ASH FALL

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

#39 **February, 1996**

MESSAGE FROM THE CHAIR

Hello everyone and Happy New Year! (*belated -ed.*) This newsletter was slated to go out many weeks ago but both Paul and I have been caught up in other commitments. Paul has been working very hard to get out GEOLOG along with ***Ash Fall*** and still keep up with his other commitments. He was the chief organizer for the GSC for this year's British Columbia-Yukon Cordilleran Roundup. Paul did a masterful job of organization and managed to stick handle his way adroitly through some pretty difficult situations. Of these situations was finding out only a couple of hours in advance that our Wine and Cheese Reception was booked into a bedroom! This year's Roundup (the 13th) was the largest ever, drawing over two thousand participants and I know many our members were there as well. One of the key sessions, organized jointly by the GSC and the British Columbia Geological Survey Branch was on mineralization related to arc volcanism in the Cordillera. This session kept the participants glued to their seats and gave tantalizing clues to potential undiscovered Mesozoic mineralization based on good solid volcanological reasoning.

But this brings me to another point. Paul and I need help! Neither of us can continue our commitments to ***Ash Fall*** and the Division. The time has come for new elections and a hand off of the newsletter. Tom Pearce has also asked not to assume the chair. It seems that this is the year most or your executives wish to step down. Please consider volunteering for one of the several vacancies that we will have this year. Paul has done a great job with the Newsletter and if no one takes the baton it is in danger of being dropped. The nomination forms are attached. We will strive to get out another mailing in 4 weeks with the names of the nominees so that we can have a mail in elections before GAC '96 as called for in our bylaws.

Those of you on the Volcano List server may have seen the notice that IAVCEI has "gone public!" During July in Boulder during the Annual General Assembly of the IUGG, IAVCEI has sanctioned meeting with voting by country delegates. As the IAVCEI representative on the Canadian National Committee for IUGG, I had the honour of representing Canada at this momentous meeting. Wally Johnstone and the rest of the IAVCEI executive worked hard to be able to bring a motion to the meeting that allowed for individual membership. IAVCEI has become the first organization within the IUGG to allow individual membership. I think that this is an important step forward for individuals to become involved in IAVCEI and I urge you to become a member. You can check out the details on the web site: **http://xrfmac.lanl.gov/HEIKEN/one/membership** or

send your membership cheque to the address listed later in this newsletter.

We have nominations for both the Career Achievement Medal and the Leopold Gelinas medals so please remember to attend our Annual General Meeting in Winnipeg and honour the winning individuals. We will give you more information about special sessions, field trips etc. in the next newsletter. A reminder that the Pan Pacific Hazards '96 conference is also fast approaching. The conference on Earthquakes, Tsunamis and Volcanoes will be held in Vancouver July 29th-August 2nd. It has attracted an exceptional field of presenters from across disciplines. We will give you a sneak preview of the Volcanology sessions in the next issue of ***Ash Fall.***

Catherine Hickson

EDITOR'S (?)CORNER; SQUARE; CELL; CAGE.....

I'm having a hard time holding still for the compliments on the Cordilleran Roundup above. The credit belongs to those of the admin and winter works staff from the Vancouver office who, year after year surpass themselves in efforts and in heart, one more time, to give Roundup the lift it needs to be successful. These efforts cannot be lauded too highly, or often enough, to do them justice. I draw your attention to Fred Longstaffe's comments, as recipient of the 1993 GAC Past Presidents Medal, about support staff (***GEOLOG*** 22-3, p.27). Enough said.

I will enlarge somewhat on Cathie's comments above, regarding help. ***Help!!!!*** It was on the last lap towards Roundup that I became aware of the horrifying volcanic hazard piling up in my in tray - correspondence and articles to be included in Ash Fall, in volcanic landslide proportions, when there was already an all-but-complete version sitting in or near the out basket. Herewith the latter. The ancillary duties have been piling up, particularly over the course of the last year, beginning with my commitment to take over the editorial duties for ***GEOLOG***. By December, the hats had accumulated to bury the tiny little beanie at the back of my closet, proudly bearing the label "Scientist" beneath a six-centimetre layer of dust (not ash, alas).

Yes, there's another reason. The s[redacted] postdoc has come to an end and I'm presently gainfully employed in finishing off a summary volume for the Canada-British Columbia Mineral Development Agreement. By the very nature of these beasts, their time is over and so, I suspect, is my time at the Geological Survey of Canada. It's time to look for a(nother) job, which will mean even less time. Not least for my own self-preservation, I've started to divest myself of commitments, other than ***GEOLOG***, which I undertook to run for a while. I might add that ***Ash Fall*** is the last such commitment, because it's my favourite task. I do, however, think it's time to give someone else a kick at the editorial work. I think the process is refined to a point where one can be turned out over a weekend or so. Week....end - yes; here it is in the dictionary. I'm not done with ***Ash Fall*** yet, so there's no immediate panic; there are still two or three issues to pump out but I would like to turn over the awesome burden of signing 2-3 cheques per year (and entering them into the balance sheets) to some deserving soul; ***Ash Fall*** can be transferred more gradually. In short, I am not seeking re-election as Secretary-Treasurer.

As a closing comment, don't get me wrong in this; it's been and still is, an awful lot of fun. Time to pass the baton while it is still fun. I've had one expression of interest from a person who, while they would not stand in anyone else's way for the job, does not want to see the newsletter die. Take that step; give me a call and find out how to get involved. It's ***your*** newsletter, as I've said before. Make it so.....

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ACCEPTANCE OF THE 1995 CAREER ACHIEVEMENT AWARD BY JACK SOUTHER

As some of you know I retired to the position of Emeritus Scientist three years ago. However, for most of the past winter my second career as a ski guide has kept me away from the Vancouver and left me with a gnawing feeling of professional guilt. So when Cathie phoned me at Whistler a few weeks ago I thoroughly expected to be fired. When she explained that: no, I had been selected for the 1995 Career Achievement Award, I was incredulous. Knowing the calibre and dedication of my many colleagues in volcanology and petrology this is indeed a humbling experience. I am pleased and grateful for the recognition symbolized by this award. My sincere thanks to the selection committee and the support of GAC membership.

As I reflect on my 40 odd years as a geologist I am struck by the enormous changes that have occurred during this time, not just changes in technology and the way we do things but also changes in ideas and concepts about how the earth itself works.

I feel particularly lucky to have shared the excitement of this dynamic period of discovery and to have worked with so many of you who made it happen. For the next few minutes I'd like to flip through a few old slides to recall the way things were back in '52 and retrace some of our steps from there back to the present. And I say our steps advisedly because, although the slides are mine, the ideas they represent are the work of many.

During my last year of serious field work in 1992 I used a shiny new Jet Ranger equipped with a GPS satellite navigation system. It set us into comfortable camps in the high alpine of the Queen Charlotte Islands where we had 2-way radio and a lap top computer. Not too many years before that state-of-the-art transportation was provided by the Bell model D which we used on Operation Stikine in 1956 and in which every landing was either a controlled or uncontrolled crash and it could barely cary a basic survival package. Before that, we threw things out of airplanes using parachutes. It seemed like a good idea at the time. Trouble is "Supply and Service" back in Ottawa wanted the chutes back at the end of the season which meant adding wet parachutes to packs already overloaded with rocks and fossils. Next we moved to free air drops from low-flying Supercubs which worked very well and provided most of the logistic support for my mapping in Telegraph Creek and Tulsequah. Going back still farther, when I started my career, we still relied on the old not-so-reliable packhorse and spent at least 50% of our time clearing trails. It was sometimes hard to say whether the horses were working for us or we were working for them.

So what was known about Cenozoic volcanoes in the Cordilleran back in 1952 when trapper nelsons were state-of-the-art bulk carriers and we communicated over vast distances by lighting smudge fires?

