Commission on

Explosive Volcanism

The CEV Newsletter sponsored by IAVCEI
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In This Issue

The CEV Newsletter

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In this Newsletter..

Welcome to the December 1998 issue of the CEV Newsletter we hope you enjoy it! There has been a great deal of activity lately in the research community that is of interest to CEV members, and this Newsletter focuses on summarizing some of that activity for you.

First, Piero Dellino (University of Bari, Italy) provides a summary of the "Cities on Volcanoes" meeting that was held in Rome and Naples. This was a very interesting conference that brought together scientists, educators, local political leaders, and members of the insurance industry to discuss volcanic hazards in urbanized areas. Cities on Volcanoes is but one of several meetings that have focused (or will in the near future) on this extremely important issue.

Immediately following the Cities on Volcanoes meeting, the International Volcanological Congress took place in Cape Town, South Africa. Some of the classic studies of explosive volcanism were done on the kimberlite diatremes of southern Africa, and comparisons of models from Africa and elsewhere led to some heated, but collegial, discussions in the CEV-sponsored Kimberlites, Diatremes, and Maars symposium. We have asked two of the proponents of different models, Barbara Scott-Smith and Volker Lorenz, to present their models and arguments in a future CEV newsletter. If anyone else would like to write a note on other models, we would welcome that. Perhaps the relatively small size of the meeting broke down some discipline barriers, as one particularly encouraging aspect of this meeting was how it fostered dialogue between volcanologists, petrologists, and modelers of all persuasions. Two reviews of the meeting are included in this newsletter, each with markedly different, although positive, impressions of the meeting.

Armin Freundt reports on the "Particulate Gravity Currents Conference," held in Leeds (UK) recently. As you will see in his report, the nature of pyroclastic flows and surges, along with turbidity currents and the like, continue to occupy a prominent position in the research community. On the topic of pyroclastic currents, there have been many papers recently that focus on their deposits, particularly on the clues provided by lithic breccias in them. We would like to invite anyone who has a strong opinion (or even a not-so-strong opinion) on recent work on

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the mechanics of pyroclastic currents to submit a piece to CEV on the topic! Similarly, there are at least two recent books that would benefit from reviews in this forum: *The Physics of Explosive Volcanic Eruptions* (edited by R.S.J. Sparks and J.S. Gilbert) and *From Magma to Tephra: Modeling Physical Processes of Explosive Volcanic Eruptions* (edited by A. Freundt and M. Rosi). If anyone would like to review these books for CEV, we would certainly appreciate it.

We are pleased to have articles describing research at Bristol University (by Steve Sparks) and at University of Hawaii (by Steve Self). As we have stated in previous newsletters, we want CEV to be a major source of informal communication among the community so that researchers are aware of all the major research efforts around the world. We hope this can help to reduce redundancy and facilitate collaboration.

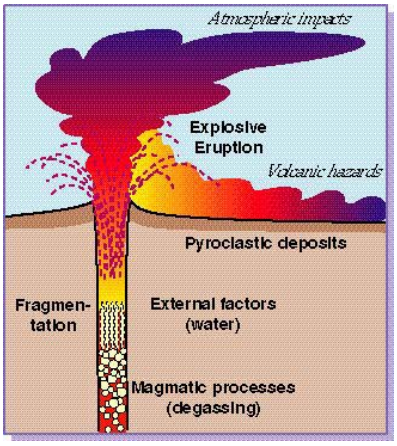
The next major conference for IAVCEI is the International Union of Geodesy and Geophysics General Assembly next summer (July 1999) in Birmingham, UK (http://www.bham.ac.uk /IUGG99). There will be several sessions at the General Assembly of direct interest to CEV members, on topics such as coupling between magma rise/fragmentation and eruption column/pyroclastic current processes, turbulence, volcano geophysics, and hazards to urban centers. Abstract deadline is 15 January 1999.

In addition, there are several field workshops of interest to CEV. All of these are summarized at the end of this Newsletter. We also include our annual membership listing in this issue.

In our last newsletter we proposed starting up a CEV Working Group on Numerical Modeling. We've had a strong positive response from a dozen or so CEV members, but it's not clear whether this is a sufficient level of interest to move forward. Please, if you're interested in participating in such a working group, let us know. If we decide to move ahead with the idea we will set up an evening meeting at Birmingham to develop a plan of action.

And now, enjoy the real part of the Newsletter!

G. A. Valentine & M. H. Ort, Co-Leaders



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A Royal Society Discussion Meeting and Poster Session

Organized through the

Volcanic and Magmatic Studies Group of the Geological Society

"Causes and Consequences of Eruptions of Andesite Volcanoes"

London, 6th and 7th October 1999.

Poster session contact: Dave Rothery, secretary of VSMG , Open University, Dept. of Earth Sciences, Milton Keynes MK7 6AA, email d.a.rothery@open.ac.uk

Meeting contact: Royal Society Discussion Meetings office, 6, Carlton House Terrace, London SW7

Convenors: P.Francis, J.Neuberg and R.S.J. Sparks

Cities on Volcanoes, *Rome and Naples (Italy), June 28 to July 4, 1998*

By Piero Dellino

"Cities on Volcanoes", an international meeting organized by Osservatorio Vesuviano and Gruppo Nazionale per la Vulcanologia, and sponsored by IAVCEI, was held from the 28th of June 1998 to July the 2nd in the facilities, and under the patronage, of the Italian Civil Protection Department, located at Castelnuovo di Porto (Roma), and continued to July the 4th in the Royal Palace of Naples. The aim of the conference was to share experience between volcanologists, sociologists, economists and city planners in order to evaluate scientific results and strategies for the management of volcanic risk in densely populated areas.

