have been 3 eruptive episodes this century: a cryptodome formed in 1910, a lava dome formed in 1943-1945, and a summit crater eruption occurred in 1977-1978. The 1977 eruption was associated with profound tilting and vertical uplift up to 40 cm/day at the summit.

References

Katsui, Y., Komuro, H., Uda, T., 1985, Development of faults and growth of Usu-Shinzan cryptodome in 1977-1982 at Usu Volcano, north Japan: Journal of the Faculty of Science, Hokkaido University, Ser. IV, v. 21, no. 3, p. 339-362.

Katsui, Y., Yokoyama, I., and Murozumi, M., 1981, Usu Volcano, in Katsui, Y., ed., Field Excursion guide to Usu and Tarumai volcanoes and Noboribetsu Spa: Symposium on Arc Volcanism, Volcanological Society of Japan, p. 1-37.

Kumagai, T., Takahashi, H., and Oyagi, N., 1988, Precursor of volcanism observed by crustal movement in Iwo-Jima: Kagoshima International Conference on Volcanism, Proceedings, p. 366-367.

Minakami, T., 1960, Fundamental research for predicting volcanic eruptions: Earthquakes and crustal deformations originating from volcanic activities: Bulletin of the Earthquake Research Institute, v. 38, p. 497-544.

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Sawada, Y., 1989, Pers. comm.

Suzuki, S., and Kasahara, M., 1979, Seismic activity immediately before and in the early stage of the 1977 eruption of Usu Volcano, Hokkaido, Japan: Journal of the Faculty of Science, Hokkaido University, Ser. VII, v. 6, p. 239-254..

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Kuttyaro									
VOLCANO #	LATITUDE LONGITUDE	ROCK TYPE	TYPE OF MONITOR	YEAR MEASUREMENTS INITIATED	FREQUENCY OF MEASUREMENTS	HAS THERE BEEN DEFORMATION?	OTHER SIGNS OF UNREST	DATES OF UNREST	EXPLOSIVITY (LARGEST KNOWN VEI)
0805-032	42.50 N	A,D	E	1972	3	Y	?	No historic eruptions	?
	141.18 E		L	1974	4	Y			
			G	1958	T	Y			
			P	1989	4	U			

Comments: Kuttyaro Caldera is one of the largest calderas in Japan, measuring about 20 km in diameter. A negative gravity anomaly has been observed.

References

Sawada, Y., 1989, Pers. comm.

Yokoyama, I., 1983, Gravimetric studies and drilling results at the four calderas in Japan, in Arc Volcanism: Physics and Tectonics: Terra Scientific, Tokyo, p. 29-41.

Tarumai									
VOLCANO #	LATITUDE LONGITUDE	ROCK TYPE	TYPE OF MONITOR	YEAR MEASUREMENTS INITIATED	FREQUENCY OF MEASUREMENTS	HAS THERE BEEN DEFORMATION?	OTHER SIGNS OF UNREST	DATES OF UNREST	EXPLOSIVITY (LARGEST KNOWN VEI)
0805-04	42.68 N	A	T	1981	3	Y	S,T	Eruption in 1978; activity	5
	141.38 E		G	1965	4	U		continued through 1981	
			E	1971	4	Y			
			R	?	4	U			
			P	1988	3	U			

Comments: There was no significant deformation measured during the phreatic activity of 1978-1981 at Tarumai. However, leveling measurements since 1983 indicate oscillatory fluctuations at the summit.

References

Katsui, Y., Yokoyama, I., and Murzumi, M., 1981, Tarumai Volcano, in Katsui, Y., ed, Field Excursion guide to Usu and Tarumai volcanoes and Noboribetsu Spa: Symposium on Arc Volcanism, Volcanological Society of Japan, p. 38-54.

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Yokoyama, I., ed., 1984, Joint geophysical and geochemical observations of Usu volcano and Tarumai volcano in 1983: Hokkaido University, 214 p. (in Japanese with English abstract and captions)

Tokachidake									
VOLCANO #	LATITUDE LONGITUDE	ROCK TYPE	TYPE OF MONITOR	YEAR MEASUREMENTS INITIATED	FREQUENCY OF MEASUREMENTS	HAS THERE BEEN DEFORMATION?	OTHER SIGNS OF UNREST	DATES OF UNREST	EXPLOSIVITY (LARGEST KNOWN VEI)
0805-05	43.42 N	B,A	E	1985	4	N	S,G,T	Activity increased since 1983;	3
	142.68 E		T	1987	0	Y		intense thermal activity	
			G	1989	4	U		during 1985	
			P	1989	3	N			

Comments: There were no significant EDM changes detected at Tokachidake prior to the small phreatic eruption in 1985.

References

Miyamachi, H., Maekawa, T., Okayama, M., Kasahara, M., and Okada, H., 1990, Observation of crustal deformation associated with the 1988 Tokachidake volcanic eruptions: Rep. Natur. Disaster Sci. Center Hokkaido, v. 5, p. 75-92. (in Japanese with English abstract and captions)

Mori, H., Miyamachi, H., Suzuki, A., Maekawa, T., and Okada, H., 1988, Geodetic research at volcanoes in Hokkaido, Japan: Kagoshima International Conference on Volcanism, Proceedings, p. 342-345.

Okada, H., Nishimura, Y., Miyamachi, H., Mori, H., and Ishihara, K., 1990 (in press), Geophysical significance of the 1988-1989 explosive eruptions of Mt. Tokachi, Hokkaido, Japan: Bulletin of the Volcanological Society of Japan, v. 35.

Sawada, Y., 1989, Pers. comm.

Meakandake (Akan Caldera)									
VOLCANO #	LATITUDE LONGITUDE	ROCK TYPE	TYPE OF MONITOR	YEAR MEASUREMENTS INITIATED	FREQUENCY OF MEASUREMENTS	HAS THERE BEEN DEFORMATION?	OTHER SIGNS OF UNREST	DATES OF UNREST	EXPLOSIVITY (LARGEST KNOWN VEI)
0805-07	43.38 N	A	E	1988	3	N	S,G,T	Eruption in 1988	2
	144.02 E		G	1989	4	U			
			P	1989	4	U			

Comments: Seismicity and geothermal activity increased in 1987. A small eruption occurred in 1988.

References

Newhall, C.G., and Dzurisin, D., 1988, Historical unrest at large calderas of the world, v. 1: U.S. Geological Survey Bulletin 1855, p. 584-591.

Okada, H., 1990, Pers. comm.

Unzen (Chijiwa area)									
VOLCANO #	LATITUDE LONGITUDE	ROCK TYPE	TYPE OF MONITOR	YEAR MEASUREMENTS INITIATED	FREQUENCY OF MEASUREMENTS	HAS THERE BEEN DEFORMATION?	OTHER SIGNS OF UNREST	DATES OF UNREST	EXPLOSIVITY (LARGEST KNOWN VEI)
0802-10	32.75 N 130.30E	A,D	L	1894	4	Y	S	Seismic swarm in 1984	?

Comments: Unzen is located in an 8 km-wide E-W trending graben. Leveling surveys between 1894 and 1958 indicate 10-15 cm of subsidence.

References

Newhall, C.G., and Dzurisin, D., 1988, Historical unrest at large calderas of the world, v. 2: U.S. Geological Survey Bulletin 1855, p. 1022-1038.

Sawada, Y., 1989, Pers. comm.

Teishi									
VOLCANO #	LATITUDE LONGITUDE	ROCK TYPE	TYPE OF MONITOR	YEAR MEASUREMENTS INITIATED	FREQUENCY OF MEASUREMENTS	HAS THERE BEEN DEFORMATION?	OTHER SIGNS OF UNREST	DATES OF UNREST	EXPLOSIVITY (LARGEST KNOWN VEI)
no #	35.00 N 139.10 E	B	P	1988	1	Y	S	Seismicity has increased since 1978; a submarine eruption occurred in July 1989	?

Comments: Teishi is a submarine volcano located off the Izu Peninsula. Uplift and increased seismicity preceded the 1989 eruption.

References

Shimada, S., Fujinawa, Y., Sekiguchi, S., Ohmi, S., Eguchi, T., and Okada, Y., 1990, Detection of a volcanic fracture opening in Japan using Global Positioning System measurements: Nature, v. 343, p. 631-632.

