ASH FALL
Newsletter of the Volcanology and Igneous Petrology Division
Geological Association of Canada

#45 **February, 1998**

UPCOMING MEETINGS

QUEBEC 98

The meeting is highlighted by the division sponsored special session Processes in **Physical Volcanology and Volcaniclastic Sedimentation, Modern and Ancient** put together for us by Wulf U. Mueller, ably assisted by Phil Thurston and John Stix. The all-day session on Wednesday the 20th will feature 14 oral presentations, with a morning theme on methods, experimental studies and volcanic processes. Two keynote speakers have been corralled to address these problem in the morning: K. Russell (UBC), our president, will discuss the virtues of ground penetrating radar, and J. White was imported from Otago, New Zealand to discuss hydro-volcanic eruptions. If the morning session does not completely saturate you, the afternoon session will boggle your mind with interesting case studies concerning ancient felsic complexes, ocean floor basalts, and pyroclastic flows and their reworked counterparts. The posters which follow, of course, are the best place to discuss ideas, gather more information and relax your weary mind with a beer or two.

Don't forget the lunch break between the two sessions will be our annual Division Meeting with a pizza lunch, and medal presentations.

The Division is not sponsoring any specific field trips at Quebec 98, but there are a number of ones with interesting volcanological (e.g. Betts Cove ophiolite) and petrological interest (Sept-Iles intrusion, two Grenville trips), come and sample them, you won't regret it

IAVCEI ANNUAL MEETING CAPE TOWN

July 11-16; 1998

For information contact their web site
http://www.uct.ac.za/depts/geolsci/ivc98
Abstracts are due February 28, 1998

EDITORIAL COMMENT

It seemed time to get out a newsletter, to assure the 150 members that we are all still alive and potentially an active forum to reach those interested in volcanology and petrology. I have continued with this issue, as before, to survey the various web sites for titbits. Certainly there is lots of information about Montserrat, and as always a few others are grumbling happily away. I was especially interested by the eruption at Bezymianny, in Kamchatka as a couple of hiking professors from this institution visited it last summer, and I had seen their pre-eruption photographs. But are my interests necessarily the interests of the Division? I would particularly welcome short book reviews of recent volumes. In the absence of commentary to the contrary, I will continue as before, but if there is anything you would like to see, let me know by snail mail in a plain brown envelope or by e-mail. All relevant addresses are in the masthead on the second page. In any case come to the annual meeting if you can and let me know in person.

RECENT ERUPTIONS

From the Montserrat Volcano Observatory:

There was a major eruption of the Soufriere Hills Volcano in the early hours of 26-Dec-97. A build-up of hybrid earthquakes occurred during the evening of Christmas Day and the earthquakes merged together about 2 am. At 3 am the activity escalated rapidly and a large collapse of the dome occurred predominantly down the White River. There was a very widespread and destructive pyroclastic surge cloud which swept over the ridges around the White River. The pyroclastic surge cloud moved over the villages of Morris, Reids, St Patricks, Trials and probably Fairfield. The visibility prevented a complete evaluation of the northern limit of the surge. The pyroclastic surge cloud also swept around and over the western end of the South Soufriere Hills to a distance of about 1 km to the east of the mouth of the White River.

Volcanology and Igneous Petrology Division
Geological Association of Canada

- *Chair*: J.K.Russell U.B.C Vancouver
  russell@perseus.geology.ubc.ca
- *Vice Chair*: G. Pe-Piper St. Mary's U. Halifax
  gpiper@shark.stmarys.ca
- *Sec'ty Treas.*: E.H. Chown U. Quebec Chicoutimi
  chchown@uqac.uquebec.ca
- *Past Chair*: C. Hickson GSC Vancouver
  chickson@gsc.emr.ca