Scientific sessions were organized accordingly, and culminated in three working groups: one, coordinated by C. Newhall and C. Siebe, on eruptive scenarios and hazard evaluation; another, coordinated by T. Pareschi and G. Valentine, on risk evaluation and Geographic Informative Systems (GIS); and the third, coordinated by M. Martini and D. Hill, on surveillance systems, precursors and alert levels. The results of the working groups were then discussed in a plenary session.

It was a tremendous opportunity for professionals bringing experience on active volcanic areas of the world to contact people facing similar problems. It is interesting to point out that, no matter how different the socio-economic background conditions are, the scientific action and the decision-making approach seem generally to converge.

Consensus emerged on the need to not base hazard maps on the scenario resulting from the maximum eruption to eruption of medium magnitude (subplinian-vulcanian) that are more frequently registered in the stratigraphic record of explosive volcanoes. Naturally, the scientific effort required by this probabilistic approach is more demanding, especially where the knowledge of the volcanic history is not complete and accurate, but gives more realistic and convincing estimates to the city planners, as reported from the experience at Popocatepetl (Siebe, pers. comm.), Vesuvius (Santacroce et al.) and Phlegrean Fields (Orsi et al.). When this kind of method cannot be used, because of the lack of data or because multiple volcanic vents with different types of activity have to be considered (Smith et al.), a flexible approach of hazard evaluation (Wood et al.), involving various scenarios whose effects on the territory are "cross-related" using a robust GIS implementation is recommended (Daly and Wood). Such an approach has been proposed for the city of Auckland (New Zealand).

Various aspects of the relations between hazard zonation, hazard maps and risk were discussed; interesting points and new perspectives emerged. Generally, hazard maps are based on the dispersal area of actual deposits. In some cases, as, for example, with plinian fallout, the data can be used to address risk evaluation, because the amount of solid material emplaced is directly related to the damage, and if a certain limit is exceeded, roof collapse is expected. In other cases, as for pyroclastic flows, the actual deposits gives no direct indication of the expected damage, which instead is related to the dynamics of the flows, namely its velocity, concentration, temperature, etc. In these cases physical models and numerical simulations, based on input data that honor geological constraints, can help in

of the volcanic history. These scenarios, in fact, generally refer to catastrophic events (plinian-ultraplinian eruptions) that can be very rare (recurrence time of thousand years). They are not easily accepted by authorities, because of the economic cost of an emergency plan thatrefers to a highly improbable phenomenon. Attention must instead be paid to the most probable scenario at short-medium term (tens up to a hundred years), which generally refers

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reconstructing the flow dynamics (Dellino and La Volpe; Macedonio and Neri) and allow the determination of parameters, as for example the dynamic pressure (Valentine), that can be directly used to calculate the expected damage. To perform risk calculation, the huge amount of data needs to be correlated and referenced in a system allowing either the representation of impact on the territory and a fast and flexible updating of information. GIS is the more elegant and effective way to achieve these goals, and is a formidable tool for territory planning and civil protection needs (Pareschi et al.). Interesting uses of GIS, as integrated systems for physical simulation, have also been proposed (Gomez et. al.).

The interpretation of surveillance data in terms of reliable precursors is a difficult task (Martini and Giannini). Anyway, the combined interpretation of the variations of seismic, gravimetric, magnetic, geoelectric and ground deformation data, together with flux and composition of magmatic gases (if (Francis; Love et al.) satellite imagery for the analysis of high-resolution thermal data (Abrams and Lang), and numerical stereo-photogrammetry for evaluating ground movements (Kelfoun et al.).

All the scientific efforts of the volcanological community can be negated if authorities and population do not have the perception of the utility and credibility of results. We are indeed confronted with the task of sustaining a steady and responsible dissemination of information, either before or during volcanic crisis. Before crisis, education actions in schools and information centers are marking a sensible progress in the knowledge that children, and consequently parents, have of the volcanic risk (Driedger, Okada, Orsi). This is very important because consciousness of risk has a central role in reducing the social impact of expected eruptions (Ronan et al.).

In the past, problems have sometimes arisen because of conflicting information sparsely disseminated by individuals throughout the media. Signals have however emerged during the conference that a standard protocol

present), is able to give significant clues on the reactivation of the eruptive system. The participants in the working group on monitoring system, precursors and alert levels agreed that volcanoes which have been quiescent for hundred of years likely will give precursors months or years before the next eruption, while those which have been quiescent for years or tens of years will give precursors only days or weeks before the eruption. Calderas can give more complex signs of renewal of their activity. It was furthermore suggested that only a few alert levels should be defined and very clearly presented to the public.

The effectiveness of surveillance is strictly linked to the quality and density of the array used for continuously monitoring geophysical and geochemical parameters. This system is generally well implemented (Gomez et al.; Okada et al.) where volcano observatories are present and consistently financially supported, but this situation doesn't occur on every active volcano. For this reason the engineering of relatively inexpensive mobile stations and the use of remote sensing is becoming more and more important. Interesting examples come from the use FTIR spectroscopy for the analysis of volcanic plumes of action can be accepted by volcanologists (Newhall). Its use may eliminate subjectivity and improvisation during volcanic crisis and moreover reduce the source of possible incomprehension with authorities and friction between scientists. The experience of the volcanic crisis at Popocatepetl (Meli) is an example of a modern and integrated approach of crisis management. The use of probability trees in the analysis of ongoing phenomena during crisis can additionally help volcanologists in the process of decision making (Aspinal).

A post conference excursion focused on showing the volcanological, sociological and urban aspects of the active volcanic areas of the Phlegran Fields and Vesuvius concluded the meeting.