As this slide illustrates there was a curious gap in the Pacific Ring of Fire, extending south from Alaska almost to Washington. I say almost because Bill Mathews had put Garibaldi on the map but the rest of B.C. was blank. This began to change in 1956 when the crash mapping program of Operation Stikine identified Mount Edziza, Level Mtn., the Iskut River cones and a host of smaller centres as Cenozoic volcanoes. Although this allowed us to put some more spots on the world volcanic map their tectonic significance would not be not appreciated for at least another decade.

In 1965 John Wheeler foresaw the need for a volcanological program in the Cordillera. I was given the enviable job of working on Mt Edziza with the able assistance of Maurice Lambert who deserves a lot of credit for the initial mapping. By 1970 we had established that eruptions of alkali basalt, followed by extrusion of silicic peralkaline lavas, had occurred episodically at Mt Edziza over a period of at least 10 million years and that volcanic activity was accompanied by E-W extension and incipient rifting. But the regional tectonic context was still unresolved.

The link between volcanism and tectonics began with the recognition of sea-floor spreading and the development of plate tectonic theory. For many of us in the Vancouver office of GSC the significance of these new concepts was brought home in 1970 when we attended the first Penrose Conference in Cal. which dealt with "The New Global Tectonics". The ideas that came together there such as the chemical polarity across volcanic fronts and the relationships between magma series and tectonic environments were further explored at a GAC volcanology conference in Vancouver the same year. And these became the basic theoretical framework for much of the later work on Cenozoic volcanism in B.C.

A short time after this I did some work on the Wrangell lavas in the St Elias Mtns of SW Yukon and was struck by the difference in volcanic style between the Wrangell lavas where an enormous volume of andesite had issued without any apparent breaks and was accompanied by profound uplift and compressive folding, In contrast to the episodic eruption of alkaline basalt and highly fractionated silicic peralkaline rocks in the Stikine Belt. The two belts were coeval but completely different in eruptive style and chemistry, suggesting this model in which the Wrangell Lavas are related to a calcalkaline arc developed along a converging plate margin and the Edziza lavas in a continental regime of extension and normal faulting adjacent to a transcurrent plate margin.

In southern B.C. where I worked for a time on Mt Cayley and some of the beautiful nearby Tuyas, the Garibaldi Belt and its early Cenozoic predecessor the Pemberton Volcanic Belt were interpreted as calcalkaline arcs related on the one hand to subduction of the Juan de Fuca plate and on the other to an extensional backarc environment which produced the transitional Basalts of the Chilcotin Group.

Thus by 1977 when the GAC published "Volcanic Regimes" we had a pretty good handle on the tectonic environments that controlled Cenozoic volcanism in the northern and southern parts of the Cordillera, but the enigmatic E-W Anahim Belt was still not understood.

As presently defined the belt includes the Bella Bella dyke swarms and King Island syenite Pluton on the Coast, three central shield volcanoes, the Rainbow, Ilgachuz, and Itcha ranges on the Interior Plateau and, at its distal end, the post glacial Nazko Cone. As Cathie has pointed out the Clearwater lavas are off-track and have lead a life of their own. The alkaline to peralkaline chemistry of the Anahim Belt rocks is characteristic of intraplate volcanism and the discovery that age dates decreased systematically from west to east lead several of us to propose a hotspot origin.

And so another piece was added to the puzzle. It is certainly not the final piece but at least we have closed the Canadian gap in Pacific Ring of Fire, not just with dots, but dots within a regional tectonic framework. It may not be right but all-in-all we have come a long way from the almost blank map we started with. And from my perspective it all seems to have happened very rapidly. If the pace of change during my career continues for the next 20 or 30 years you young ones are in for an exciting trip full of unimaginable surprises. I hope you enjoy the journey as much as I have. Thanks and God speed.

Jack Souther

VOLCANIC ACTIVITY
MT RUAPEHU, NEW ZEALAND

The fragmented information about Ruapehu was due to difficulties obtaining information over Telnet from Australia. I have patched together this account of the eruption by heavily editing several messages, mainly from the Volcanic Surveillance Team. I apologize for any inconsistencies, errors or omissions - ed.

"Mt Ruapehu burst into action on 24th September with an emptying of its crater lake, which poured over the lip of the crater and sent mudflows into several valleys. No-one was injured but some skiers (the mountain ha(s/d) a good snow cover) had some close calls. The ski fields were immediately evacuated and the eruption proceeded to intermittent, to almost constant ash eruptions, with an eruption column that rose a few kilometres above the mountain. The mountain, save for the volcano observatory at the Chateau, was evacuated. The roads and air space nearest to the mountain were closed to public access."

Malcolm D. Buck (M.Buck@unsw.edu.au)

This was followed on 24th September by a summary of the first 24 hours:

"Small explosions, sending steam-rich plumes to heights of a few hundreds of metres have continued sporadically. The effects of these explosions have generally been confined to the area of the crater itself, and they are not powerful enough to register on our Chateau seismograph.

"Medium-sized explosions have been a particular feature of the activity from about 18.00 hr until nightfall. These are ejecting steam-rich but ash-bearing plumes which have risen to heights of 500 to over 1500 m above the volcano. These explosions leave a distinctive, modest seismic signature as recorded by us at the Chateau seismograph.

"The eruptions....have presented scientists from the Institute of Geological and Nuclear Sciences with a wealth of new data and information. The Wairakei Research Centre is recording types of seismic activity which have never previously been seen at Ruapehu. These include extended periods of low-frequency volcanic tremor and some unusual low-frequency earthquakes. A larger component of fresh magma (molten rock) has been erupted last week than in any eruption since 1945. There are increased levels of magmatic gas, specifically SO_2, recorded as chemicals dissolved in water samples recovered from Crater Lake. There have been 3 lahar-producing events, accompanied by a high frequency of other explosions through Crater Lake. .....there is a high probability of events of a similar size to the lahar-forming eruptions of Monday 18th and Saturday 23rd September occurring in the future..... Our data also imply that there is a significant possibility that the activity to date is an introduction to a larger eruption....."

Brad Scott

Based on the observations, the Alert Level was raised from 3 (Significant local eruption in progress) to 4 (Hazardous local eruption in progress). The next update was on 27th September:

".....After a quieter period yesterday, visual observations this morning from 0600 confirmed a new period of moderately vigorous activity occurring at the same time as elevated seismic levels. Our observation flight has confirmed that the lake still exists but is greatly reduced in size. As of 0930 the size of eruptions was greatly reduced relative to earlier this morning. Indications are that the plume had risen to about 8-10 km during more vigorous activity, but the timing of individual explosions was a longer intervals (typically 10-45 minutes) than on September 25th.

".....Preliminary results indicate that there has been no tilt of the north slopes of the mountain since May 1994. Seismologists from the Institute's Wellington office have installed an additional 8 seismometers in an arc around the W, S and E sides of the mountain about 20 km from the crater."

James White, University of Otago <jwhite@gandalf.otago.ac.nz>

On 28th September, the following observations were broadcast:

Three flights.....obtained close-up views into the crater (Sept.27th).....The remnant of Crater Lake is now at a level some tens of metres below the outlet and steaming vigorously. The nature of the eruption plume this morning implies that the lake is still present at the time of this report. Observations this morning show that the activity is generally mild, with puffs of ash-bearing steam rising from the crater. There was a spectacular discrete explosion last night at 06.40. The Whangaehu River ..... bed has been scoured by the passage of lahars to a level estimated to be at least a metre below its old position. Activity at the volcano has been relatively quiet through the day."

Brad Scott

On 29th September:

"A large volcanic earthquake (M3.2) was recorded at 0841h, accompanied by an eruption column. to about 6000 m, a lahar down the Whangaehu catchment and ash fall south of the volcano."