Region: Mariana Islands									
Pagan									
VOLCANO #	LATITUDE LONGITUDE	ROCK TYPE	TYPE OF MONITOR	YEAR MEASUREMENTS INITIATED	FREQUENCY OF MEASUREMENTS	HAS THERE BEEN DEFORMATION?	OTHER SIGNS OF UNREST	DATES OF UNREST	EXPLOSIVITY (LARGEST KNOWN VEI)
0804-17	18.13 N	B	E	1981	?	Y	S	Eruption in 1981	3
	145.80 E		T	1981	?	Y			
			I	?	?	Y			

Comments: Deformation monitoring was not initiated until 6 days after the 15 May 1981 eruption of Pagan. The eastern-lagoon water level was monitored, and a drop in the level was noted. The water-level drop may have resulted from uplift of the central part of the island or from drainage of the lake caused by earthquakes and the eruption. EDM reflectors were installed on the south flank of the mountain. EDM line length varied considerably; whether it was due to the intrusion of magma or gravitational instability of the reflector stations is not known.

References

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Anatahan									
VOLCANO #	LATITUDE LONGITUDE	ROCK TYPE	TYPE OF MONITOR	YEAR MEASUREMENTS INITIATED	FREQUENCY OF MEASUREMENTS	HAS THERE BEEN DEFORMATION?	OTHER SIGNS OF UNREST	DATES OF UNREST	EXPLOSIVITY (LARGEST KNOWN VEI)
0804-20	16.35 N 145.67 E	?	E	1990	?	N	S	Seismic swarm in April 1990; no historic eruptions	?

Comments: Deformation monitoring was initiated in April, 1990 after several seismic swarms were recorded. EDM lines were remeasured in June but there were no significant changes.

References

Banks, N.G., 1990, Pers. comm.

Region: Kamchatka									
Karymsky									
VOLCANO #	LATITUDE LONGITUDE	ROCK TYPE	TYPE OF MONITOR	YEAR MEASUREMENTS INITIATED	FREQUENCY OF MEASUREMENTS	HAS THERE BEEN DEFORMATION?	OTHER SIGNS OF UNREST	DATES OF UNREST	EXPLOSIVITY (LARGEST KNOWN VEI)
1000-13	54.07 N	D	E	1972	4	Y	S,G	Eruption in 1970; lava dome	3
	159.60 E		T	1976	T	Y		growth continued through	
			L	1972	?	Y		1985	

Comments: Karymsky Volcano is located within the Karymsky Caldera. The volcano erupted in 1970 and actively built a lava dome through 1985.

References

Newhall, C.G., and Dzurisin, D., 1988, Historical unrest at large calderas of the world: U.S. Geological Survey Bulletin 1855, v. 2, p. 649-663.

Plosky Tolbachik									
VOLCANO #	LATITUDE LONGITUDE	ROCK TYPE	TYPE OF MONITOR	YEAR MEASUREMENTS INITIATED	FREQUENCY OF MEASUREMENTS	HAS THERE BEEN DEFORMATION?	OTHER SIGNS OF UNREST	DATES OF UNREST	EXPLOSIVITY (LARGEST KNOWN VEI)
1000-24	55.93 N	B	E	1975	?	Y	S	Eruption in 1975	4
	160.47 E		T	1976	?	Y			
			R	1975	?	Y			
			V	1975	?	Y			

Comments: Deformation monitoring was initiated 1 week after the 1975 eruption began in order to monitor the growth of 3 scoria cones.

References

Fedotov, S.A., Enman, V.B., Magus'kin, M.A., Levin, V.Ye., Zharinov, N.A., and Enman, S.V., 1983, Deformations of the Earth's surface in the vicinity of the New Tolbachik volcanoes (1975-1976) in Fedotov, S.A., and Markhinin, Ye.K., eds., The great Tolbachik fissure eruption: Cambridge, University Press, p. 267-282.

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Tokarev, P.I., 1978, Prediction and characteristics of the 1975 eruption of Tolbachik Volcano, Kamchatka: Bulletin Volcanologique, v. 41, no. 3, p. 251-258.

Zharinov, N.A., Dobrokhotov, Yu.S., Magus'kin, M.A., and Enman, S.V., 1983, Tilt of the Earth's surface during the formation of Cone II of the Great Tolbachik fissure eruption in 1975, in Fedotov, S.A., and Markhinin, Ye.K., eds., The great Tolbachik fissure eruption: Cambridge, University Press, p. 301-306.

Klyuchevskoi									
VOLCANO #	LATITUDE LONGITUDE	ROCK TYPE	TYPE OF MONITOR	YEAR MEASUREMENTS INITIATED	FREQUENCY OF MEASUREMENTS	HAS THERE BEEN DEFORMATION?	OTHER SIGNS OF UNREST	DATES OF UNREST	EXPLOSIVITY (LARGEST KNOWN VEI)
1000-26	56.18 N	U	E	1978	?	Y	U	Eruption in 1985	4
	160.78 E		R	1978	?	N			
			T	1978	0	Y			
			L	1978	?	U			
			V	1978	?	N			

Comments: Preceding the parasitic eruption of 1983, there was 10 cm of uplift between 1979 and 1982.

References

Zharinov, N.A., Enman, V.B., Skuridin, Yu.F., Eremeev, N.N., Lokotko, M.I., 1988, Measurement of land-surface deformation at Klyuchevskoi volcano: Volcanology and Seismology, v. 6, no. 4, p. 569-581.

Region: Alaska									
Pavlof									
VOLCANO #	LATITUDE LONGITUDE	ROCK TYPE	TYPE OF MONITOR	YEAR MEASUREMENTS INITIATED	FREQUENCY OF MEASUREMENTS	HAS THERE BEEN DEFORMATION?	OTHER SIGNS OF UNREST	DATES OF UNREST	EXPLOSIVITY (LARGEST KNOWN VEI)
1102-03	55.42 N 161.90 W	B	L	1972	3	Y	S	Eruption in 1986	3

Comments: Pavlof has erupted 20 times in this century. Leveling data indicated a steady tilt downward toward the adjacent Shumagin trench from 1977 through 1982. An aseismic tilt reversal in 1978 to 1980 interrupted this trend. The most recent eruptive activity began in 1986.

References

Beavan, J., Hauksson, E., McNutt, S.R., Bilham, R., and Jacob, K.H., 1983, Tilt and seismicity changes in the Shumagin seismic gap: Science, v. 222, no. 4621, p. 322-325.

Newhall, C.G., and Dzurisin, D., 1988, Historical unrest at large calderas of the world: U.S. Geological Survey Bulletin 1855, v. 2, p. 698-707.

Novarupta									
VOLCANO #	LATITUDE LONGITUDE	ROCK TYPE	TYPE OF MONITOR	YEAR MEASUREMENTS INITIATED	FREQUENCY OF MEASUREMENTS	HAS THERE BEEN DEFORMATION?	OTHER SIGNS OF UNREST	DATES OF UNREST	EXPLOSIVITY (LARGEST KNOWN VEI)
1102-16	58.27 N 155.16 W	R,D,A	E	1989	4	N	N	Eruption in 1950	6

Comments: Novarupta, located in the Valley of Ten Thousand Smokes, is thought to be a funnel-shaped structure that was backfilled with its own ejecta in 1912 and subsequently extruded a rhyolitic dome. In 1912, the Valley of Ten Thousand Smokes was the site of one of the three largest historic eruptions. During this eruption, the vast majority of ejected pyroclastic material originated from the Novarupta vent area.

References

Newhall, C.G., and Dzurisin, D., 1988, Historical unrest at large calderas of the world: U.S. Geological Survey Bulletin 1855, v. 2, p. 721-731.

Kleinman, J., 1990, Pers. comm.

Augustine									
VOLCANO #	LATITUDE LONGITUDE	ROCK TYPE	TYPE OF MONITOR	YEAR MEASUREMENTS INITIATED	FREQUENCY OF MEASUREMENTS	HAS THERE BEEN DEFORMATION?	OTHER SIGNS OF UNREST	DATES OF UNREST	EXPLOSIVITY (LARGEST KNOWN VEI)
1103-01	59.37 N	A	E	1986	4	N	S	Eruption in 1986	4
	153.42 W		T	1987	0	N			
			V	?	?	Y			

Comments: Augustine Island uplift occurred in 1964 probably as a result of an earthquake. Uplift was measured where dead barnacles were found above living barnacles. Wave-cut terraces provide evidence of past episodes of uplift.