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Exploring Volcanoes Utilization of their resources and mitigation of their hazards

The first IAVCEI General Assembly of the new millenium, as well as pre-Assembly field excursions and post-Assembly activities, will be held in Denpasar, Bali in Indonesia 18-22 July 2000. A wide range of volcanological topics has been identified covering magmatic processes, utilization of volcanic energy, mineralization, volcanic hazards, and so forth. The Organization Committee for the 2000 General Assembly is being chaired by Dr R Sukhyar of the Volcanological Survey of Indonesia (VSI).

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Magmatic Diversity: Volcanoes and Their Roots, *IVC Congress, South Africa*

By Dr. C. Leah Moore

One of the most exciting events on the 1998 volcanological calendar this year was the International Volcanological Congress, "Magmatic Diversity: Volcanoes and Their Roots", held in Capetown in July. The event was a roaring success despite unfortunate events that prevented the attendance of Andy Duncan, Chairman of the organizing committee, and Grant Heiken, our own IAVCEI President. The rest of us muddled on and endeavored to absorb information from the excellent oral and poster presentations. The Symposia covered a broad spectrum of research domains, some with a particular southern Africa as it certainly isn't being used the same way now as when it was first coined.

Presentations in the Komatiite Symposium seemed polarized into those that supported a "dry" source for most komatiites (e.g. Arndt *et al*. 1998) versus those that supported the traditional model (hydrous source based on textural observations), or at least argue that the evidence is equivocal and there is likely more variability in komatiites than is otherwise suggested (e.g. Beresford *et al*. 1998). Support for hydrous source materials includes: that the presence of water reduces liquidus temperatures; komatiite assemblages always incorporate hydrous phases; some komatiites contain vesicles, which may be of magmatic origin; some contain magmatic amphibole; and laboratory evidence supports the presence of water

flavor (Table 1.).

It was refreshing to see discussions on contentious issues in many symposia. Some of the more energetic included: whether komatiites form from hydrous or anhydrous melts; whether systematic models for the emplacement of kimberlites truly reflect the physical expression of kimberlites in a number of localities (especially southern Africa); continued debate on the mechanisms of flood basalt eruption (show us your LIPs), and, trying to figure out who knows what we really mean by "peperite"

Symposia at IVC'98

1. Carbonatite and Alkaline Magmatism from Source to Emplacement

2. Flood Volcanism

3. Ultramafic Magmas

4. Oceanic Volcanism

5. Magmatism Related to the Opening of Oceans (MOO)

6a. Arc Volcanism and Lithosphere Evolution

6b. Fluid Processes and Chemical Fluxes in Subduction Zones

7a. Granite Related Mineralization

7b. Erupted and Non-erupted Granites

8. Between Magma Source and Eruption

9. Peperites: Processes and Products of Magma-Sediment Mixing and Implications for the Mechanisms of Explosive Magma Water Interaction

10. Relationship Between Kimberlites, Maars, and Diatremes

11. Open Symposium

Table 1

for the production of komatiite compositions, komatiitic pyroxenes and spinifex textures. Arguments against a hydrous source include: the lack of degassing textures and associated phenocryst formation; isotopic evidence for a mantle source depleted in incompatible elements; that the hydrous minerals associated with komatiites may be generated by hydrothermal alteration; and that experimental results for the formation of komatiitic textures, pyroxenes and textural features are ambiguous. The jury is still out on this debate.

CEV sponsored the Kimberlite Symposium, which turned out to be a thought provoking session. A tag-team of scientists (e.g. Field *et al*. 1998, Scott-Smith *et al*. 1998) described the physical configuration and emplacement mechanisms of kimberlite bodies in South Africa and Canada. They discussed a range of observed morphologies and stratigraphies for kimberlite bodies, and the associated control of enclosing

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lithologies on kimberlite pipe shape. They also challenged the phreatomagmatic model for the genesis of these features. Supporters of the inverted cone or funnel shaped pipe model with systematic internal stratigraphy for kimberlites, and the phreatomagmatic model for kimberlite pipe genesis, were given the view the eruption dynamics of flood basalts; and Nick Arndt got the last (but not necessarily final) word on "dry" versus "wet" komatiites. Worthy Wager medalists Giovanni Macedonio and John Davidson gave stimulating presentations on geophysical modeling and subduction zone volcanism respectively.

For many the highlight of the meeting was the field trips. Pre-Conference field

opportunity to discuss the rationale behind the models' development (e.g. Lorenz 1998), but the parties agreed to disagree.

The Peperite Symposium also benefited from CEV support. This session was more exploratory than confrontational in that participants were resolving the true definition of the term "peperite". A delightful presentation on the type peperite in Limagne, France (DeGoer *et al*. 1998) opened this session. Although the original model for the formation of "pepper rocks" (glassy basaltic fragments in a light-colored limey to marly matrix) was that they had formed due to "the injection of basaltic magma into water soaked mud", subsequent work in the Limagne area has shown that these sediments result from aerial and repeated phreatomagmatic explosions. They are now recognized as subaerial hydromagmatic deposits. "Peperite" has more recently been used to describe the products of thermally induced magma-sediment mixing (as per the original incorrect hypothesis at Limagne). The balance of the Symposia focused on case studies showing the diverse range of sediments that can be generated in this way (e.g. Allen 1998, Busby 1998, Cas *et al*. 1998, Gifkins *et al*. 1998, McPhie & Hunns 1998, Moore 1998).

If you review the abstract volume targeting particular symposia, you will find that such healthy discourse took place in a number of the sessions.