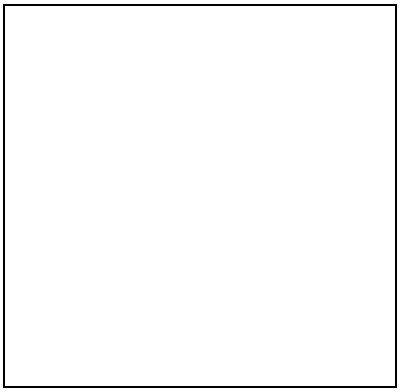
Councilors;

- *West*: P. Metcalfe, Vancouver
  pmetcalfe@gsc.NRCon.gc.ca
- *Central*: T. Pearce, Queen's Kingston
  pearcet@QUCDN.queensu.ca
- *East*: J. Stix U. Montreal, Montreal
  stix@ere.umontreal.ca

Web site:
[http://perseus.geology.ubc.ca /~russell /GAC_volc/]
Corresponding Address
c/o Sciences de la terre
Université du Québec à Chicoutimi
Chicoutimi, QC G7H 2B1

Some material also swept up the northern side of the South Soufriere Hills nearly reaching the top and then descended the river as the Dry Ghaut to the south-east and reached within about 200 m of the sea. Seismic data and observations by police indicated two explosions occurred at 3.15 and 3.25 am following the main collapse.

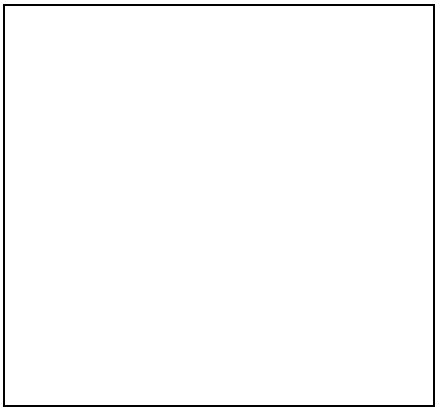
EP TOMS saw the ash and SO2 clouds from a large eruption occurring on the morning of 26-Dec-1997. The ash cloud is represented by colours, with the SO2 cloud represented by contours (each contour of SO2 represents 5 DU). Montserrat is indicated by a cross. The cloud first moved west of the volcano and then south, which agrees with the report from Montserrat.



Rabaul Volcanological Observatory reported that Manam Volcano, located at 4.1 south latitude, 145.1 east longitude, was strongly eruptive between 080610 and 081730 UT on the 8th of February. Dark ash laden clouds were emitted and rose to about 7 km. Ash was blown to the south, Southeast. ADEOS TOMS saw the ash cloud on the 9th of February as it passed overhead between 11 AM and 12 noon local time (between 0100 and 0200 UT).

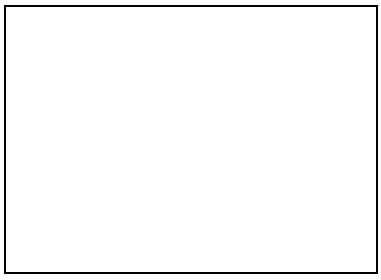
Bezymianny, Kamchatka Peninsula

Bezymianny volcano (55 degrees, 58 minutes north latitude, 160 degrees, 36 minutes east longitude), a frequently active volcano in north-central Kamchatka, began showing signs of renewed activity on May 3, 1997. Early on the morning of May 8 local time (May 7 UT), an ash plume was observed rising to about 13,000 feet ASL; at 1:00 PM local Kamchatka time (Midnight UT), the volcano went into continuous seismic tremor and about 2:00 PM local Kamchatka time (0100 UTC), a strong eruption occurred sending an ash plume to an estimated 40,000-45,000 feet ASL and extending in an east to Northeast direction for several tens of miles. Two vents may have been active as of 4:00 PM local time (0300 UTC). ADEOS TOMS detected the ash cloud on May 8 UT and possibly on May 9.



Langila Volcano, New Britain

Rabaul Volcanological Observatory reported that Langila Volcano, located at 4.5 south latitude, 148.0 east longitude, erupted on the 9th of February. Ash clouds rose to approximately 23000ft (about 7 km) and drifted to the west. An ash cloud MAY have been detected from ADEOS TOMS on the 10th of February.