References

Detterman, R.L., 1968, Recent activity on Augustine Island, Alaska: U.S. Geological Survey Professional Paper 600C, p. C126-C129.

Power, J., 1990, Pers. comm.

Redoubt									
VOLCANO #	LATITUDE LONGITUDE	ROCK TYPE	TYPE OF MONITOR	YEAR MEASUREMENTS INITIATED	FREQUENCY OF MEASUREMENTS	HAS THERE BEEN DEFORMATION?	OTHER SIGNS OF UNREST	DATES OF UNREST	EXPLOSIVITY (LARGEST KNOWN VEI)
1103-03	60.48 N 152.75 W	A	P	1989	4	U	S	Eruption in 1989	3

Comments: The December, 1989 eruption followed 23 years of quiescence. Most deformation monitoring techniques are not practical due to the remote location and harsh climate.

References

Iwatsubo, E.Y., 1990, Pers. comm.

Region: United States									
Baker									
VOLCANO #	LATITUDE LONGITUDE	ROCK TYPE	TYPE OF MONITOR	YEAR MEASUREMENTS INITIATED	FREQUENCY OF MEASUREMENTS	HAS THERE BEEN DEFORMATION?	OTHER SIGNS OF UNREST	DATES OF UNREST	EXPLOSIVITY (LARGEST KNOWN VEI)
1201-01	48.786N	A	E	1981	4	N	G	Increased fumarolic activity	2
	121.82 W		T	1975	4	N		in 1975	
			G	1975	?	U			

Comments: Hydrothermal activity in Sherman Crater on Mt. Baker increased abruptly in 1975. As a result of this increased activity, tilt surveys were initiated by the USGS.

References

Chadwick Jr., W.W., Iwatsubo, E.Y., Swanson, D.A., and Ewert, J.W., 1985, Measurements of slope distances and vertical angles at Mount Baker and Mount Rainier, Washington, Mount Hood and Crater Lake, Oregon, and Mount Shasta, and Lassen Peak, California, 1980-1984: U.S. Geological Survey Open-File Report 85-205, 96 p.

Frank, D.,Meier, M.F., and Swanson, D.A., 1977, Assessment of increased thermal activity at Mount Baker, Washington, March 1975-March 1976: U.S. Geological Survey Professional Paper 1022-A, 49 p.

Malone, S.D., 1979, Gravity changes accompanying increased heat emission at Mount Baker, Washington: Journal of Volcanology and Geothermal Research, v. 6, p. 241-256.

Rainier									
VOLCANO #	LATITUDE LONGITUDE	ROCK TYPE	TYPE OF MONITOR	YEAR MEASUREMENTS INITIATED	FREQUENCY OF MEASUREMENTS	HAS THERE BEEN DEFORMATION?	OTHER SIGNS OF UNREST	DATES OF UNREST	EXPLOSIVITY (LARGEST KNOWN VEI)
1201-03	46.87 N	A	E	1982	4	N	N	Has not erupted since late	4
	121.758W		T	1982	4	N		1800's	
			L	1982	4	N			

Comments: Mount Rainier is the highest volcano in the Cascade Range. Recent activity includes glacial outburst floods on the SW flank.

References

Chadwick Jr., W.W., Iwatsubo, E.Y., Swanson, D.A., and Ewert, J.W., 1985, Measurements of slope distances and vertical angles at Mount Baker and Mount Rainier, Washington, Mount Hood and Crater Lake, Oregon, and Mount Shasta, and Lassen Peak, California, 1980-1984: U.S. Geological Survey Open File-Report 85-205, 96 p.

Dzurisin, D., Johnson, D., and Symonds, R., 1983, Dry tilt network at Mount Rainier, Washington: U.S. Geological Survey Open-File Report 83-277, 9 p.

St. Helens									
VOLCANO #	LATITUDE LONGITUDE	ROCK TYPE	TYPE OF MONITOR	YEAR MEASUREMENTS INITIATED	FREQUENCY OF MEASUREMENTS	HAS THERE BEEN DEFORMATION?	OTHER SIGNS OF UNREST	DATES OF UNREST	EXPLOSIVITY (LARGEST KNOWN VEI)
1201-05	46.20 N	B,A,D	E	1973	1	Y	S	Last dome-building eruption	5
	122.18 W		T	1980	1	Y		occurred in 1986	
			L	1980	1	Y			

Comments: Numerous extrusions at St. Helens between June 1980 and October 1986 were predicted from tens of minutes to several weeks in advance on the basis of recurring seismic, deformation, and gas-emission patterns.

References

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Hood									
VOLCANO #	LATITUDE LONGITUDE	ROCK TYPE	TYPE OF MONITOR	YEAR MEASUREMENTS INITIATED	FREQUENCY OF MEASUREMENTS	HAS THERE BEEN DEFORMATION?	OTHER SIGNS OF UNREST	DATES OF UNREST	EXPLOSIVITY (LARGEST KNOWN VEI)
1202-01	45.37 N	A	E	1980	4	N	N	Occasional seismic swarms	2
	121.70 W		T	1983	4	N		during the 1980's	

Comments: Mount Hood last erupted in 1865.

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South Sister									
VOLCANO #	LATITUDE LONGITUDE	ROCK TYPE	TYPE OF MONITOR	YEAR MEASUREMENTS INITIATED	FREQUENCY OF MEASUREMENTS	HAS THERE BEEN DEFORMATION?	OTHER SIGNS OF UNREST	DATES OF UNREST	EXPLOSIVITY (LARGEST KNOWN VEI)
1202-07	44.10 N	A,D	L	1985	4	N	N	Last eruption occurred	?
	121.77 W		E	1985	4	N		around 150 B.C.	

Comments: South Sister is the youngest of 3 overlapping composite volcanoes.

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Newberry									
VOLCANO #	LATITUDE LONGITUDE	ROCK TYPE	TYPE OF MONITOR	YEAR MEASUREMENTS INITIATED	FREQUENCY OF MEASUREMENTS	HAS THERE BEEN DEFORMATION?	OTHER SIGNS OF UNREST	DATES OF UNREST	EXPLOSIVITY (LARGEST KNOWN VEI)
1202-11	43.68 N	B,R	E	1985	4	N	N	Last eruption occurred	4
	121.25 W		L	1985	4	N		around 620 B.C.	

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Yamashita, K.M., and Doukas, M.P., 1987, Precise level lines at Crater Lake, Newberry Crater and South Sister, Oregon: U.S. Geological Survey Open-File Report 87-293, 18 p.

Crater Lake									
VOLCANO #	LATITUDE LONGITUDE	ROCK TYPE	TYPE OF MONITOR	YEAR MEASUREMENTS INITIATED	FREQUENCY OF MEASUREMENTS	HAS THERE BEEN DEFORMATION?	OTHER SIGNS OF UNREST	DATES OF UNREST	EXPLOSIVITY (LARGEST KNOWN VEI)
1202-16	42.93 N	A	E	1981	4	N	N	Last eruption occurred	6
	122.12 W		L	1985	4	N		around 4650 B.C.	

Comments: Crater Lake is located within an 8x5 km caldera. It was the site of a caldera-producing eruption 6,600 ybp.

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Yamashita, K.M., and Doukas, M.P., 1987, Precise level lines at Crater Lake, Newberry Crater and South Sister, Oregon: U.S. Geological Survey Open-File Report 87-293, 18 p.

Shasta									
VOLCANO #	LATITUDE LONGITUDE	ROCK TYPE	TYPE OF MONITOR	YEAR MEASUREMENTS INITIATED	FREQUENCY OF MEASUREMENTS	HAS THERE BEEN DEFORMATION?	OTHER SIGNS OF UNREST	DATES OF UNREST	EXPLOSIVITY (LARGEST KNOWN VEI)
1203-04	41.40 N	A	E	1981	4	N	N	Seismic swarm in 1978;	3
	122.18 W		T	1972	4	N		last eruptive activity	
			G	1981	4	N		in 1786	
			P	1990	4	U			

Comments: Mount Shasta consists of 4 overlapping cones. A debris avalanche occurred between 360,000 and 300,000 ybp.