An interest area that is blossoming at IAVCEI-related meetings is the study of granitic rocks. This not only complements work by enthusiastic petrologists, experimentalists and geochemists studying the processes at the magma source and between magma source and eruption, but also provides insights into magmatic properties of the eruptive equivalents, which lie squarely in the domain of explosive volcanism.

The meeting culminated in keynote presentations at which: Steve Self trotted us around the globe to re

trips tempted people with visits to volcanics and intrusives, from Archaean successions to modern, in exotic places from Reunion Island to the Karoo, and northern South Africa. Mid-Conference field trips looked at features of interest in the immediate vicinity of Capetown, including overviews of the geology of the Cape Granites, Cape Peninsula and Robben Island (where Nelson Mandela was incarcerated). Another excursion addressed the geology of the Cape Winelands, but it didn't seem to matter which trip you went on, you were still introduced to popular vintages from the region.

Post-Conference field trips were many and varied. They included: two excursions to northern South Africa, one to look at komatiites in Komati Valley and elsewhere in the Barberton region, and one to visit kimberlites in the Kimberley region. Arguments presented during the Capetown based meeting were presented with even greater passion in the field. There was an excursion to the Bushveld Complex, and three separate excursions to Namibia to visit the southern Jurassic-Tertiary volcanics, the Etendeka volcanics, and the north-western Mesozoic magmatic complexes.

A number of CVS members attended the Etendeka four-wheel-drive, camp-out-in-the-desert extravaganza. They were treated to: impressive exposures showing the interaction of eruptives with dune sand, spectacular landscapes featuring excavated flat-topped and stepped mountains, discussion on the correlation of these eruptives with the equivalent succession in Brazil, and a heated debate on whether the Etendeka quartz latites were fluidal lava flows or pyroclastic flows.

A few others attended the tour of the north-western Namibia Mesozoic alkaline igneous complexes and

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were treated to spectacular spires rising from the desert floor (e.g. Spitzkoppe), some surrounded by ring-dikes and cone sheets (e.g. Messum, Okenyenya), many bearing bizarre minerals in equally unusual mineral associations. We saw a lifetime quota of quartz and nepheline syenite; visited Brandberg, the highest mountain in Namibia; saw fossilized trees that had apparently washed in from Angola; sampled fluorite from the

Review of Capetown IVC on Magmatic Diversity

By Alexandrina Fülop

I had a great opportunity to attend the Cape Town IAVCEI Meeting. Many thanks to the Organizing Committee (especially to Chris Harris and Karen Diedricks, very much involved in planning our stay there.)

I found most of the lectures and posters very interesting but I felt most

largest fluorite resource in the world at Okorusu; and enjoyed camping, great food cooked on the Brai (bar-be-qued over the fire), spectacular sunsets, and amazing wildlife. Reports on the other field trips were as favorable as these.

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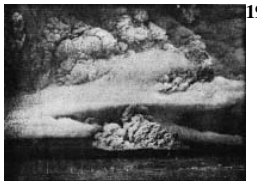
Komagatake 1929



interested in Symposia 9 and 10 on peperites and maars, respectively. I am happy that this meeting devoted a great deal of space to discussing how volcanism interacts with sedimentation. Working in ancient volcanic sequences, I have many questions related to such a topic.

In particular, papers like those presented by McPhie and Hunns, Busby, Vasquez and Riggs, Gifkins, and Allen and Cas pointed out certain textures used to interpret different types of fragments with direct implications for vent processes and magma evolution. I found interesting examples of extrusions and intrusions, as well as lavas and ignimbrites interacting explosively and passively with water-saturated sediments. I saw pumiceous hyaloclastites and pumice clasts related to quench fragmentation.

In the peperite symposium, Allen and Cas presented interesting mixing features of ignimbrite with unconsolidated mud, explained by liquefaction processes of wet mud and/or fluidization processes from steam generated from heated water or simply formed as a result of post depositional loading into the unconsolidated mud.

Busby gave two examples of how fissure-fed magmas intrude a stratigraphic section resulting in magma sediment mixtures: intrusion of hydroclastically fragmented magma or intrusions of fluid magma together with slumping and resedimentation of the sediment mass while the magma was still hot. She pointed out preferred interpretations leading to reconstructions of magma evolution.

Gifkins, Allen and McPhie offered a new approach to pumice clast genesis. Pumice clasts are seen as a result of non-explosive quench fragmentation of highly vesicular magma during extrusion or intrusion. They recognized pumiceous hyaloclastites and peperites in two deposits: the Miocene Green Tuff Belt from Japan and the Cambrian Mount Read volcanic rocks, Western Tasmania, Australia. They are both examples related to highly vesicular rhyolitic magma intruded into

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wet volcaniclastic sediments.

A very nice description on peperites was given by McPhie and Hunns in the

ferent volcanic centers in that area. An early idea about its relation with tectonics is not sustained by any systematic studies.

Ort and Vasquez compared Ukinrek

Early Permian Berserker beds at Mt. Chalmers, intruded by rhyolitic pumiceous sills. Pumiceous peperites appear with vesicular sediment domains containing tube pumice shards and feldspar crystals infilled with sediment containing rinds of tube pumice. They assume a submarine shelf environment suppressed an explosive eruption but allowed vesiculation.

Another author, Moore, showed an interesting interaction between magma and water-saturated sediments beneath lava flows and at the margins of intrusions. Her example belongs to the basaltic-andesite subaqueous succession from Kabuto, southwest Hokkaido, Japan. Transitions appear from peperites to hyaloclastites through quench-fragmented glass shard sand and disconnected lobes, proving the dominance of quench fragmentation over the explosive process.