Etna

Etna is continuing to erupt from Bocca Nuova and SE

Crater, an activity that is spectacular but normal, indicating persisting stable conditions and no immediate threat of an imminent flank eruption. Detailed observations of the summit craters were made twice in the last week during excellent weather conditions; these visits revealed that rapid infilling at Bocca Nuova has resumed and SE Crater has a vigorously growing new summit.

Kilauea Eruption Status

From Volcano Watch, Feb. 5: The east rift zone eruption of Kilauea Volcano continued unabated during the past week. There was constant effusion of lava from the Pu`u `O`o vent, and the molten rock was confined to the tube system from the vent to the sea coast without any surface breakouts. Lava from the tube system entered the ocean at two locations - Waha`ula and Kamokuna. The public is reminded that the ocean entry areas are extremely hazardous, with explosions accompanying frequent collapses of the lava delta. The steam cloud is highly acidic and laced with glass particles.

Northeast Pacific

Beginning at 1200 GMT on 25 January 1998, intense seismicity was detected in the Northeast Pacific Ocean using the T-phase Monitoring System developed by NOAA/PMEL to access the U.S. Navy's SOund SUrveillance System (SOSUS).

The initial activity was located on the summit and southern flank of Axial Seamount on the central Juan de Fuca Ridge near 45 55'N and 130 00'W, approximately 300 miles west of Cannon Beach, Oregon.

The character of the seismicity is very similar to that observed at CoAxial Segment and the Northern Gorda Ridge, both episodes that were later confirmed to be eruptive events. Volcanic seismicity is distinctive in having numerous small events that arise from the ambient noise without a large mainshock. The initial level of activity for this event is greater than either the CoAxial or Gorda Events.

As of this writing, all U.S. Navy SOSUS arrays and NOAA recording systems are operational and an excellent data set showing the initiation and early migration of activity is being analyzed. Thanks to all personnel at NOPF Whidbey Island.

A response effort is being organized by NSF/RIDGE and NOAA/VENTS investigators. A short expedition using the Oregon State University research vessel WECOMA is planned for February 9-16. Jim Cowen and Bob Embley are co-ordinating the response for the Ridge Steering Committee.

1997 REVIEW

These items are excerpted from the 1997 Geoscience Reviews in the February *Geotimes*.

VOLCANOLOGY
by John Stix

Volcanic Activity

During 1997 Popocatapetl volcano, near Mexico City alternately expanded as dome and periodically exploded, emitting extremely large and variable amounts of sulphur dioxide. One June 30, a 13 km-high eruption column formed and enough ash fell on the Mexico City airport to close it temporarily. Since its reactivation in1993, the volcano has steadily increased its activity.

The lava dome at Soufriere Hills volcano in Montserrat grew large enough by late March to spill over the crater walls in radial pyroclastic flows. On June 25, a large pyroclastic flow killed a number of people and by August , the pyroclastic flows began to destroy the capital Plymouth, 5 km west of the crater. As at Popocatapetl, activity at Soufriere Hills has steadily increased.

The resurgent dome at Long Valley caldera in eastern California continues to deform, and seismicity has increased since mid-1997. On Nov. 30 the largest earthquake observed in 1997 (magnitude 4.9) occurred on the southwestern flank of the resurgent dome. Long Valley is a restless caldera that needs to be watched closely.

New research directions

Studies at Rabaul caldera, Papua New Guinea, showed that the September 1994 eruptions from Vulcan and Tavurvur were compositionally heterogeneous and derived from magma chambers at different levels in the crust. The Bishop tuff a 760 000 year old eruption in the Long Valley Caldera is now seen to be the result of simultaneous Plinian fallout and pyroclastic flows and not sequential as previously thought. The Ito pyroclastic flow of Japan, examined by the anisotropy of magnetic susceptibility, appears to have been produced by turbulent flow and expansion.