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Dzurisin, D., Johnson, D., Murray, T., and Myers, B., 1982, Tilt networks at Mount Shasta and Lassen Peak, California: U.S. Geological Survey Open-File Report 82-670, 42 p.

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Medicine Lake									
VOLCANO #	LATITUDE LONGITUDE	ROCK TYPE	TYPE OF MONITOR	YEAR MEASUREMENTS INITIATED	FREQUENCY OF MEASUREMENTS	HAS THERE BEEN DEFORMATION?	OTHER SIGNS OF UNREST	DATES OF UNREST	EXPLOSIVITY (LARGEST KNOWN VEI)
1203-05	41.53 N	B,R	L	1954	4	Y	S	Seismic swarms in 1988 and	3
	121.53 W		E	1989	4	U		1989	
			G	1981	4	U			
			P	1990	4	U			

Comments: Seismic swarms in 1988 and 1989 prompted renewed interest in the Medicine Lake Highlands. Leveling surveys indicate subsidence has occurred since the 1954 survey and that deformation is centered on the Medicine Lake volcano.

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Lassen									
VOLCANO #	LATITUDE LONGITUDE	ROCK TYPE	TYPE OF MONITOR	YEAR MEASUREMENTS INITIATED	FREQUENCY OF MEASUREMENTS	HAS THERE BEEN DEFORMATION?	OTHER SIGNS OF UNREST	DATES OF UNREST	EXPLOSIVITY (LARGEST KNOWN VEI)
1203-06	40.492N	A	E	1981	4	N	N	Eruption in 1914-1921	3
	121.508W		T	1981	4	N			

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Long Valley									
VOLCANO #	LATITUDE LONGITUDE	ROCK TYPE	TYPE OF MONITOR	YEAR MEASUREMENTS INITIATED	FREQUENCY OF MEASUREMENTS	HAS THERE BEEN DEFORMATION?	OTHER SIGNS OF UNREST	DATES OF UNREST	EXPLOSIVITY (LARGEST KNOWN VEI)
1203-08	37.70 N	R	E	1982	3	Y	S	Seismic swarms have occurred	4
	118.87 W		T	1982	4	U		from 1978 to present	
			L	1975	3	Y			
			G	1982	3	Y			
			S	1989	0	Y			

Comments: Long Valley Caldera resulted from a voluminous eruption approximately 700,000 years ago and has been the locus of repeated eruptions since that time. Recurring seismic swarms, uplift of the caldera floor, and increased fumarolic activity have been detected since 1978. This activity has been attributed to the expansion of 2 subsurface magma chambers beneath the caldera and faulting on the south moat.

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Yellowstone									
VOLCANO #	LATITUDE LONGITUDE	ROCK TYPE	TYPE OF MONITOR	YEAR MEASUREMENTS INITIATED	FREQUENCY OF MEASUREMENTS	HAS THERE BEEN DEFORMATION?	OTHER SIGNS OF UNREST	DATES OF UNREST	EXPLOSIVITY (LARGEST KNOWN VEI)
1205-01	44.58 N	R	E	1984	4	Y	S,T	Deformation has been	?
	110.53 W		L	1923	4	Y		documented since 1975	
			A	1987	0	N			
			G	1977	?	U			
			V	1985	?	Y			
			P	1987	4	Y			

Comments: Rapid crustal uplift at an average rate of 15±1 mm/yr was discovered by comparing leveling surveys conducted within Yellowstone Caldera between 1923 and 1984. The caldera floor stopped rising during 1984-1985, and began subsiding from 1985-1990.

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Region: Hawaii									
Kilauea									
VOLCANO #	LATITUDE LONGITUDE	ROCK TYPE	TYPE OF MONITOR	YEAR MEASUREMENTS INITIATED	FREQUENCY OF MEASUREMENTS	HAS THERE BEEN DEFORMATION?	OTHER SIGNS OF UNREST	DATES OF UNREST	EXPLOSIVITY (LARGEST KNOWN VEI)
1302-01	19.425N	B	E	1965	1	Y	S,G	Almost continuous activity	2
	155.292W		T	1958	0	Y			
			L	1912	4	Y			
			R	1922	4	Y			
			G	1975	4	U			
			P	1987	3	U			

Comments: Seismicity and deformation at Kilauea are closely related to changing magma volume of a shallow reservoir beneath the summit and intrusions into the rift zones. Displacement of the unbuttressed south flank is related to intrusion of magma into the rift zones.

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Tilling, R.I., Christiansen, R.L., Duffield, W.A., Endo, E.T., Holcomb, R.T., Koyanagi, R.Y., Peterson, D.W., and Unger, J.D., 1987, The 1972-1974 Mauna Ulu eruption, Kilauea Volcano: An example of quasi-steady-state magma transfer, in Decker, R.W., Wright, T.L., and Stauffer, P.H., eds., Volcanism in Hawaii: U.S. Geological Survey Professional Paper 1350, v. 1, p. 405-469.

Wolfe, E.W., Garcia, M.I., Jackson, D.B., Koyanagi, R.Y., Neal, C.A., and Okamura, A.T., 1987 the Poo Oo eruption of Kilauea Volcano, episodes 1-20, January 3, 1983, to June 8, 1984, in Decker, R.W., Wright, T.L., and Stauffer, P.H., eds., Volcanism in Hawaii: U.S. Geological Survey Professional Paper 1350, v. 2, p. 471-508.

Mauna Loa									
VOLCANO #	LATITUDE LONGITUDE	ROCK TYPE	TYPE OF MONITOR	YEAR MEASUREMENTS INITIATED	FREQUENCY OF MEASUREMENTS	HAS THERE BEEN DEFORMATION?	OTHER SIGNS OF UNREST	DATES OF UNREST	EXPLOSIVITY (LARGEST KNOWN VEI)
1302-02	19.475N	B	E	1965	3	Y	S,T	Eruption in 1975 and 1984	0
	155.608W		T	1974	0	Y			
			L	1964	4	Y			
			G	1976	4	U			
			P	1987	4	U			

Comments: Mauna Loa began to gradually inflate 10 years before the 1984 eruption. Based on analysis of deformation and seismic data, a forecast of eruptive activity was appropriately made in 1983.

References

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Mauna Kea									
VOLCANO #	LATITUDE LONGITUDE	ROCK TYPE	TYPE OF MONITOR	YEAR MEASUREMENTS INITIATED	FREQUENCY OF MEASUREMENTS	HAS THERE BEEN DEFORMATION?	OTHER SIGNS OF UNREST	DATES OF UNREST	EXPLOSIVITY (LARGEST KNOWN VEI)
1302-03	19.82 N	B	E	1970	4	N	U	No historic eruptions	?
	155.47 W		P	1987	4	U			

Comments: EDM monitoring of Mauna Kea is part of a larger island-wide network.

References

Yamashita, K.M., 1990, Pers. comm.

Hualalai									
VOLCANO #	LATITUDE LONGITUDE	ROCK TYPE	TYPE OF MONITOR	YEAR MEASUREMENTS INITIATED	FREQUENCY OF MEASUREMENTS	HAS THERE BEEN DEFORMATION?	OTHER SIGNS OF UNREST	DATES OF UNREST	EXPLOSIVITY (LARGEST KNOWN VEI)
1302-04	19.692N	B	E	1971	4	N	N	Last erupted in 1801	0
	155.87 W		T	1975	4	N			

References

Yamashita, K.M., 1990, Pers. comm.

Region: Mexico									
Colima									
VOLCANO #	LATITUDE LONGITUDE	ROCK TYPE	TYPE OF MONITOR	YEAR MEASUREMENTS INITIATED	FREQUENCY OF MEASUREMENTS	HAS THERE BEEN DEFORMATION?	OTHER SIGNS OF UNREST	DATES OF UNREST	EXPLOSIVITY (LARGEST KNOWN VEI)
1401-04	19.42 N	A,D	G	1977	?	U	G,T	Fumarolic activity increased	4
	103.72 W		L	1982	4	Y		1979-81 and from 1985 to the	
			T	?	?	U		present	

Comments: Two stratovolcanoes form the Colima volcanic complex. Since 1576, three cycles of eruptive activity have been identified which have culminated in major ashflow eruptions. The volcano is currently exhibiting behavior that would suggest that a fourth eruptive cycle has begun.