Vazquez and Riggs presented two types of lava sediment interactions: an explosive one, generating peperites and a non-explosive one, generating autobreccia/sediment mixtures. Similar processes are suggested in the vent, when magma interacts with water saturated sediments.

Waters and Cas identified two types of peperitic breccias with different textures reflecting different origins, but both are formed by quench fragmentation of the margins of the basaltic magma during their shallow intrusion into the unconsolidated fine grained sediments.

Cas and Scutter used textures and facies associations of hyaloclastites and peperites to indicate the emplacement of basalt and rhyolite intrusions from the late Devonian Bunga Beds, southeastern Australia, into a water-saturated sediment pile. They described interesting quench fragmented and mixing textures and three general types of peperites, associated with 1) margins of intrusions and lavas, 2) water-settled fallout and sediment mixing and 3) peperites associated with syn-volcanic resedimentation.

In the kimberlite/maar/diatreme symposium, Nemeth and Martin approached the phreatomagmatic volcanism in the Balaton Highland volcanic field, Pannonian Basin, Hungary. The authors suggest that the distribution of unconsolidated wet Pannonian sediments and the subsurface concentration of magmatic CO_2 is a possible control on the distribution of the dif

maars deposits from Alaska with Hopi Buttes maars deposits from Arizona, using facies analysis. They showed similar deposits but different scales, with transitions from the disorganized maar rim facies through sand-wave structures to planar distal facies. Differences arose from the presence of a low-density convecting column at Ukinrek maars and denser collapsing columns at Hopi Buttes.

Vasquez and Ort based their considerations on the maar-forming eruptions from Hopi Buttes on maar rim sequences. They described pyroclastic rocks and peperites related to magma-wet sediment interaction in the shallow-diatreme facies. Maar-forming eruptions are thought to result from fuel-coolant interaction between magma and wet sediment and not from violent exsolution of juvenile volatiles, as previously proposed for the Hopi Buttes, which would create an opposite stratigraphy.

In the Erupted/Non-erupted Granites symposium, De Silva gave a talk on large silicic volcanic fields with caldera complexes and ignimbrites, with eruptions triggered by the magmatic overpressure or by the mechanical failure of the weakened crustal lid. He analyzed calderas both as purely volcanic phenomena or tectonomagmatic phenomena, marking a new step in the evolution of caldera models.

I really enjoyed Self's lecture on ignimbrites, based on the recently erupted Mount Pinatubo, compared to Bishop Tuff. The internal stratigraphy of ignimbrites evidences progressive aggradation but also variations in mass flux of the material transported by flow. Ignimbrites, secondary pyroclastic flows and fall deposits are synchronously deposited suggesting the necessity of reexamination of the ignimbrites emplacement.

Marti, Soriano and Dingwell focused on tube pumice clasts as magmatic "strain markers" of stress events developed before or during fragmentation processes. Vesicle tubes, zones of localized shear deformation and preferred orientations of the fragmentation surfaces are inferred to record stress events of highly foamed magma, a rigid behavior and brittle fragmentation of its bulk.

The "Open" Symposium 11 also had interesting papers related to volcanism, explosive or quench fragmentation processes.

(Fülop continued on page 11)

Scutter and Cas presented pumiceous hyaloclastites from the Island of Ponza, Italy, that resulted from the quench fragmentation of the outer margins of domes and lava flows. A subaqueous mid-bathyal rhyolitic volcanism is responsible for the hyaloclastites and the identified perpendicular quench fractures allowed sea water to penetrate to greater depths in the brecciating lava.

Szakacs and Ort lecture represents an example of concept evolution. They noticed that some depressions are improperly called craters or calderas despite their different morphological features and different genesis, proposing new names in accordance with their specific features.

Stillman emphasized the pre-Miocene seamount stage and the early Miocene mass-wasting leading to the presently exposed facies on Fuerte Ventura Island, Canary Islands, unusual among the Atlantic volcanic islands. The landslides and resulted debris flows uncovered the seamount stage up to Late Cretaceous pillow lavas and breccias, hyaloclastites and intercalated calcareous and siliceous sediments.

Gertisser and Keller presented a detailed stratigraphy of the tephra fall deposits from Merapi volcano, Central Java, which records the Late Holocene explosive eruptions and allows correlations and dating of the associated deposits over large areas.

Mastrolorenzo, Palladino and Tadeucci gave a good talk evaluating the risk in the area of Vesuvius. They presented specific depositional domains and their deposits evidencing an early hydromagmatic activity in the eruption strongly amplified by the disruption of the drainage system.

Another paper related to Symposium 7a, Granites and Mineralization, collaterally related to fragmentation processes. Paulick and McPhie took an example from Talanga massive sulfide deposit in Queensland, Australia, proving how the original textures in glassy volcanic rocks may be modified due to diagenetic and hydrothermal alteration and how an erroneous interpretation may be avoided. In that case, the homogeneous distribution of unaffected quartz phenocrysts in pseudoclastic rhyolites and by contrast, the systematic textural differences between clasts and matrix in volcaniclastic rocks, are keys for a correct interpretation.

The closing session impressed me, In particluar, I noted that both great new achievements and new limits appear when using mathematics, computer modeling,and geochemistry in volcanology. This emphasizes the complexity of volcanic processes.

I had a good stay in Capetown. I felt the pulse of a very well organized meeting. I saw new steps in concepts evolution. I saw a little bit of geology of the Cape Peninsula. All that I want now is to keep the rhythm of this volcanological beat.