Brad Scott

No major events were reported until October 10th and observation of the volcano were hampered by poor weather conditions, at least until October 1st. A gap in the messages then occurred, during which the Alert Level was reduced to 3. We resume the account on 10th October:

"The weather conditions today have prevented any observations of the volcano.....No substantial eruptions have occurred at Ruapehu since the 1503h event on Saturday October 7th.....The intensity of volcanic tremor and continued small eruption earthquakes indicate that the present eruption episode is continuing.....The Alert Level remains at 3."

Brad Scott

This situation continued until the night of Wednesday 11th October:

"Ruapehu volcano has experienced a period of near-continuous moderate eruptive activity overnight (until 0500 hours on 12th October). Raised tremor levels have ..... closely resembled activity during the two peaks of the eruption to date, on 25th September and 7th October, but have not been accompanied by large explosion earthquakes. New Zealand Army personnel in the Rangipo desert observed, between 9 and 10:30 pm on 11th October, a large eruption plume rising to approximately 10 km height and accompanied by ejection of hot ballistic blocks and lightning. The eruption plume has been tracked....to elevations in excess of 11,000 m....the plume does not appear to have detached from the volcano and the column is presumably being fed by ongoing weak to moderate activity from Crater Lake basin."

BF Houghton

It is apparent from this and succeeding accounts that the October 7th eruption closely resembled that of September 25th. Later on the 12th, more details of the 11th/12th event were available:

"The levels of tremor have been similar to those seen during the two peaks of explosive activity to date, on 25th September and 7th October, but have not been accompanied by any large explosion earthquakes. The ..... continuous explosive eruption, produced an eruption plume which reached to about 8-10 km altitude when visible in the early morning. This plume ... produced a significant fall at least as far away as Gisborne. .....preliminary indications are that the volume is between 0.01 and 0.1 km^3, making this the biggest volcanic ash fall deposit erupted in New Zealand since the 1945 Ruapehu eruption.

"The style of activity at Ruapehu and its seismic signature have changed during the course of last night. The limited eye-witness accounts of the eruption and field observations by Institute scientists suggest that water from the crater lake played a much less important role in the activity. Incandescent material was reaching the surface, and eruptions last night and this morning were sustained for longer times. Although the eruption plumes themselves are not reaching greater heights than their counterparts earlier in the eruption sequence, the plumes (at least when visible in daylight) carried more ash to greater heights than the steam-rich plumes seen in the last 3 weeks.

"The present eruption episode is continuing at an elevated level. We are now recording

alternating periods of extended near-continuous vigorous ash eruptions, betwen quieter periods of low to moderate tremor and minor ash eruption.....Alert Level remains at 3."

CJN Wilson

On Friday 13th October:

"Activity at the volcano has been reduced all day. An observation flight..... showed two active vents in the north and the south parts of the crater lake basin. Ash and steam were being continuously emitted, with more ash coming from the southern vent."

CJN Wilson

Conversely, a flight on the following day was to show more ash emitted from the nortern vent. Bad weather made observation of the volcano impossible for the next few days. Reports from more distant areas confirmed that: "Ash plumes have risen to more than 10,000 m Heavy ash falls have been reported between Waiouru and the east coast. Ash emission appears to have declined."

IA Nairn

Commercial flights observed ash plumes to about 5,000 m, declining over the next few days. Late on the afternoon of 16th October, an observation flight had partially impeded views of the crater:

"Weak emission of steam and ash from at least 3 vents largely filled the crater; ash was rising to c. 500m above the crater and the plume was drifting to the east at low elevations."

BF Houghton

On 19th October:

".....numerous degassing eruption type events recorded by the Dome (summit) seismograph. Field parties observed moderate ash eruptions from the southern vent in Ruapehu crater, at times which correlate with Dome seismic events. At other times, a voluminous gas plume was emitted from the northern vent.

"A helicopter-lifted party ..... on the upper slopes of Ruapehu... encountered a ground-hugging plume of SO_2 gas being blown down the upper slopes at Whakapapa. This experience demonstrated the possible existence of a gas hazard at Ruapehu during suitable wind conditions."

IA Nairn

The last report on Volcano Listserv, by IA Nairn and dated Friday 20th October, stated that:

"Tremor levels have remained low at Ruapehu since the last bulletin at 1700 h on 19th October. The number of degassing eruption type events has declined in size and frequency.....The volcano has been seismically quiet this morning.

"Data from COSPEC measurements of SO_2 output *(show that)* SO_2 output from Ruapehu on both these days was >10,000 T/D. This is a large discharge when compared with other erupting volcanoes such as Pinatubo and Etna, where discharges around 5,000 T/D have been measured during eruption periods.....SO_2 discharge has been large during the last week since the Crater Lake was removed. The SO_2 discharge probably results from at least two sources:

1) Remobilisation of sulphur contained in the upper part of the volcano conduit system as elemental sulphur deposited over at least the last 50 years.

2) SO_2.....derived from new magma involved in the present eruption episode. The proportions of gas from these two sources cannot be determined. The gas discharge indicates that a substantial volume of magma is freely degassing beneath Ruapehu volcano."

Recent GVN Bulletins have had reports about Ruapehu. Over the last year, reports have been in v.19, nos. 9 and 12, and v.20, nos. 1, 4, and 5.

Compiled by the editor

RABAUL UPDATE - MINOR ERUPTION STARTS AT TAVURVUR

Tavurvur began erupting again on November 28th, lower in intensity than the last eruptive activity in March. There weren't any good precursors although we did begin recording low-frequency events from Tavurvur as early as early November. This is the third eruptive episode at Tavurvur since the eruption began last September. Activity seems similar to the activity in 1941-1943, when Tavurvur had a number of small eruptions after the Vulcan eruption of 1937.

Ben Talai, Rabaul Volcano Observatory

ERUPTION IN THE NORTHERN MARIANAS

A seamount 25 miles northwest of Saipan erupted recently; fishermen saw discolored water and alerted personnel of the CNMI (Commonwealth of the Northern Mariana Islands) Wildlife and Emergency Management Office (EMO), who surveyed the site and measured a bottom depth of 200 m. More recently, fishermen reported "submarine explosions" (nothing broke surface). EMO went back on October 25th, confirmed the explosions, and measured a bottom depth of 60 m. The type of navigation equipment used is not known, so it is not yet certain that the seamount grew 140 m.

CNMI issued a tsunami alert, because near-surface activity could build a very unstable structure which might collapse, generating waves which would threaten the nearby islands of Saipan, Rota, and Tinian (the tsunami travel time would be about fifteen minutes). As of November 2nd, the eruption seems to have died down, at least temporarily. The tsunami alert was cancelled, after police mistakenly ordered an evacuation following an earthquake unrelated to the eruption.

The Northern Marianas are predominantly basalt and andesite, though the breached cone of Maug Island has a submarine dome (Maug looks like it erupted very much like Mt. St. Helens). Basaltic activity has occured within the last fifteen years at the island of Pagan and on the seamount Esmeralda Bank.

Gerard Fryer, Hawaii Inst. of Geophysics & Planetology

SHISHALDIN VOLCANO, ALEUTIAN ISLANDS

54°45.33' N 163°58.00' W; summit elevation 9373 ft (2857 m)
All times are local (GMT -9)

Based on satellite imagery and pilot reports received by the Federal Aviation Administration, Shishaldin Volcano on Unimak Island in the eastern Aleutian Islands erupted December 23rd around 18:30 AST. Between 6:30 and 8:00 pm, pilots reported an ash plume as high as 35,000 feet asl; prevailing winds at that altitude carried the plume primarily north and northwest. AVO analysis of a satellite image from 7:12 pm Saturday showed a weak plume extending approximately 50 km northwest of Shishaldin, that dissipated by midday on December 24th. On December 24th, AVO received a report of a possible very light ashfall at approximately 1:30 am in Cold Bay, 90 km northeast of Shishaldin. AVO received no further reports of eruptive activity but will continue to monitor the situation through pilot reports and analysis of satellite images.