References

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De la Cruz, S., 1989, contribution to the Bulletin of Volcanic Eruptions: Volcanological Society of Japan, no. 26, p. 63-64.

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Popocatépetl									
VOLCANO #	LATITUDE LONGITUDE	ROCK TYPE	TYPE OF MONITOR	YEAR MEASUREMENTS INITIATED	FREQUENCY OF MEASUREMENTS	HAS THERE BEEN DEFORMATION?	OTHER SIGNS OF UNREST	DATES OF UNREST	EXPLOSIVITY (LARGEST KNOWN VEI)
1401-09	19.02 N 098.62 W	A	E	1989	4	U	S	Eruption in 1943	1

Comments: A small number of low magnitude B-type earthquakes have been detected by the recently installed seismic monitoring station.

References

De la Cruz-Reyna, S., 1990, Pers. comm.

Tacaná									
VOLCANO #	LATITUDE LONGITUDE	ROCK TYPE	TYPE OF MONITOR	YEAR MEASUREMENTS INITIATED	FREQUENCY OF MEASUREMENTS	HAS THERE BEEN DEFORMATION?	OTHER SIGNS OF UNREST	DATES OF UNREST	EXPLOSIVITY (LARGEST KNOWN VEI)
1401-13	15.13 N	A,D	E	1986	4	N	S	Elevated levels of activity	1
	092.10 W		T	1986	4	U		in 1986	
			L	1986	4	N			

Comments: Tacaná lies on the border of Mexico and Guatemala. A seismic swarm in 1986 culminated in a phreatic explosion which opened a 20 m craterlet in the NW flank of the volcano.

References

Banks, N.G., Ewert, J.W., and Lockhart, A.B., 1987, Volcano hazards in Guatemala: Preparedness and suggested program for their mitigation: Final Report and Recommendations of the U.S. Geological Survey/Office of Foreign Disaster Assistance Volcano Crisis Assistance Team, 48 p.

De la Cruz-Reyna, S., 1990, Pers. comm.

Region: Guatemala									
Santiaguito (Santa Maria)									
VOLCANO #	LATITUDE LONGITUDE	ROCK TYPE	TYPE OF MONITOR	YEAR MEASUREMENTS INITIATED	FREQUENCY OF MEASUREMENTS	HAS THERE BEEN DEFORMATION?	OTHER SIGNS OF UNREST	DATES OF UNREST	EXPLOSIVITY (LARGEST KNOWN VEI)
1402-03	14.758N	D	E	1988	3	Y	S	Frequently active since dome	6
	091.548W		R	1988	3	Y		extrusion began in 1922	

Comments: Santiaguito dome, in southwestern Guatemala, is located on the flanks of Santa Maria volcano. This continuously active dacite dome and lava flow complex began forming in 1922 in an explosion crater on the southwestern slope of the older volcano. Santa Maria and Santiaguito lie on a northeast-trending linear fracture zone. Periods of increased extrusion have occurred in 4 discrete cycles. Dome extrusion is commonly accompanied by pyroclastic activity and followed by lava flows.

References

Marso, J.N., 1990, Pers. comm.

Rose, W.I., 1987, Volcanic activity at Santiaguito volcano, 1976-1984: Geological Society of America Special Paper 212, p. 17-27.

Fuego									
VOLCANO #	LATITUDE LONGITUDE	ROCK TYPE	TYPE OF MONITOR	YEAR MEASUREMENTS INITIATED	FREQUENCY OF MEASUREMENTS	HAS THERE BEEN DEFORMATION?	OTHER SIGNS OF UNREST	DATES OF UNREST	EXPLOSIVITY (LARGEST KNOWN VEI)
1402-09	14.482N	B	E	1987	3	N	T,S	Frequently active	4
	090.882W		R	1987	3	N			
			T	1987	3	N			
			L	1988	3	N			

Comments: Fuego has erupted 61 times since 1524. Eruptions are characterized by pyroclastic flows.

References

Marso, J.N., 1990, Pers. comm.

Pacaya									
VOLCANO #	LATITUDE LONGITUDE	ROCK TYPE	TYPE OF MONITOR	YEAR MEASUREMENTS INITIATED	FREQUENCY OF MEASUREMENTS	HAS THERE BEEN DEFORMATION?	OTHER SIGNS OF UNREST	DATES OF UNREST	EXPLOSIVITY (LARGEST KNOWN VEI)
1402-11	14.38 N	B,A	E	1987	?	N	S	Eruption in 1989	3
	090.603W		G	1975	?	Y			
			L	1979	?	U			
			T	1989	2	U			

Comments: Time-dependent changes in the gravity field were observed between 1975 and 1979. Elevation control was established in 1979 through leveling. Gravity and elevation changes were contemporaneous with eruptive activity from 1979 to 1980.

References

Eggers, A.A., 1983, Temporal gravity and elevation changes at Pacaya Volcano, Guatemala: Journal of Volcanology and Geothermal Research, v. 19, p. 223-237.

Eggers, A.A., and Chavez, D., 1979, Temporal gravity variations at Pacaya Volcano, Guatemala: Journal of Volcanology and Geothermal Research, v. 6, p. 391-402.

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Marso, J.N., 1990, Pers. comm.

Region: El Salvador									
Izalco									
VOLCANO #	LATITUDE LONGITUDE	ROCK TYPE	TYPE OF MONITOR	YEAR MEASUREMENTS INITIATED	FREQUENCY OF MEASUREMENTS	HAS THERE BEEN DEFORMATION?	OTHER SIGNS OF UNREST	DATES OF UNREST	EXPLOSIVITY (LARGEST KNOWN VEI)
1403-03	13.815N 089.635W	B	G	1964	4	N	U	Eruption in 1966	3

Comments: Izalco has been frequently active since 1770.

References

Rose Jr., W.I., and Stoiber, R.E., 1969, The 1966 eruption of Izalco Volcano, El Salvador: Journal of Geophysical Research, v. 74, no. 12, p. 3119-3130.

Region: Costa Rica									
Rincón de la Vieja									
VOLCANO #	LATITUDE LONGITUDE	ROCK TYPE	TYPE OF MONITOR	YEAR MEASUREMENTS INITIATED	FREQUENCY OF MEASUREMENTS	HAS THERE BEEN DEFORMATION?	OTHER SIGNS OF UNREST	DATES OF UNREST	EXPLOSIVITY (LARGEST KNOWN VEI)
1405-02	10.83 N 085.33 W	A	T	1982	2	U	S,T	Small phreatic eruption in 1987	3

Rincón de la Vieja has erupted 12 times since 1860.

References

Van der Laat, R., 1989, Pers. comm.

Miravalles									
VOLCANO #	LATITUDE LONGITUDE	ROCK TYPE	TYPE OF MONITOR	YEAR MEASUREMENTS INITIATED	FREQUENCY OF MEASUREMENTS	HAS THERE BEEN DEFORMATION?	OTHER SIGNS OF UNREST	DATES OF UNREST	EXPLOSIVITY (LARGEST KNOWN VEI)
1405-03	10.75 N	A	E	?	?	U	N	No historic eruptions	?
	085.15 W		T	?	?	N			
			L	1983	?	N			
			G	1985	?	N			

Comments: Miravalles is located on the rim of Guayabo Caldera. An active fumarole area is located on a prehistoric debris avalanche on the SW flank of the volcano. There has been no measured deformation to date.

References

Alvarado, G., 1989, Pers. comm.

Barquero, R., 1989, Miravalles volcano and geothermal project (Costa Rica): Monitoring and geological setting: Boletin del Observatorio Vulcanologico del Arenal, Año 2, no. 3, p. 22-27.

Arenal									
VOLCANO #	LATITUDE LONGITUDE	ROCK TYPE	TYPE OF MONITOR	YEAR MEASUREMENTS INITIATED	FREQUENCY OF MEASUREMENTS	HAS THERE BEEN DEFORMATION?	OTHER SIGNS OF UNREST	DATES OF UNREST	EXPLOSIVITY (LARGEST KNOWN VEI)
1405-032	10.47 N	A	E	1984	1	Y	S,T	In continuous eruption since	4
	084.73 W		T	1974	2	Y		1968	
			G	?	?	U			

Comments: Arenal is a symmetrical small-volume cone 3 km south of the dissected remains of a larger inactive volcanic center, Cerro Chato. The deformation data from Arenal shows continuous subsidence and is believed to be related to the loading of lava which has been erupting since 1968.