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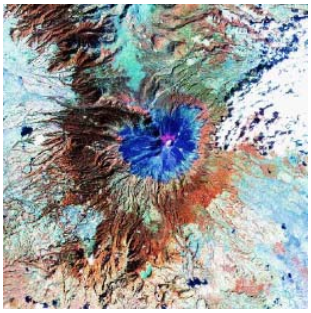


Popocatepetl

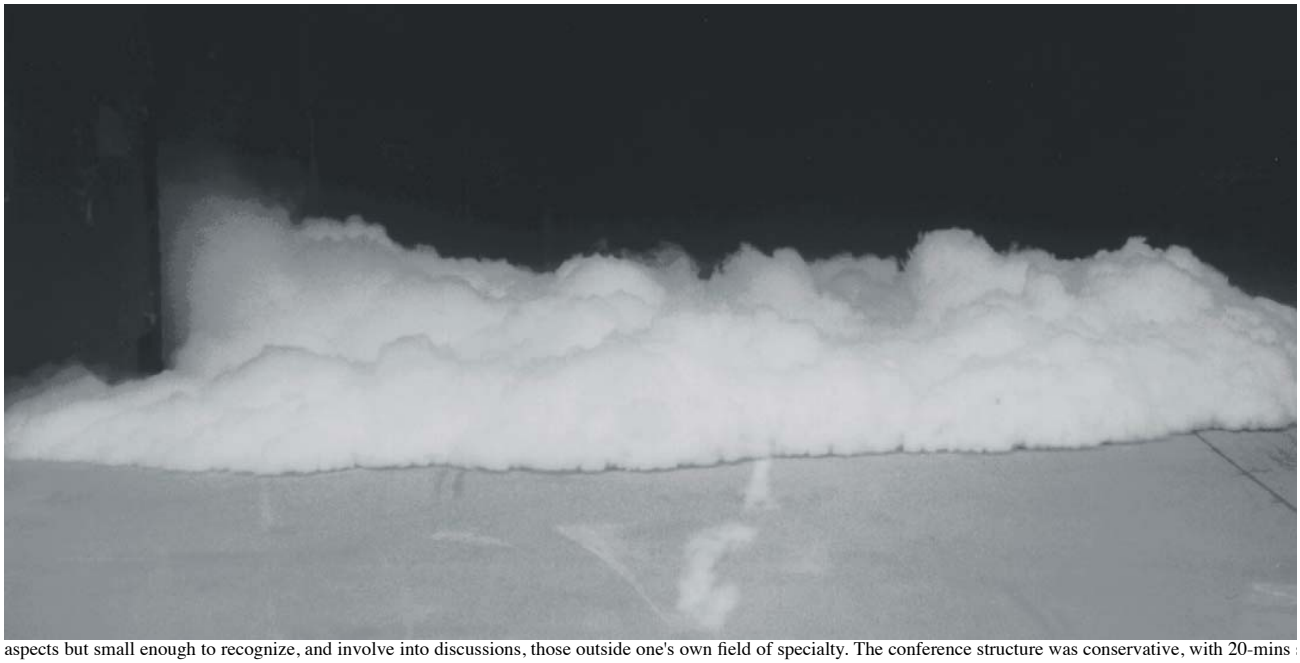
with the two plenary lectures given by
Macedonio and Davidson.

Report on the **Particulate Gravity Currents Conference** *Leeds, Sept. 7-9, 1998,*

by Armin Freundt

This conference at the University of Leeds was well organized by Ben Kneller, Bill McCaffrey, Jeff Peakall, Tim Druitt, and their coworkers, who managed to bring toge renowned specialists through students from the fields of sedimentology, fluid mechanics, petroleum geology, civil and hydraulic engineering, and, of course, volcanol These produced a wide range of approaches to *Sediment Transport and Deposition by Particulate Gravity Currents*, the full title of the conference.

With some 40 talks, 30 posters, 110 participants, and, with one exception, without parallel sessions the conference was big enough to cover the different thematic



aspects but small enough to recognize, and involve into discussions, those outside one's own field of specialty. The conference structure was conservative, with 20-mins for oral presentations (50 min keynotes) and poster sessions during coffee and lunch breaks. Tuesday afternoon, however, was dedicated to open discussion sessions on selected topics, two of which are summarized below, because they were CEV related.

Monday morning's session was introduced by a key

note by Tamotsu Takahashi, who reviewed similarities

(Freundt continued from page 12)

servational and other evidence shows that these "surge-derived pyroclastic flows" were formed by suspension sedimentation out of a surge, and moved down valleys at moderate speeds of <10 m/s.

The session on granular flows on Tuesday morning was opened by Charles Campbell's keynote, introducing physical concepts of granular flow simulation models; definition and explanation of the "granular temperature"; and elucidation of energy flow from driving pressure through kinetic particle motion, shear work, granular temperature, and dissipative collisions to heat production. The transition from fluid to solid behavior with decreasing granular temperature and increasing particle concentration was found to always occur near a critical shear-to-pressure stress ratio, and the stress ratio of a flow was found be dependent on particle number, shear rate, and particle stiffness. Stephen Straub's rapid granular flow simulations using particle combos of different size and density showed that during transport large particles ascend through the fines, and light and heavy particles segregate to form reverse and normal grading, respectively. Having learned before that grading can be produced by macroviscous granular flow, as well as by fluidization and hindered settling, grading lost much value for information about the transporting flow. The Simoni, et al. presentation showed how greatly debris flow mobility is enhanced by the presence of mud even at low water contents of a few percent. Ongoing later comments attested to the great impressions (of various kinds) the granular flow experiments by McElwaine, et al. made on everyone, since they used up to 350.000 ping-pong balls to create an avalanche down a ski jump.