Shishaldin Volcano is located near the center of Unimak Island in the eastern Aleutian Islands. It is a spectacular symmetric cone with a summit elevation of 9373 ft (2857 m) above sea level. A small summit crater produces a steady, vigorous cloud of steam with occasional small amounts of ash. Shishaldin is one of the most active volcanoes in the Aleutian volcanic arc, erupting at least 27 times since 1775. The most recent eruptive period occurred in 1986-1987; activity consisted of minor steam and ash emission that continued for several months. The nearest village is False Pass, 20 mi (32 km) east-northeast of the volcano.

Tina Neal, Alaska Volcano Observatory <tneal@usgs.gov>

MONTSERRAT VOLCANIC ACTIVITY CONTINUES

On August 8th, reports indicated increasing seismic activity, and scientists monitoring the volcano in Montserrat advised a raising of the level of alert. On August 6th, the elderly and sick from the villages near the volcano were evacuated to tent villages already in place in the north of the island. On August 7th, local authorities started the evacuation of the elderly and sick from the south, including the main town of Plymouth. On Saturday 12th August, a gas venting episode triggered a series of small earthquakes. The scientists reported that over 100 earthquakes were detected during the period up to 7:00 am on Sunday 13th August, the largest occurring at 2:22 am on the 13th and recording a magnitude of 3.5 on the Richter scale.

Two eruptions occurred on 19th August, one on 20th August and one on 21st August, the biggest since the beginning of volcanic activity in July. On 21st August, a large explosion took place generating a vertical column to 2,500 metres, part of which then descended as a cold ash avalanche upon the western flanks of the volcano, including the capital town Plymouth and neighbouring villages. The government decided to evacuate approximately 5,000 people to safe areas in northern parts of Montserrat. This evacuation included the population of the capital, Plymouth (some 3,000 persons). On August 31st, two additional vents were identified in the volcano.

This situation lasted until the threat of Hurricane Luis on 5 and 6 September 1995, when the evacuees moved back to their homes on the lower slopes of the volcano. By 30th October, three months after the first steam explosion of the Chance's Peak volcano, the volcanic activity in Montserrat had declined in intensity, registering a fluctuating but generally modest number of local earthquakes and periodic small explosions of ash and steam. The last significant event in this period was the announcement on 25th September of the non-explosive growth of a new lava dome at the western foot of Castle Peak, which itself was a recently pre-historic dome nested within the horseshoe-shaped English's Crater. Despite this changeable situation, schools and business reopened and Montserrat returned to its normal life. An information campaign, through the local media was carried out, in order to inform the population on the current situation and the activities undertaken by the authorities.

On Friday, 8th December, increased volcanic activity was reported in Chances Peak volcano, with the lava domes in the south west crater continuing to grow and now representing a significant threat. A number of mini collapses occurred when rocks broke off the dome, each producing small pyroclastic flows. Material from one of the domes was building up against the western side of the crater wall; this would pose a major threat to Plymouth should it grow beyond the height of the crater. The whole of the Castle's Peak is now unstable and sections of it or the crater rim could collapse to threaten settlements on the lower flanks of the volcano. Due to the instability of the situation, the governor of Montserrat declareda state of emergency in the islandon December 1st; Plymouth and all surrounding areas were evacuated to the safety zone in the north of the island.

Department of Humanitarian Affairs, Geneva

ERUPTION OF CERRO NEGRO, NICARAGUA

Initial observations by Wilfried Strauch, Virginia Tenorio and Rolf Schick noted that, on the day before the eruption, only 2 small seismic events were recorded by the local seismic station CNGN, but these were not above the usual background intensity or number. During a visit to the crater on Monday, 13th November, no precursors such as surface effects, increased degassing, or high fumarole temperatures were detected. The start of the eruption was detected by the seismic service of INETER from data of CNGN seismic station (500 m from the crater) at 11:45 am on November 19th. It began with 30 minutes of mildly increasing seismic activity, a pause and then

continually increasing strength. This coincides with the reports of local residents, especially from the town of Malpaisillo (about 10 km north of Cerro Negro), who noticed the first explosions at this hour and reported in the afternoon about increasing activity. The Civil Defence was alerted.

Problems from ash fall were slight, and the lava was expected to flow northwards from the cone towards the town of Malpaisillo. Since much of the area has been covered by previous lavas the material damage is not expected to be high. First observations on the night of 19th November indicated mild Strombolian activity with vertically directed ejecta and gradually increasing strength. These characteristics remained similar in following days, but with increasing intensity.

Observations of activity between 20:00 on November 21st and 10:30 on November 22nd were made by B. van Wyk de Vries and Pedro Perez. At 20:00 hrs on November 21st, incandescent bombs were being thrown up to 300-400m above the lip of the 1992 crater edge. Ash content was very low compared with the 1992 and May-August 1995 activity, and bombs were often very large (metres across), which deformed and broke up in flight. Pulses of material averaged 20 per minute, maintaining an almost constant fountain of material. Trajectories were mostly near-vertical, usually not less than 80°. Because of this few bombs have fallen outside the crater, which is being filled up. Pedro Perez climbed to the crater edge to take photographs and observe. A new cone is growing within the old one, which at 07:00 hrs on November 22nd had almost reached the lip of the 1992 crater. The new cone's crater is slightly to the NW of the May-August activity. A second construction 50 m west of the new crater appears to be a lava dome, from which at 07:00 hrs a small lava flow 2-5m wide and 50m long, was flowing. The flow was following the edge of the new cone, towards the lowest part of the 1992 crater. The new cone has a steep (>45°) basal scarp, 2-5m high, followed by a level part and then a steeper slope (25°) to the crater. The scarp resembles a lava flow front, and behind it small faults cut into the cone. From these observations they concluded that the cone was built of still plastic material and was spreading outwards.

Activity over the period of observation was not constant. Ejecta pulses maintained a frequency of 20 per minute, but the size of each pulse and its duration varied. At times the pulses were short discrete events, while at others they merged into an almost continuous fountain. Short periods (5-10 s) of non-ejection occurred, usually terminated with a loud explosion. Longer periods of low activity took place from 12:10 to 12:30 on November 22nd, and 02:00 to 02:15, terminated by gradually increasing activity. From 02.55 to 03:10 ejecta heights were <150 m but ash content and degassing were much higher, as seen by dark clouds escaping with each explosion and a thick, white lower plume, which appeared to be escaping from the location of the dome. By 05:00 hrs the eruption had regained previous levels and was increasing to near constant fire fountain like activity, bomb size was increasing and pulse frequency increasing to 22 per minute, but counting was difficult because pulses were merging. The eruption continued at this level as (from 06:00 hrs to 10:30 hrs) deformation survey points were set up using Leica differential GPS equipment. From 09:30 to 10:00 a series of strong explosions ejected material to the lower slopes of the cone. Sand to gravel size ash was falling to the west of the cone, but no large ejecta. In comparison to the massive 1992 ejecta the present material is highly vesicular with millimetre-size vesicles; olivine, pyroxene and plagioclase are present and some plagioclase crystals are 1 cm in length. Large bombs inspected on the north side were similar in vesicle content to the small particles, but with dense interiors.

During the evening of November 22nd, Helman Taleno, Leonel Urbina and Cristian Lugo noted that the new cone overgrew the side of the 1992 crater to the north and material began spilling down the north slope towards Cerro La Mula. From 19:00 to 23:00, a tongue of lava had appeared over the edge of the old crater, following from the path of the small lava seen at 07:00 on November 22nd. The front moved at less than 1 m per hour, but spilled rocks off the front which constantly fell down to the base of the main cone.

Tremor from the eruption began at 11:45 on November 19th, the amplitude increased continously and at 02:00 on November 21st saturated the nearest station CNGN (Cerro Negro, 60 dB gain). Tremor was detected on short period seismic stations within a 30km radius (seismic stations at volcanoes San Cristobal and Momotombo and near the city of Leon). Energy release increased continuously and tremor is felt over 1 km away, as a smooth rocking motion.