References

Alvarado, G., 1989, Pers. comm.

Van der Laat, R., 1989, Pers. comm.

Wadge, G., 1983, The magma budget of Volcan Arenal, Costa Rica from 1968 to 1980: Journal of Volcanology and Geothermal Research, v. 19, p. 281-302.

Platanar									
VOLCANO #	LATITUDE LONGITUDE	ROCK TYPE	TYPE OF MONITOR	YEAR MEASUREMENTS INITIATED	FREQUENCY OF MEASUREMENTS	HAS THERE BEEN DEFORMATION?	OTHER SIGNS OF UNREST	DATES OF UNREST	EXPLOSIVITY (LARGEST KNOWN VEI)
1405-034	10.299N 084.22 W	B,A	T	1982	2	N	N	No historic eruptions	?

Comments: Platanar is highly eroded and has not erupted in historic times. Extensive mudflow deposits are found in the major valleys draining the volcano.

References

Van der Laat, R., 1989, Pers. comm.

Poás									
VOLCANO #	LATITUDE LONGITUDE	ROCK TYPE	TYPE OF MONITOR	YEAR MEASUREMENTS INITIATED	FREQUENCY OF MEASUREMENTS	HAS THERE BEEN DEFORMATION?	OTHER SIGNS OF UNREST	DATES OF UNREST	EXPLOSIVITY (LARGEST KNOWN VEI)
1405-04	10.20 N	A	E	1984	2	Y	S,T,G	Phreatic explosions since	3
	084.22 W		T	1982	1	U		1989	
			L	1982	3	U			
			G	1983	4	Y			

Comments: There have been increased gas temperatures and seismic swarms at Poás since 1981. Activity intensified in 1989 with phreatic explosions from the summit crater lake.

References

Alvarado, G., 1989, Pers. comm.

Newhall, C.G., and Dzurisin, D., 1988, Historical unrest at large calderas of the world: U.S. Geological Survey Bulletin 1855, v. 2, p. 873-879.

Rymer, H. and Brown, G.C., 1987, Causes of microgravity change at Poás volcano, Costa Rica: An active but non-erupting system: Bulletin of Volcanology, v. 49, p. 389-398.

Rymer, H., and Brown, G., 1987, Shallow density variations deduced from 1983-85 microgravity monitoring of Poás Volcano, Costa Rica: Abstract Volume, Hawaii Symposium on How Volcanoes Work, Hilo, Jan. 1987, p. 218.

Rymer, H., and Brown, G.C., 1987, Causes of microgravity change at Poás Volcano, Costa Rica: An active but non-erupting system: Bulletin Volcanologique, v. 49, p. 389-398.

Thorpe, R.S., Locke, C.A., Brown, G.C., Francis, P.W., and Randal, M., 1981, Magma chamber below Poás volcano, Costa Rica: Journal of the Geological Society of London, v. 138, p. 367-373.

Van der Laat, R., 1989, Pers. comm.

Irazú									
VOLCANO #	LATITUDE LONGITUDE	ROCK TYPE	TYPE OF MONITOR	YEAR MEASUREMENTS INITIATED	FREQUENCY OF MEASUREMENTS	HAS THERE BEEN DEFORMATION?	OTHER SIGNS OF UNREST	DATES OF UNREST	EXPLOSIVITY (LARGEST KNOWN VEI)
1405-06	09.98 N	A	E	1984	4	U	S,T	Seismic swarm in 1982	3
	083.85 W		T	1982	2	U			
			L	1949	4	Y			
			G	1982	?	U			

Comments: Irazú erupted in 1963 depositing ash on the slopes of the volcano. Over the next 2 years rain mobilized the ash to generate mudflows that swept down drainages destroying life and property. Leveling conducted at Irazú in May 1964 showed that there had been 11 cm of uplift of the upper part of the volcano since 1949. Re-leveling in September 1964 indicated it had subsided to the 1949 level.

References

Hudnut, D.W., 1983, Geophysical survey of Irazú Volcano: Unpub. Senior Honors thesis - Dartmouth College, p. 93.

Hudnut, K.W., Williams, S.N., and Stoiber, R.E., 1983, Geological and geophysical study of Irazú volcano, Costa Rica: American Geophysical Union Annual Meeting, Abstract, San Francisco, p. 892.

Murata, K.J., Dondoli, C., and Saenz, R., 1966, The 1963-65 eruption of Irazú Volcano, Costa Rica (The period of March 1963 to October 1964): Bulletin Volcanologique, v. 29, p. 765-793.

Van der Laat, R., 1989, Pers. comm.

Turrialba									
VOLCANO #	LATITUDE LONGITUDE	ROCK TYPE	TYPE OF MONITOR	YEAR MEASUREMENTS INITIATED	FREQUENCY OF MEASUREMENTS	HAS THERE BEEN DEFORMATION?	OTHER SIGNS OF UNREST	DATES OF UNREST	EXPLOSIVITY (LARGEST KNOWN VEI)
1405-07	10.03 N	B,A	E	1984	1	U	N	Eruption in 1866	3
	083.77 W		T	1982	2	U			

Comments: Turrialba is currently exhibiting fumarolic activity in the crater. There has been no measured deformation.

References

Van der Laat, R., 1989, Pers. comm.

Region: Colombia									
Ruiz									
VOLCANO #	LATITUDE LONGITUDE	ROCK TYPE	TYPE OF MONITOR	YEAR MEASUREMENTS INITIATED	FREQUENCY OF MEASUREMENTS	HAS THERE BEEN DEFORMATION?	OTHER SIGNS OF UNREST	DATES OF UNREST	EXPLOSIVITY (LARGEST KNOWN VEI)
1501-02	04.88 N	A	E	1985	0	Y	G,S	Eruption in 1985; gas	4
	075.37 W		T	1985	?	N		emissions and seismic activity	
			L	1985	?	U		have continued	

Comments: Deformation monitoring began only 3 weeks before the 1985 eruption. Therefore, only limited conclusions can be drawn from the observations. Monitoring resumed 1 week after the eruption and continues to the present.

References

Banks, N.G., Carvajal, C., Mora, H., and Tryggvason, E., 1990, Deformation monitoring at Nevado del Ruiz, Colombia - October 1985 - March 1988: Journal of Volcanology and Geothermal Research, v. 41, p. 269-295.

Banks, N.G., Van der Laat, R., Cesar, C., and Serrano, T., 1986, Deformation monitoring at Nevado del Ruiz, Colombia: EOS, Transactions of the American Geophysical Union, v. 67, p. 403.

Galeras									
VOLCANO #	LATITUDE LONGITUDE	ROCK TYPE	TYPE OF MONITOR	YEAR MEASUREMENTS INITIATED	FREQUENCY OF MEASUREMENTS	HAS THERE BEEN DEFORMATION?	OTHER SIGNS OF UNREST	DATES OF UNREST	EXPLOSIVITY (LARGEST KNOWN VEI)
1501-08	01.22 N	A	E	1989	?	N	S,G,T	Activity began in early 1988;	4
	077.30 W		T	1989	0	Y		minor eruption in May 1989	
			L	1989	?	N			

Comments: Galeras developed signs of unrest in 1988. Seismicity, gases, and fumaroles have been monitored in addition to the deformation network..

References

Ewert, J.W., 1989, Pers. comm.

Region: Ecuador									
Cuicocha									
VOLCANO #	LATITUDE LONGITUDE	ROCK TYPE	TYPE OF MONITOR	YEAR MEASUREMENTS INITIATED	FREQUENCY OF MEASUREMENTS	HAS THERE BEEN DEFORMATION?	OTHER SIGNS OF UNREST	DATES OF UNREST	EXPLOSIVITY (LARGEST KNOWN VEI)
1502-011	00.30 N 078.37 W	A	E	1987	3	N	N	No historic eruptions	?

Comments: Cuicocha is located on the flanks of Cotacachi Volcano. A lava dome surrounded by a crater lake occupies the vent area. There have been no historic eruptions, and no active fumaroles or thermal springs.