The first open discussion round, focussed on linking process models and sedimentary deposits, was introduced by Ben Kneller. He summarized aspects of suspension fallout and flow stratification and emphasized that suspension fallout evolves in response to both concentration and velocity changes downstream. Even if a deposit can be assigned to, for example, a high sedimentation rate, this does not provide unambiguous evidence on the flow character since this can be attributed to either high concentration or large deceleration. The following discussion, stirred up by Peter Kokelaar's short talk on "why deposit is not flow", centered on how far deposits reflect characteristics of the lower current boundary layer, which is in turn controlled by the current's behavior. If a higher concentration underflow evolves, will that be separated from its parental current by a relatively sharp boundary or will there be a smooth gradient in properties? How will such a system interact with topography?

The afternoon's open discussion session on "Dynamics of Large Pyroclastic Flows - are we nearing a consensus?" was introduced by Tim Druitt's review of the evidence in favor of either high- or low-concentration transport. The discussion then was a continuation of the morning's. A matter of some debate was the question of what can make high-concentration flows (especially pyroclastic ones) so highly mobile. Arguments in favor of pure grain flow processes were balanced against arguments in favor of transient pore pressure effects, and as with the previous problem (and as expected) no general agreement was reached. The general idea, however, that many ignimbrites may form by pyroclastic suspension currents found wide acceptance by the audience, and the discussion of possible criteria to verify this model focussed on lateral grain size variations and particle hydraulic equilibrium.

Extended lunch break this day was partly filled with visits to the Leeds fluid dynamics laboratory, where we saw the demonstrations of different density-current experiments and Henry Pantin showed his autosuspension experiment.

Peter Baines' Wednesday morning keynote on downslope flows into stratified environments focused on turbidity currents moving down continental slopes while interacting with ocean currents and stratification and Earth's rotation. The following presentations of various numerical models for turbidity currents demonstrated how rising and waning discharge produce reversely and normally graded deposits, respectively, how turbidity currents can draw substantial amounts of shelf water with clastic material into the deep ocean, and how flow stratification evolves with distance in response to initial high basal concentrations in initially more concentrated currents, but only evolves distally in initially low-concentration currents. Numerical modelling also defines regions in velocity-concentration space where turbidity currents ignite, extinct, or de

(Freundt continued on page 14)

(Freundt continued from page 13)

posit immediately as turbulence dies. Experimental simulations were used to quantify how far particulate gravity currents plunged into a flowing medium can spread upstream against ambient flow, and how sedimentation rate is controlled by channel restriction, widening, or flow over obstacles and steps. Andy Woods demonstrated that while there are significant changes in sediment loss from the current (expressed as mass per length), these do not necessarily reflect in sediment thickness (controlled by mass per area). Another experimental study investigated the downstream velocity evolution of suspension currents of different proportions of fine (clay) and coarse (sand) load, where clay remains suspended and contributes to current dynamics while sand sedimentation is delayed by higher clay contents causing greater velocity.

Gary Parker, in his afternoon keynote on submarine debris flows and turbidity currents, took us on a fast ride through experimental and theoretical approaches addressing the difference between submarine debris flows (which can hydroplane) and subaerial ones that can not, and the difference between rivers that approach equilibrium in velocity-concentration space and turbidity currents that divert from it by either subsiding or igniting. He also addressed the processes and importance of turbidity current channeling, and explained cross-channel thickness variations by crosscurrent variations in sedimentation and erosion rates. Widespread gravel beds extending well beyond the clast transport range in suspension currents he explained by piecewise traction of the clasts by numerous successive currents. Other contributions that afternoon showed examples of turbidite facies variations, and physically investigated the conditions of antidune migration, liquefaction of subaerial volcaniclastic flows, or plunge pool formation at bottom of continental slopes by hydraulic jumps. Ray Cas used experiments on density currents intruding into a two-layer medium to discuss the entry of pyroclastic flows into the sea, emphasizing the importance of the entry angle. Experimental studies on the turbulence structure of particle-laden density currents performed in Leeds, using high-resolution laser or ultrasonic Doppler velocimetry, are very interesting in that they reveal how density and velocity profiles of such

Posters more closely related to CEV topics included that of Choux et al. on experimental suspension currents loaded with particles of high and low density and log-normal size distributions. Low-concentration currents (1% vol.) produce deposits in hydraulic equilibrium, but with increasing concentration (30% vol.), light particles were displaced downstream and bipartite layering formed. Cole et al. investigated the formation of fines-depleted basal layers of deposits from ash-cloud-surges at Montserrat, and Kelfoun et al. complemented J.-L. Bourdier's talk on the decoupling of ash-cloud-surges from block-and-ash flows at Merapi by investigating tree damage along the 1994 flow that reveals a strong topographic control on decoupling. Experiments by de Rooij et al. complement those presented by Ray Cas in that they let particle-laden density currents intrude into a two-layer medium. These initially behave like equivalent saline currents but then decelerate as sedimentation proceeds. Sediment distribution is quite similar to that from equivalent currents moving along the tank floor.

In summary, to me this conference was a very valuable experience for several reasons. First, this event had a close to optimum size. The number of people and opinions from the different research fields was sufficient to stimulate both within and across field discussions. Though the conference was clearly focused on the physical processes, many contributions on real deposits made sure modelling didn't become superbuoyant. The ability to directly compare the physical approaches taken in the different fields allowed recognition of similarities and the differences and specific problems of each. I especially liked the planning for open discussion sessions, which could have been carried on much longer than their allotted time period. My suggestion is to try out such a small thematically constrained conference as a complement to our usual CEV field workshops. We might then want to allot even longer time windows to open discussions. Another option would be to invite specialists from other disciplines to participate in a field workshop where this is thematically suitable.

For those interested, a volume will be produced from this conference as a Special Publication of the International

currents are affected by changes in ground morphology, slope and roughness.