On 25th November, the eruption plume of Cerro Negro was clearly visible, as on earlier days, from Managua as a diffuse grey column, turning horizontal at about 2000 m. From La Paz Centro, distinct pulses of ash could be seen rising from the crater.

Ash fall was reported in Leon and Corinto and subsequent observations showed that there was great variation in the amount of fine material ejected. At times only massive bombs were thrown out, while at others strong explosions sent up dense ash clouds. Ash and scoria fell continuously on the west base of the cone, with occasional periods of heavy fall including <5 cm-size highly vesicular scoria. Heavy ash emission lasted from single pulses to several hours. Pulses of ash and bombs had a frequency of 20 per minute, a characteristic periodicity in this eruption. Pulses were strong enough to maintain a constant fountain of bombs, some of which were large and visibly red at 5km. Bombs rose to a maximum of 600 m. Explosions were audible at this distance. From Rota, the new cone was clearly visible and an unusual spinelike protrusion, later found to be a lava dome, was jutting out on the northern edge of the crater.

The lava flow which was observed forming between Cerro La Mula and Cerro Negro on 23rd November (La Mula flow) had advanced westwards about 500m down a small valley and was moving at about 1m per hour between 10:30 and 20:00 hrs on November 25th. The flow was about 30m wide. By 06:00 on November 26th, the flow had stopped advancing.

By 11:00 hrs on November 25th, the new cone had grown considerably, and was about 30-50 m below the old crater summit. The crater was about 40 m across. Bombs fell mostly on the cone and rolled down to the base. The small breach where the lava flow of 23/11 exited was partly covered by a new blocky flow, which appeared to come straight from the new cone, though no exit vent was visible. The flow had advanced half way down the flank and was covering another blocky lava, which had reached the base.

To the east of the lava exit, a dome about 100 m wide and 40 m high had grown. This initially had a serrated, spined, pyramidal shape, but changed rapidly throughout the day; by 18:00 hrs it had become table shaped. Blocks were continually spalling off the dome, which also sustained a continuous rain of bombs from the new cone. Three small but thick lava tongues extended to the base of the cone from the dome, and were advancing slowly. A small, thinner lava tongue was following the east side of the thick lavas.

The two flows seen moving northwards on the 23rd had reached about 1 to 1.5 km from the volcano. The western lobe was the largest, being about 400m wide and 3-5 m thick at the front. The eastern lobe was separated from the other lobe by a low ash covered area with a small cinder cone the two lobes. The sides of each flow were slowly (about 1m per hour) encroaching on this and thickening. All lava lobes were advancing. Many areas of the dome were glowing red. By 06:45 on 26th November, lava fronts had advanced 20-50m since nightfall on November 25th. The main west lobe had spread out eastwards and a block 15m wide had moved about 100m in the middle of the flow. The dome was less pronounced that the previous day and was blocky rather than spiny. A thick (20m) lava had formed to the north east and was still active.

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NEW ERUPTION AT RINCON DE LA VIEJA VOLCANO, COSTA RICA

(Latitude: 10°49.40'N Longitude: 85°19.42W Elevation: 1700 m)
November 4th-13th, 1995

Rincon de la Vieja is an active stratovolcano located in northwestern Costa Rica on the Guanacaste volcanic range. The area is remote, making volcano monitoring difficult, and very few population centres are located within a distance of 10 km from the volcano. Since its last magmatic eruption in 1966-67, this volcano has exhibited moderate to very vigorous fumarolic activity, with periods of increased activity in which phreatic eruptions are emitted from the active crater lake. Eruptions consist mainly of jets of hot water, wet ash and water vapour.

The largest eruptions have occurred outside the active crater. Muddy hot water from the eruption descended as hot lahars along streams draining the steep area north of the active crater. The Penjamo and the Azul rivers are under lahar hazard. Both rivers merge to form the Pizote river, which flows north to Lake Nicaragua. Lahar sediments in 1991 travelled up to 18 km from their source along the Pizote River and destroyed two bridges on the Penjamo and Azul rivers.

OVSICORI-UNA monitors Rincon de la Vieja volcano with a permanent vertical short period seismographic station (approximate gain of 40.000) located five kilometres southwest of the main crater. Seismic (real time) monitoring started in November, 1984. Periodic field observations, geodetic measurements and ground water and gas condensate geochemistry are also used to monitor the volcano.

In early October a group of park rangers from the Guanacaste Conservation Area (GCA), affiliated with the Costa Rican National Park System reported an increase in fumarolic activity and the occurrence of landslides on the main crater walls. Personnel from the GCA stationed near the Interamerican Highway, 28 km WSW (downwind) of the volcano reported smelling sulphur on several occasions during the two days prior to the eruption.

During 1995, the total seismicity (low and high frequency) recorded by the Rincon de la Vieja seismographic station was less than 10 earthquakes per month until June and no tremor was recorded during the same period. During July, August and September, the monthly totals of seismicity were respectively 78, 40 and 26 earthquakes (low and high frequency added together). In addition, the monthly totals of polychromatic tremor (medium frequency: 2.0-2.3 Hz) ranged between 1-1.5 hours for July, August and September.

The OVSICORI-UNA seismographic station was out of service until six days prior to the eruption. Low frequency earthquakes gradually increased from 4 (November 1st) to 18 (November 5th), decreasing to 11 on November 6th. High frequency earthquakes were recorded only after November 3rd, and decreased from 3 events (November 4th) to 1 event (November 6th).

On November 6th, at 15:04 (21:04 GMT), Rincon de la Vieja started a period of increased activity which peaked on November 8th. The first event, at 15:04 (21:04 GMT), consisted of a moderate vapour eruption with subordinate ash, lasting 130 seconds. The eruption was probably not higher than 1.5 Km above the summit of the volcano. Constant disharmonic tremor produced by very vigorous fumarolic activity was recorded for several hours after the eruption.

Date	6th	7th	8th	9th	10th	11th	12th	13th
No of recorded eruptions	2	8	24	27	23	17	22	22

Only two eruptions occurred during the first 17 hours. The eruptions then increased in frequency, 8 eruptions occurring on November 7th and 24 on November 8th. The climax of the eruption occurred on the morning of November 8th, when the highest frequencies and seismic signal

amplitudes of eruptions were recorded. At this point, eruption columns extended up to 3 km above the active crater.

Two scientists from OVSICORI visited the summit area of the volcano on November 7th, between 9:00 and 11:30, finding craters up to 2 m in diameter, produced by impacts from blocks with diameters between 0.5 m and 1 m. Erupted blocks were still hot 90 minutes after eruption, but close examination indicated that no juvenile material was present. The OVSICORI team observed several phreatic eruptions from a distance of less than 500 m from the crater rim, typical of eruptions extruded through a crater lake. The eruptions produced jets of dark, wet ash and hot water with cypresoidal appearance that fell outside the active crater and produced mudflows along the drainages of the Penjamo and Azul rivers. On November 8th, avalanches related to lahars caused partial damage to the main road bridge across the Penjamo river, north of the volcano. Erosion of up to several metres occurred in the upper part of both drainages as a consequence of lahar movement. At lower elevations, deposition of mudflows occurred at the slope break. The speed at which lahars descended to the main road, calculated using arrival times of avalanche fronts, ranged between 23-93 km/h, with an average of 44 km/h.

The shock wave of an eruption on November 9th, at 04:11, was felt in Liberia located 25 km southwest of the volcano. Glowing blocks were also reported for the same eruption by observers located on the northern flank of Rincon de la Vieja. This report confirmed the observation of the ejection of very hot blocks, made the previous day by the OVSICORI field team.

The eruptions described are similar to previous eruptions of Rincon de la Vieja. The presence of jets of water, cypresoidal shaped eruption columns, lahar avalanches and the absence of juvenile material suggests that these eruptions were phreatic. A transition to phreatomagmatic perhaps began, but was never completed.