Studies of the Osceola Mudflow (Mt. Rainier, Wash, ca. 5600 years) show this 120 km-long flow owed its mobility to high water contents. A model for sector collapse in volcanoes caused by volcanic basement spreading, as documented at Mombacho volcano, Nicaragua.

The Dec. 1989 eruption of Redoubt volcano, Alaska served as a model for two-stage crystallization of two separate magmas, in which magma mixing, upward movement and decompressive release of gas and overpressure drove the eruption. Seismic data, physical and acoustic

properties of magma, suggest that low frequency seismic signals may be used to deduce the nature of a volcanic conduit beneath a volcano.

Other interesting research directions include the use of synthetic aperture radar satellite interferometry to measure regional deformation at active volcanic centres such as Long Valley caldera, Mt. Etna and Katmai. Next year the first earth orbiting satellites will be launched. The interferometry and EOS initiatives are a clear sign of the impact of satellite remote sensing on volcanology

New Books

Volcanic Plumes by R.J.S. Sparks and colleagues: Wiley.

Volcanoes, Crucibles of Change by R.V Fisher, G. Heiken, and J. Hulen: Princeton Press.

New Videos

Reducing Volcanic Risk produced by S Brantley, IAVCEI-UNESCO.

IGNEOUS PETROLOGY

by Rebecca A. Lange

The most fruitful research has focused on (1) efforts to constrain the rates of various magmatic processes, (2) better quantification of the role of volatile components, (3) closer examination of the details of melt generation in the mantle, and (4) more rigorous filed, experimental and theoretical constraints on the dynamics of explosive volcanic eruptions.

Rates of magmatic processes

Techniques used to determine the rates of magmatic processes include uranium-thorium disequilibriua dating, geospeedometry using experimentally determined kinetic rate laws for various reactions, and radiometric age dating. Some of the most interesting applications include estimates of melt segregation rates in the mantle, volcanic eruption rates and their patterns of variation in different tectonic environments, longevity of upper crustal magma chambers, melt accumulation rates in crustal chambers, the timing and duration of magmatic differentiation events (protracted of punctuated), and phenocryst growth rates and residence times in magmatic bodies (Christensen and Halliday, Earth and Planetary Science Letters 144;547-561).

The role of volatiles

Improved techniques for analysing volatiles in magmatic minerals and glasses, now used by field geologists and experimentalists like, have better qualified the role of volatiles in magmatic processes. For example, we now have a much better idea of the concentration of water, carbon dioxide, and sulphur in magmatic liquids before eruption (and their concentration gradients in zoned magmas) through the study of glass inclusions entrapped in phenocrysts in rapidly erupted volcanic material.

Recently developed pressure vessels allow volatile-rich liquids to be quenched rapidly from 200-400 million pascals (depending on the bulk composition of the liquid) without loss of dissolved volatiles. Because the solubility of volatile compounds can now be determined accurately, especially in liquids such as hydrous basalts that are otherwise difficult to quench, degassing behaviour can be evaluate more rigorously.

Measurements of physical properties of melts that contain volatiles continue to be refined. Several recent studies document the surprisingly large reduction in rhyolitic melt viscosity caused by rather small amounts of dissolved water (less than 2 weight percent). This result suggests that fairly dry rhyolitic melts (about 1 weight percent of water) may be much more mobile in the crust than previously realized.

Generation of melts

Mantle melting during adiabatic upwelling in mid-ocean spreading ridges is now being studied by use of a device that allows small-degree (about 5 percent) partial melts of peridotite to be quenched, using diamond aggregates. These experiments have been augmented by rigorous theoretical models of melt production during adiabatic upwelling. The continued experimental and theoretical approach balances classical inverse models that use the composition of erupted basalts about a particular ridge segment to infer the overall degree of melting in the mantle and the depth at which melting began during upwelling.

Volcanoes just visible, Costa Rica 5 centavos