References

Ewert, J.W., 1989, Pers. comm.

Guagua Pichincha									
VOLCANO #	LATITUDE LONGITUDE	ROCK TYPE	TYPE OF MONITOR	YEAR MEASUREMENTS INITIATED	FREQUENCY OF MEASUREMENTS	HAS THERE BEEN DEFORMATION?	OTHER SIGNS OF UNREST	DATES OF UNREST	EXPLOSIVITY (LARGEST KNOWN VEI)
1502-02	00.17 S	A	E	1987	4	N	S	Seismic swarms in 1988 and	4
	078.60W		T	1971	4	Y		1990; phreatic explosions	
			L	1988	4	N		in 1990	

Comments: Deformation recorded by dome tiltmeter was coincident with phreatic explosions in 1990.

References

Ewert, J.W., 1990, Pers. comm.

Cotopaxi									
VOLCANO #	LATITUDE LONGITUDE	ROCK TYPE	TYPE OF MONITOR	YEAR MEASUREMENTS INITIATED	FREQUENCY OF MEASUREMENTS	HAS THERE BEEN DEFORMATION?	OTHER SIGNS OF UNREST	DATES OF UNREST	EXPLOSIVITY (LARGEST KNOWN VEI)
1502-05	00.65 S	A	E	1987	4	N	S	Increased seismic and	4
	078.43 W		T	1971	4	N		fumarolic activity since 1975	

Comments: Cotopaxi last erupted in 1944. Single-setup leveling showed no inflation of the volcano.

References

Ewert, J.W., 1989, Pers. comm.

Hall, M.L., and Yepes, H., 1981, La vigilancia y estado actual del Volcan Cotopaxi: Politecnica, Monografia de Geologia 2, v. 6, no. 4, p. 119-131.

Region: Galapagos Islands									
Fernandina									
VOLCANO #	LATITUDE LONGITUDE	ROCK TYPE	TYPE OF MONITOR	YEAR MEASUREMENTS INITIATED	FREQUENCY OF MEASUREMENTS	HAS THERE BEEN DEFORMATION?	OTHER SIGNS OF UNREST	DATES OF UNREST	EXPLOSIVITY (LARGEST KNOWN VEI)
1503-01	00.37 S 091.55 W	B	T	?	?	U	G	Eruption in 1978; has remained active to present	4

Comments: Caldera collapse was accompanied by seismic activity in 1968.

References

Newhall, C.G., and Dzurisin, D., 1988, Historical unrest at large calderas of the world: U.S. Geological Survey Bulletin 1855, v. 2, p. 880-885.

Region: West Indies									
Nevis Peak, Nevis									
VOLCANO #	LATITUDE LONGITUDE	ROCK TYPE	TYPE OF MONITOR	YEAR MEASUREMENTS INITIATED	FREQUENCY OF MEASUREMENTS	HAS THERE BEEN DEFORMATION?	OTHER SIGNS OF UNREST	DATES OF UNREST	EXPLOSIVITY (LARGEST KNOWN VEI)
1600-04	17.15 N 62.58 W	A	T L	? 1987	? 4	N U	S	Seismic activity and hot springs are only known activity	?

Comments: Earthquake swarms occurred in 1950-51 and 1960-61. A new hot spring formed in 1953.

References

Shepherd, J.B., 1989, Eruptions, eruption precursors and related phenomena in the Lesser Antilles, in Latter, J.H., ed., Volcanic Hazards: Berlin, Springer-Verlag, p. 292-311.

Yamashita, 1990, Pers. comm.

Soufriere Hills, Montserrat									
VOLCANO #	LATITUDE LONGITUDE	ROCK TYPE	TYPE OF MONITOR	YEAR MEASUREMENTS INITIATED	FREQUENCY OF MEASUREMENTS	HAS THERE BEEN DEFORMATION?	OTHER SIGNS OF UNREST	DATES OF UNREST	EXPLOSIVITY (LARGEST KNOWN VEI)
1600-05	16.72 N	A	T	1966	?	Y	S,T	Seismic activity increased in	?
	062.18 W		L	1987	4	U		1966-1967	

Comments: In 1966, inflation south of the summit area of Soufriere Hills was detected near the center of recent seismicity. Inflation reached a maximum between July and October 1966 and then inflation rates decreased through January 1967. Deflation occurred during the next 3 months and was followed by an inflationary period between March and September 1967. The net change was inflationary. There has not been an eruption.

References

Shepherd, J.B., 1989, Eruptions, eruption precursors and related phenomena in the Lesser Antilles, in Latter, J.H., ed., Volcanic Hazards: Berlin, Springer-Verlag, p. 292-311.

Shepherd, J.B., Tomblin, J.F., and Woo, D.A., 1971, Volcano-seismic crisis in Montserrat, West Indies, 1966-67: Bulletin Volcanologique, v. 35, p. 145-163.

Yamashita, K., 1990, Pers. comm.

Soufriere de Guadeloupe									
VOLCANO #	LATITUDE LONGITUDE	ROCK TYPE	TYPE OF MONITOR	YEAR MEASUREMENTS INITIATED	FREQUENCY OF MEASUREMENTS	HAS THERE BEEN DEFORMATION?	OTHER SIGNS OF UNREST	DATES OF UNREST	EXPLOSIVITY (LARGEST KNOWN VEI)
1600-06	16.05 N	A,D	T	1976	?	Y	S	Eruption in 1976	3
	061.67 W		G	1976	?	U			

Comments: Single-setup leveling and borehole tilt changes were recorded during the 1976 eruption.

References

Cheminee, J.L., and Dubois, J., 1988, French volcanic monitoring system: Kagoshima International Conference on Volcanism, Proceedings, p. 183-186.

Shepherd, J.B., 1989, Eruptions, eruption precursors and related phenomena in the Lesser Antilles, in Latter, J.H., ed., Volcanic Hazards: Berlin, Springer-Verlag, p. 292-311.

Pelee, Martinique									
VOLCANO #	LATITUDE LONGITUDE	ROCK TYPE	TYPE OF MONITOR	YEAR MEASUREMENTS INITIATED	FREQUENCY OF MEASUREMENTS	HAS THERE BEEN DEFORMATION?	OTHER SIGNS OF UNREST	DATES OF UNREST	EXPLOSIVITY (LARGEST KNOWN VEI)
1600-12	14.82 N	A	E	?	?	Y	S	Eruption in 1979	4
	061.17 W		T	1976	?	U			

Comments: The deformation monitoring system was modernized after the 1976 eruption of La Soufriére, St. Vincent. There has been no significant deformation.

References

Cheminee, J.L., and Dubois, J., 1988, French volcanic monitoring system: Kagoshima International Conference on Volcanism, Proceedings, p. 183-186.

Shepherd, J.B., 1989, Eruptions, eruption precursors and related phenomena in the Lesser Antilles, in Latter, J.H., ed., Volcanic Hazards: Berlin, Springer-Verlag, p. 292-311.

Soufriere, St. Vincent									
VOLCANO #	LATITUDE LONGITUDE	ROCK TYPE	TYPE OF MONITOR	YEAR MEASUREMENTS INITIATED	FREQUENCY OF MEASUREMENTS	HAS THERE BEEN DEFORMATION?	OTHER SIGNS OF UNREST	DATES OF UNREST	EXPLOSIVITY (LARGEST KNOWN VEI)
1600-15	13.33 N	B,A	T	1977	3	Y	S,G	Eruption in 1979	4
	061.18 W		L	1987	4	U			

Comments: Tilt measurements indicated that the volcano inflated gradually before the 1979 eruption and deflated rapidly during the eruption. Deflation continued for approximately 1 year after the eruption had ended.

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Yamashita, K., 1990, Pers. comm.

Region: Iceland and the North Atlantic									
Surtsey									
VOLCANO #	LATITUDE LONGITUDE	ROCK TYPE	TYPE OF MONITOR	YEAR MEASUREMENTS INITIATED	FREQUENCY OF MEASUREMENTS	HAS THERE BEEN DEFORMATION?	OTHER SIGNS OF UNREST	DATES OF UNREST	EXPLOSIVITY (LARGEST KNOWN VEI)
1702-01	63.32 N 020.58 W	B	L	1967	4	Y	N	Eruption in 1963	3

Comments: Surtsey is a very young volcano whose only eruption occurred from 1963 to 1967. Ground deformation observed for several years following the eruption was interpreted as compaction of the recently erupted 200 m-thick pile of tephra and lava.