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STROMBOLI

28-29 September 1995

Stromboli has shown a generally low level of activity during most of 1995 so far, much lower than it was in summer-autumn 1994. Visits by numerous persons in August to October revealed that eruptions occurred from several vents and produced either low lava fountains or ash plumes. The most regular activity occurred, as during recent years, from vent 3/1 in the NE part of crater C3, consisting of continuous night glow and frequent spatter ejections, at times projecting bombs outside the crater. Small ash and bomb explosions occurred from its southwestern neighbor, vent 3/2. The northeasternmost vent in the crater area, vent 1/1 in C1, had periods of vigorous lava fountaining, often dropping incandescent bombs on the upper part of the Sciara del Fuoco, particularly in early September. During dry weather, a very dense gas plume was always visible above Stromboli, often forming a hazy layer at about 850-900 m altitude that extended for tens of kilometers away from the volcano.

A summit visit on 28-29 September by Giada Giuntoli and Boris Behncke was made in order to reveal changes to the crater morphology and eruptive behavior, but bad weather and very strong gas and steam emission from the craters seriously hampered the observations which therefore give only a sketchy impression of the state of the volcano at that time. The view of the craters from the summit was almost impossible because the vapor and gas plume was driven immediately above the viewing point at Pizzo sopra la Fossa by strong wind.

Craters 2 and 3 had not changed significantly since the last summit visit on 20 April. No active vents and no fumarolic activity were seen at night (when observations were at times possible) in C2, and vent 3/1 showed its usual fluctuating glow but no spatter ejections. Vent 3/2 had very weak emissions of reddish ash at intervals ranging from 5 to 20 minutes. The ash passively mixed with the dense vapor plume and did not pierce through it, pointing to the low energy of the emissions. No noise was heard during these emissions, but weak noises could have easily been masked by the stormy wind at Strom- boli's summit.

Crater 1 had been largely filled with small spatter cones during the summer 1994 activity, but destruction of these cones began with a powerful phreatic explosion on 5 March 1995. That explosion opened a pit about 70 m in diameter and blew away half of the largest 1994 cone (at vent 1/2) and all of the smaller cones north and northeast of it (in the vent area 1/1). The remaining half of the cone at 1/2 has further collapsed since April 1995 and now forms a small rounded hump instead of the spine-like feature it was before. The "Gemelli" (twin) cones in vent area 1/3 remain standing. None of them has erupted after September/October 1994, but a new incandescent vent (about 10 m wide) has formed at the SE base of the southwestern twin cone. This vent was the site of brief noisy gas explosions that did not eject any rock fragments but a diffuse incan- descent gas cloud.

The most vigorous eruptions during the observation period occurred from vent 1/1 which itself could not be observed. The eruptions ejected black ash plumes that rose vertically above the vapor plume, at times higher than 100 m, in spite of the wind, testifying the much higher energy of these eruptions with respect to those from vent 3/2. At dark, incandescent ejections were seen in some of these eruptions, and loud roar- ing noises were always audible. Such eruptions occurred at intervals ranging from 5 minutes to more than 1 hour.

Observations by more fortunate observers in early October disclosed continuing low-level activity with eruptions from vents 1/1 and 3/2 and incandescence from vents 1/3 and 3/1. Many of the eruptions produced ash plumes and were probably phreatomagmatic.

After the period of very intense activity in summer- autumn 1994, Stromboli presents itself at a very low level of activity since early 1995, lower probably than at any time since the last major effusive eruption in 1985-1986. The low level of visible activity is confirmed by the seismic data acquired by the University of Udine (see recent GVN Bulletins) and has been interpreted as a possible precursor of a much more powerful eruption in the near future by several researchers, resulting in a warning and prohibition of access to the volcano in April-May. The alarm, although never officially lifted, has not been men- tioned anymore during recent months, and people again croweded the summit during the summer nights.

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ETNA ERUPTS AGAIN

This description is compiled from several sources - ed
John B.Murray of Open University, describing the start of Etna's autumn eruption, wrote:

"We (John B.Murray and Fiona McGibbon, Open University; Nicki Stevens, Reading University, Phil. Sargent, Sue Elwell and Sarah Cooper, Nottingham Trent University) visited Mt Etna as part of a routine ground deformation and topographic measurement programme between September 9th and October 14th. Observation of activity was hampered by bad weather during the first 3 weeks, but on calm days the summit appeared to be fairly quiet, though light ash falls were noted from 2 km to 3 km away in the third week of September. A thicker ashfall was experienced

whilst making GPS measurements 50 metres from the Bocca Nuova edge on September 27th during an intense snowfall, though high winds masked any sounds from the crater.

"Things changed on October 1st. Just before 15h, we began to distinctly hear explosions from the summit every 2 to 3 seconds, despite the fact that we were working a distance of 5 km to the south. An hour later, we were on the edge of the Northeast Crater, which was responsible for the noise. There were 2 tiny vents, perhaps 3 to 5 metres across, that were faintly glowing red apparently at least 100 metres below us. Despite the loud detonations, only one small shower of ejecta was seen to leave one of the vents, rising only about 10 metres above it. The Chasm (La Voragine) was emitting fume quietly, and detonations (only audible from the edge) came from a vent within the Bocca Nuova every minute or so.

"The following night, a bright summit glow could be seen from Nicolosi (16 km south), and on the morning of October 3rd, explosions from the Northeast Crater could be heard very loudly every 2 seconds or so from the track 800 metres west, which had been covered with a thin layer of red ash overnight. After a lull midday, we could hear explosions late afternoon from below Piano Provenzana, at a distance of more than 7 km, and light ash fell on us near Monte Corbara (5 km NW). We eventually approached the crater 18:15, to find 2 of the guides and a camera crew from Italian TV returning from the edge. They warned us that some bombs were falling outside the crater, so we kept our distance, skirting round towards the high ground behind, but before we could do so a large strombolian explosion sent about 10 brightly-glowing juvenile bombs just over the edge, rolling down towards us. A few seconds later a single bomb about 20 cm across landed 10 metres from us, i.e. a distance 100 to 200 metres from the edge. Similar expulsion of bombs, ejected to smaller distances, occurred every 2 minutes or so until we came down at 18h 45m. Audible explosions were occurring about once every 4 seconds.

"The following day (October 4th) activity had decreased greatly. At 09:40, the Northeast Crater was making much quieter bangs, though at the higher rate of nearly one per second, and no material was ejected. By 13:30, it was quiet. The Chasm was quietly fuming, but the Bocca Nuova contained 2 vents, one of which was exhaling gas explosively once a minute, whilst the other was collapsing, producing brownish clouds of ash every 5 minutes or so. We climbed into the Southeast Crater to the edge of the actual vents, which emitted gas quietly and not under pressure, apart from one area just below the S rim.

"Activity generally diminished until the end of the trip, though there were louder rumblings from the Bocca Nuova on October 8th. On October 12th, there was a series of fairly continuous collapses within the Northeast Crater between 8 and 9 in the morning, which built up a vertical column of ash rising at least 800-1000 m above the summit; this drifted towards the west, casting a deep shadow north of the town of Bronte. No sounds accompanied this output. At the same time, the Bocca Nuova was producing audible detonations about once a minute, mainly from a vent on the east side of the the floor, but the larger vent on the NW side occasionally exploded too, throwing 20 cm diameter old, non-magmatic blocks 30 to 50 metres up above the floor.

Boris Behncke wrote:

"When we (Boris Behncke, Carmelo Monaco of the University of Catania, Maria Felicia Monaco from Bari University, and a few others.) reached the crater rim shortly after 1230, vigorous and noisy steam emission occurred from Northeast Crater. Explosive activity occurred in places hidden from view, as deduced from the noise of bombs falling back onto the crater floor. The visibility was now much better than 5 days earlier, and after a few minutes, incandescent spots became visible in the central part of the crater floor. They gradually increased both in number and intensity, but no incandescent ejections or movements of incandescent material were visible. During this intensification of the glow, the noise level augmented dramatically, and more dense gas plumes

rose from the crater floor. Pyroclastic ejections became more frequent and more vigorous, and soon the incandescent areas were hidden from view by gas and dilute ash plumes. Such ash plumes first rose only slowly to less than 100 m above the crater floor (estimated to be 200-250 m deep) but gradually rose higher and became more heavily ash-laden. About 5 minutes after the onset of ash venting, dense, convoluting ash clouds began to rise higher than the high southeastern rim of Northeast Crater. At times, parts of the crater floor became visible, but all incandescent spots had vanished. Bomb and ash emission steadily increased, and ash began to fall on our observation point on the NW crater rim."

Boris Behncke went on to describe the activity on October 14th:

"We (Boris Behncke, Carmelo Monaco, and others from Catania.) arrived at Northeast Crater at shortly after 1700 on 14th October when the crater floor was already in the dark and soon discovered a glowing vent roughly in its central area Vigorous high- pressure gas emission produced an impressive roaring noise. The gas plume was almost vapor-free, allowing a better visibility than during previous visits.

"During the first 30 minutes of our stay on the low NW rim of Northeast Crater, glowing spatter were occasionally ejected from the incandescent bocca in the crater floor. The conduit of that vent appeared some- what inclined towards the NW, but the ejections seemed to be mostly vertical. As the roaring noise of the degassing increased, numerous incandescent spots became visible around the active vent. They appeared to be aligned more or less concentrically around the vent, and may have been cracks in the solidifying crust of a cooling and subsiding lava lake.

"After the first half hour of the observation period, Strombolian bursts from the vent in the crater floor became more vigorous and occurred up to 3 times in 5 seconds, ejecting bombs about 50 m above the pit. About 10 minutes later, the explosions again intensified, and the crater floor around the vent, which now ap- peared more funnel-shaped, was covered with incandescent bombs. Ejections rose about 100 m above the vent but remained far from reaching the low point of the crater rim. No heat was felt, but light ash falls and very strong SO_2 odor made the stay on the observation point very unpleasant. On October 15th and 16th, only very light steam emissions were seen when Etna was occasionally glimpsed from the Catania area."

Mauro Coltelli and Stefano Pannucci added the latest news received to date:

"Four strong episodes of lava fountaining occurred at the Northeast Crater during the last two weeks. The first episode started at 00:14 GMT of 9th November and lasted about one hour. Abundant ash and lapilli fell on a wide area of the SE flank of the volcano, down to the town of Catania. The second episode occurred on 10th November from 3:45 to 5:30 GMT. It produced a scoria fallout only on the upper of the volcano, close to the vent. The third took place at the 7:50 of 14th November and lasted about one hour. Ash and lapilli fell on a narrow zone of the NE flank of the volcano. Th fourth fire fountain episode occurred at the Northeast Crater in the first hours of 23rd November 1995.

Information on the Etna's November 1995 activity is on IIV Web server at the pages:
http://www.iiv.ct.cnr.it:80/files/reports/November1995.html
http://sismsrv.iiv.ct.cnr.it/tremetna.htm

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Phil. Sargent, Sue Elwell and Sarah Cooper, Nottingham Trent University
Boris Behncke and Carmelo Monaco, University of Catania; Maria Felicia Monaco, Bari U.

MAGNETIC STUFF

ERUPT SOFTWARE

For those of you who have requested ERUPT software from MicroInnovations (which has apparently discontinued operations), you can now download it from the Rockware home page at:

http://www.aescon.com/rockware/index.htm.

Both DOS and Windows versions of this software are available.

ERUPT is a graphical program that simulates various volcanic eruption types, including Strombolian, Plinian, pyroclastic flows and surges, fluid lava flows, and viscous lava dome emplacement. Tectonic (faulting), sector collapse, and erosional events are also simulated.

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MONTSERRAT VIDEO

For those of us who have no idea what it must be like to experience a volcanic crisis, Montserrat Community Television, a non-profit organisation, has made available an edited account on VHS of the events leading up to and including the evacuation. Run time is about one hour, with great shots of the vents pouring steam and ash into the air from the Tar river estage, mud slides,and the aftermath of the phreatic eruptions of August 21..... It's a great tape, especially given the arduous circumstances in which it was produced.

Copies can be obtained from MCTV at 809-491-7767, 809-491-2301, by mail fromBox 447, Church Road, Plymouth, Montserrat, or by emailing directly, for the sum of US$40.00 + $5.00 shipping.

Chris Mason <masonc@server2.candw.ag>

CONFERENCES, SYMPOSIA AND FIELD TRIPS

PAN PACIFIC HAZARDS '96 CONFERENCE

Vancouver, British Columbia, July 29th to August 2nd, 1996

Just a reminder to volcanologists and other interested people about the Pan Pacific Hazards '96 Conference. There is a major session on volcanic ash and aviation safety planned. The session includes updates on volcano research, modelling, monitoring, satellite programs, aviation issues, public hazards *etc.* We have received a lot of interest so far, indicating a strong program. You will find conference details on the WWW at the EPIX (Emergency Preparedness Information Exchange) - try a search entry to find it. Information from:

Terry Spurgeon; (604) 666-5489 (tspurgeo@sfu.ca)

MID-ATLANTIC RIDGE SYMPOSIUM

Iceland, June 1996

Over the last five years, a substantial research effort has focused on the mid-oceanic ridge in the central North Atlantic, including the France-US FARA project and various investigations under the Ocean Drilling Program, the British Bridge program, the European Marflux project, and by Russian, Japanese and Portuguese scientists. In order to provide a forum where the results of this extensive work can be summarized, and where future research objectives can be formulated, an international symposium will be held in Iceland during the week of 17 June - 21 June, 1996.

The meeting, sponsored by French and US science agencies to mark the end of the FARA program, is being convened under the auspices of InterRidge and will be held in the University of Iceland. It is supported as a Ewing symposium by Lamont-Doherty Earth Observatory with associated publication of papers in a Ewing Symposium volume. Other research reports will be published in a volume of abstracts. The symposium will include a field trip to the Reykjanes Peninsula and be preceded or followed by a field trip to the Eastern Volcanic Zone.

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Heather Sloan and Ruth Williams

ODP-INTERRIDGE-IAVCEI WORKSHOP

OCEANIC LITHOSPHERE & SCIENTIFIC DRILLING INTO THE 21ST CENTURY

Woods Hole Oceanographic Institution, 26-28 May 1996

Convenors: H.J.B. Dick (USA) and C. Mevel (France)

This symposium and workshop is jointly sponsored by the JOIDES Planning Committee of the Ocean Drilling Program, the InterRidge Initiative for internationally co-ordinated study of ocean ridges and the Commission on Large Volume Basalt Provinces of the International Association of Volocanology and Chemistry of the Earth's Interior. Its purpose is to plan an integrated program of scientific ocean drilling to evaluate and extend current models for the formation of a laterally complex and heterogeneous ocean lithosphere. A program which must include drilling in crust formed at fast and slow ridges, near and far from mantle hot spots and at large oceanic igneous provinces (LIPs) formed outside the framework of the global ridge system.

In 1988 the Ocean Drilling Program begins Phase III of scientific drilling in the oceans, concluding the current program at the end of 2002. A new phase (IV) of ocean drilling, however, is being planned for beyond 2003. It will likely involve multiple platforms and riser drilling, bringing the ability to drill in situ through the entire ocean crust.

The symposium will review the current state of knowledge of the ocean lithosphere, summarize the capabilities of present drilling technology and review new technologies planned for Phase IV. Some contributed talks and a poster session on the composition and structure of the ocean lithosphere are solicited from participants. The workshop will seek to establish community goals and priorities for ocean lithosphere drilling for 1998 to 2003 and begin the formal planning and proposal process for multi-leg deep drilling during Phase IV.

Deadline for applications is 1 February 1996. Late applications will be accepted on a space available basis only.