References

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Tryggvason, E., 1990, Pers. comm.

Heimaey									
VOLCANO #	LATITUDE LONGITUDE	ROCK TYPE	TYPE OF MONITOR	YEAR MEASUREMENTS INITIATED	FREQUENCY OF MEASUREMENTS	HAS THERE BEEN DEFORMATION?	OTHER SIGNS OF UNREST	DATES OF UNREST	EXPLOSIVITY (LARGEST KNOWN VEI)
1702-02	63.43 N	B	E	1978	4	N	N	Eruption in 1973	3
	020.17 W		T	1978	0	N			

References

Tryggvason, E., 1990, Pers. comm.

Katla									
VOLCANO #	LATITUDE LONGITUDE	ROCK TYPE	TYPE OF MONITOR	YEAR MEASUREMENTS INITIATED	FREQUENCY OF MEASUREMENTS	HAS THERE BEEN DEFORMATION?	OTHER SIGNS OF UNREST	DATES OF UNREST	EXPLOSIVITY (LARGEST KNOWN VEI)
1702-04	63.63 N	B	T	1967	4	Y	S,T	Activity increased in 1955	4
	019.03 W		V	1986	3	U			

Comments: Tryggvason has detected slight deformation near Katla by precise leveling. This deformation was interpreted as the result of variable glacial load on the relatively thin elastic crust, covering a low viscosity source region.

References

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Hekla									
VOLCANO #	LATITUDE LONGITUDE	ROCK TYPE	TYPE OF MONITOR	YEAR MEASUREMENTS INITIATED	FREQUENCY OF MEASUREMENTS	HAS THERE BEEN DEFORMATION?	OTHER SIGNS OF UNREST	DATES OF UNREST	EXPLOSIVITY (LARGEST KNOWN VEI)
1702-07	63.98 N	A,R	T	1968	3	Y	S	Eruption in 1981	6
	019.70 W		E	1980	4	Y			

Comments: Tilt observations have been made at very irregular intervals. EDM measurements demonstrated slight inflation following the 1981 eruption.

References

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Grimsvotn									
VOLCANO #	LATITUDE LONGITUDE	ROCK TYPE	TYPE OF MONITOR	YEAR MEASUREMENTS INITIATED	FREQUENCY OF MEASUREMENTS	HAS THERE BEEN DEFORMATION?	OTHER SIGNS OF UNREST	DATES OF UNREST	EXPLOSIVITY (LARGEST KNOWN VEI)
1702-22	64.41 N	B	T	1983	0	N	S,T	Subglacial eruption in 1983	4
	17.38 W		A	1950	3	U			

Comments: Grimsvotn is a subglacial volcano. Lake-level monitoring refers to changes in elevation of the floating glacier.

References

Newhall, C.G., and Dzurisin, D., 1988, Historical unrest at large calderas of the world: U.S. Geological Survey Bulletin 1855, v. 2, p. 948-955.

Tryggvason, E., 1990, Pers. comm.

Askja Caldera									
VOLCANO #	LATITUDE LONGITUDE	ROCK TYPE	TYPE OF MONITOR	YEAR MEASUREMENTS INITIATED	FREQUENCY OF MEASUREMENTS	HAS THERE BEEN DEFORMATION?	OTHER SIGNS OF UNREST	DATES OF UNREST	EXPLOSIVITY (LARGEST KNOWN VEI)
1703-03	65.03 N	B,R	E	1968	4	Y	T,S	Eruption in 1961	5
	016.75 N		T	1988	3	U			
			L	1966	3	Y			
			A	1968	4	Y			
			G	1985	3	U			
			P	1987	4	U			

Comments: Ground deformation measurements since 1966 at Askja volcano have shown 2 periods of uplift and 3 periods of subsidence. A point source modeled at a depth of 1.5-3.5 km below the surface in the central part of the caldera agrees with the leveling and EDM data. A secondary point-source model explains subsidence beneath the site of the 1961 eruption. Askja has a relatively high rate of ground deformation, which may be related to a magma chamber that responds to pressure changes in the upper part of the Iceland mantle plume. GPS measurements were made in 1987 and are planned again for 1990.

References

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Krafla									
VOLCANO #	LATITUDE LONGITUDE	ROCK TYPE	TYPE OF MONITOR	YEAR MEASUREMENTS INITIATED	FREQUENCY OF MEASUREMENTS	HAS THERE BEEN DEFORMATION?	OTHER SIGNS OF UNREST	DATES OF UNREST	EXPLOSIVITY (LARGEST KNOWN VEI)
1703-11	65.73 N	B	E	1977	2	Y	S,T	Eruptions in 1975 and 1984;	3
	016.68 W		T	1976	0	Y		increased fumarolic activity	
			L	1976	2	Y		in 1976-1980	
			G	1976	3	Y			
			A	1976	2	Y			
			C	1976	2	Y			
			P	1987	4	U			

Comments: Since 1975, gravity, leveling, and tilt measurements at Krafla reveal slow inflation of the caldera for several weeks or months followed by sudden subsidence. The inflation is interpreted as the inflow of magma into a shallow magma chamber. Subsidence of the caldera is caused by flow of magma out of the chamber along a dike into the fissure swarm to the north and south. Lake level and crack measurements have also shown deformation. GPS observations were made in 1987 and are planned again for 1990.

References

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Torfajokull									
VOLCANO #	LATITUDE LONGITUDE	ROCK TYPE	TYPE OF MONITOR	YEAR MEASUREMENTS INITIATED	FREQUENCY OF MEASUREMENTS	HAS THERE BEEN DEFORMATION?	OTHER SIGNS OF UNREST	DATES OF UNREST	EXPLOSIVITY (LARGEST KNOWN VEI)
no #	63.94 N	R	T	1986	4	N	S,T	Last eruption in 1480	5
	019.20 W		A	1986	3	U			

References

Tryggvason, E., 1990, Pers. comm.

Beerenburg (Jan Mayen Island)									
VOLCANO #	LATITUDE LONGITUDE	ROCK TYPE	TYPE OF MONITOR	YEAR MEASUREMENTS INITIATED	FREQUENCY OF MEASUREMENTS	HAS THERE BEEN DEFORMATION?	OTHER SIGNS OF UNREST	DATES OF UNREST	EXPLOSIVITY (LARGEST KNOWN VEI)
1704-01	71.08 N	B	T	1973	1	Y	G	Eruptions in 1970 and 1984	4
	008.17 W		L	1973	3	N			
			G	1973	3	N			
			I	1973	0	N			

Comments: The 1984 eruption was accompanied by elevated levels of seismicity.

References

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Region: Canary Islands									
Las Canadas Caldera (Teide)									
VOLCANO #	LATITUDE LONGITUDE	ROCK TYPE	TYPE OF MONITOR	YEAR MEASUREMENTS INITIATED	FREQUENCY OF MEASUREMENTS	HAS THERE BEEN DEFORMATION?	OTHER SIGNS OF UNREST	DATES OF UNREST	EXPLOSIVITY (LARGEST KNOWN VEI)
1803-03	28.30 N	B	E	1985	?	U	N	Eruption in 1909	3
	016.63 W		G	1985	?	U			

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Region: Antarctica									
Erebus									
VOLCANO #	LATITUDE LONGITUDE	ROCK TYPE	TYPE OF MONITOR	YEAR MEASUREMENTS INITIATED	FREQUENCY OF MEASUREMENTS	HAS THERE BEEN DEFORMATION?	OTHER SIGNS OF UNREST	DATES OF UNREST	EXPLOSIVITY (LARGEST KNOWN VEI)
1900-02	77.58 S	B	E	1980	4	Y	S,G,T	Seismic swarm in 1982	2
	167.17 E		R	1980	4	N			
			T	1980	4	U			

Comments: Erebus is in a constant state of activity with frequent minor eruptions from a semi-permanent lava lake. SO_2 emissions increased at Mt. Erebus almost 8 fold in 1983, but there was no measurable deformation at that time.

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