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NEW MEXICO GEOLOGICAL SOCIETY FALL 1996 FIELD CONFERENCE

Jemez and Nacimiento Mountains, September 25th-28th, 1996

The 1996 NMGS Fall Field Conference will examine the geology of the Los Alamos/Jemez Mountains and Nacimiento Mountains area. This scenic and geologically diverse region includes spectacular Tertiary-Quaternary volcanism, including the 20 km diameter Valles caldera, an excellent record of Rio Grande rift faulting and sedimentation, a complex Tertiary- Quaternary record of deposition and erosion by the Rio Grande, a thick and fossiliferous late Paleozoic section, and much more! The guidebook for the conference will be a 400-page, hard- bound book containing three major road logs and about 40 contributed, scientific papers.

The NMGS is soliciting papers presenting original research or review of aspects of the geology of the area, minipapers for the road logs, photographs, and other materials for inclusion in the guidebook. Field Conference guidebooks typically cover a wide range of topics in the earth sciences, and related aspects of the cultural history and modern environment of the area under consideration.

If you would like to contribute a paper, please contact one of the editors listed below by October 1, 1995, and provide a tentative title and estimated length of your paper. Manuscripts, which should be reviewed by two knowledgeable readers before submission, must be received by the editors by February 15, 1996.

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THE FIELD CONFERENCE

Day 1 will begin north of Albuquerque and proceed north through San Ysidro, skirting the southern end of the Nacimiento Mountains, into San Diego Canyon. Stops at Guadalupe Box and near Jemez Springs will examine Precambrian rocks, regional structure, and Pennsylvanian-Permian stratigraphy and paleontology. In addition, stops in this area will feature Quaternary volcanism, hot spring activity, and geomorphology. Day 1 then proceeds through the Jemez Mountain on NM 4 to Los Alamos where the final stop will present an overview of the volcanic stratigraphy, structure, and hydrogeology of the Pajarito Plateau and western Espanola Basin of the Rio Grande rift.

Day 2 will traverse the Baca Ranch, which occupies Valles caldera. Access to this area, one of the largest, intact, privately- owned blocks of land in the state, has been graciously granted to NMGS by the Baca Land and Cattle Company. Day 2 offers an unique opportunity to examine volcanic structures and products in the caldera, along with Quaternary lake deposits, unusual manifestations of hydrothermal activity, and glorious scenery. Day 2 will conclude with examination of the youngest volcanic deposits of the caldera, and discussion of their implications for future volcanism in the Jemez Mountains.

Day 3 will focus on the geomorphology, environmental geology, hydrology, and soils of the Pajarito Plateau. Spectacular vistas along White Rock Canyon will reveal the late Neogene evolution of the Rio Grande, and sites of paleoseismic investigations of Holocene faulting will be visited. The Bandelier Tuff, product of the volcanism that produced the Valles caldera at 1.2 Ma, will be examined in detail. The trip and field conference will conclude by traversing the southern Jemez Mountains, examining some of the earliest volcanic products of the volcanic field, to the Cochiti Lake area. The final stop features particularly photogenic tent rocks, and examination of the Peralta Tuff.

VOLCANOLOGY SUMMER FIELD COURSE

New Mexico, Summer 1996

The 4th University of New Mexico - Los Alamos National Laboratory Volcanology Summer Field Course will be instructed at the University of New Mexico Young Ranch field station in the Jemez Mountains, New Mexico, between July 19th and August 11th, 1996. The course consists of a series of 9 mapping and stratigraphic exercises designed to provide an understanding of field relationships of volcanic rocks in terms of eruptive processes. The exercises, directed by 5 faculty members from both institutions, include aspects of lava flows, pyroclastic deposits, and derivative sediments over the full range of magma compositions from rhyolite to basalt, from near vent to distal, products of magmatic and hydromagmatic eruptions, and also include sampling of gas and water from active geothermal features. The assignments and related field trips take advantage of the diverse volcanic geology of the well-known Miocene-Quaternary Jemez Mountains volcanic field, including the Valles Caldera and Bandelier Tuff. The 45 alumni of the course include seniors and graduate students representing universities in 12 states within the US and 9 countries.

This course carries transferable graduate credit (4 semester hours) from UNM and partial scholarships are available. The cost for the 1996 course will be about US$1100.00 and includes tuition, fees, room, board, and transportation during the course. Admission to the course is competitive and will be restricted to about 15 students. Application deadline is March 18, 1996.

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XXI EUROPEAN GEOPHYSICAL SOCIETY GENERAL ASSEMBLY

The Hague, May 6th-10th, 1996

***SE8* Understanding and predicting explosive volcanism**

This session (SE 8) of Solid Earth Geophysics of the coming EGS General Assembly covers a large range of subjects. In this session we encourage a multidisciplinary approach of understanding explosive volcanism (origin and evolution of eplosive eruptions, coexistence and/or transition between contrasting eruptive styles during the same eruption, explosive eruptive cycles etc.) in order to evaluate explosive eruptive scenarii and to develop predictive models.

These aspects will namely include:

- Volcanology, petrology geochemistry and textural studies of explosive volcanic products.
- Composition and behaviour of the gas phase,
- Study of chemical and physical parameters governing explosive eruptive phenomena; pre-eruptive conditions and evolution of these parameters during eruption in the eruptive conduit and at the surface,
- Study of the interactions at the magma- hydrothermal system interface,
- Correlating and and interpreting geological, geochemical and geophysical volcano crisis data sets,
- Modeling of explosive eruption leading to possible predictive models

Convener: **B. Villemant**
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***SE9* Thirty Years of Inquiry into Relation of Benioff-Waditi Zone and Magma Composition: Myth or Reality**

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The relationship between the depth to the Benioff- Wadati zone and the composition of the volcanic rocks above the earthquake centres has been explained through different processes (breakdown of different mineral phases, thickness of the crust, etc.) The existence of compositional differences of slow and fast spreading types of oceanic crust, composition of mantle wedge, varying heat flow, involvement of oceanic sediments have profound influence on magma composition. Are the observations of authors like Kuno or Hatherton and Dickinson still valid?

EUROPEAN SEISMOLOGICAL COMMISSION
XXV GENERAL ASSEMBLY
Reykjavik, Iceland, September 9th - 14th, 1996

In addition to the open symposia, several sessions of special interest to the mid-oceanic ridge research community are foreseen:

- Seismology and Faulting at Ridges
- The Iceland Hot Spot
- Crust/Mantle Structure and Processes
- Seismology, Deformation and Structure of Volcanoes
- Field trips to the plate boundary areas, e.g. the rift and transform zones of South Iceland

Information: **LOC XXV General Assembly ESC**
Att: Mr. Bardi Thorkelsson
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Bustadavegur 9, 150 Reykjavik
Iceland
Fax: +354 552 8121
Email: esc96@vedur.is

EJECTA
VOLCANO CALENDAR

The 1996 IAVCEI Volcano Calendar has been available for some time now. Includes 13 great colour photos of world volcanoes. This wall-style calendar includes the chronology of all major historic eruptions!

cover	Stromboli, Italy
Jan	Peulik, Alaska
Feb	Io, Jupiter
Mar	Merapi, Indonesia
Apr	Fogo, Cape Verde Is.
May	Egmont, New Zealand
Jun	Fernandina, Galapagos
Jul	Arenal, Costa Rica
Aug	Las Tres Virgenes, Mexico
Sep	Cascades, Oregon
Oct	Pacaya, Guatemala
Nov	Shasta, California
Dec	Etna, Italy (blowing a smoke ring!)

- U.S. addresses: $10 each (U.S. dollars); cheques payable to "IAVCEI Calendar Account," postage included.
- Non-U.S. addresses: $10 each + $2 per order for postage (U.S. dollars or cheque for U.S. dollars drawn on a U.S. bank); cheques payable to "IAVCEI Calendar Account."
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