Association of Sedimentologists (IAS).

Moore continued from page 8

I SYMPOSIUM ON

VOLCANISM &

RELATED

ENVIRONMENTS

Gramado,

State of Rio Grande do Sul,

Brazil,

in June 13th to 18th, 1999.

The Symposium has the objective of bringing together professional and scientists in the Earth Sciences who are interested in this theme in order to discuss volcanism with petrologists, geochemists, stratigraphers, structuralists,

FROM MAGMA TO TEPHRA: Modelling Physical Processes of Explosive Volcanic Eruptions

Edited by Armin Freundt, GEOMAR, Kiel, Germany and Mauro Rosi, Università di Pisa, Pisa, Italy.

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The combination of processes that operate from the degassing of magma to the emplacement of tephra makes an explosive volcanic eruption, and the physical characterization of these processes is the scope of this book. It summarizes the insights into key aspects of explosive volcanic eruptions gained from physical modelling to date.

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Excellent reading for research volcanologists, private scientists, professionals, university libraries, government research institutes, graduate students and researchers.

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sedimentologists, among others. This is the first meeting on volcanology in Brazil, and will open the opportunity for evaluation of new results and consolidated knowledge. The Symposium will have technical and poster sessions, in addition to exchange of views among scientists.

Lectures

Prof. David I. Groves from the University of Western Australia Gold mineralizations in volcanic terrains

Prof. Raymond Cas from Monash University

Prof. Gary Lowell from USA Eruptive Style of Mesoproterozoic A-Type Calderas in Southeastern Missouri, USA

Organizing Committee:

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Adriane Machado, Secretary (UFRGS)

Wilson Wildner (CPRM)

Ricardo da Cunha Lopes (CPRM)

The Organizing Committee has selected some themes related to the broad area of "Volcanism and Related Environments", and these will be organized in technical and poster sessions. A few scientists have been invited to act as regional organizers in Brazil and also as reviewers of the submitted abstracts. This marks the national character of the event.

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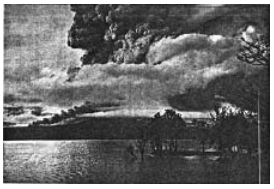

Komagatake, 1929

Research in Physical Volcanism within the School of Ocean and Earth Science and Technology (SOEST), University of Hawaii at Manoa,

By Stephen Self

Introduction

The University of Hawaii's main campus at Manoa, a suburb of Honolulu on the island of O'ahu houses the multidisciplinary School of Ocean and Earth Science and Technology (SOEST), which consists of five departments and several institutes. Faculty in the Geology and Geophysics and Oceanography Departments and in the Hawaii Institute for Geophysics and Planetology (HIGP) conduct volcanological research. The work spans submarine volcanism, subaerial volcanism, and remote sensing of volcanic activity and volcanoes. SOEST's volcanology program can truly claim that it embraces studies of the Earth's volcanoes in all environments and with methods ranging from deep-sea submersibles to all land-based techniques to satellite-borne sensors from space. HIGP scientists also study effusive and explosive volcanism on other planets and asteroids.

In 1991, volcanologists here set up an informal Hawaii Center for Volcanology (HCV) to provide a link between state-wide volcanological activities at the two university campus groups, SOEST and at the Center for the Study of Active Volcanoes (CSAV) at University of Hawaii at Hilo, and the USGS Hawaii Volcano Observatory (HVO) at Hawaii National Park (Kilauea volcano). Hilo and HVO are both on the Island of Hawaii (nicknamed the Big Island), 350 km from Honolulu. HCV mainly serves to facilitate research and education activities and does not have a separate staff from the academic and government scientists at UH and USGS. There are about 40 scientists affiliated with HCV.

To describe all the volcanological research undertaken at SOEST is beyond the scope of this short article but interested readers can check out the range of activities and individuals involved by going to the web sites given below, and following leads from these addresses:

For the remainder of this account we concentrate on studies of physical volcanism and on active volcanoes that are being presently undertaken or were completed

http://www.soest.hawaii.edu/GG/hcv.html

HIGP: *http://www.pgd.hawaii.edu/*; including continuously updated GOES satellite images of the current lava flow field at Kilauea volcano on the Big Island (*http://virtual1.pgd.hawaii.edu/goes/*)

The volcanology-geochemistry-petrology (VGP) group within the Dept. of Geology and Geophysics: *http://www.soest.hawaii.edu/GG/vgp.html*

SOEST's general home page: *http://www.soest.hawaii.edu/*

CSAV: *www.uhh.hawaii.edu/~CSAV*

in the recent past by SOEST faculty and researchers. Selected references of published papers relating to these topics are given at the end.

Terrestrial Studies

In the past few years, studies have been made of both basaltic and silicic volcanism, with the aim of a better understanding of eruption mechanisms, emplacement mechanisms of eruptive units, and atmospheric degassing .

Subaerial Basaltic Volcanism

Much of the work on basaltic systems has been on lava

(Self continued on page 17)

(Self continued from page 16)

flow-forming activity but some concerns the release of ash and gas

Aaron Pietruszka (PhD). This shows that Kilauea's magma fundamentally changed comp after these explosive events. A

clouds which have had dramatic effects on the environment (e.g., Laki, 1783, Iceland). The process of lava-rise or inflation and the emplacement of the active pahoehoe flow field at Kilauea are important in shedding light on the controls on growth and evolution of lava flow fields. Studies have shown the same processes to work at several scales, from Hawaiian lavas emplaced at rates on the order of 1 cubic km of magma per decade, to flood basalts emplaced at much higher rates (1000's of cubic km in 10's of years, perhaps). A study was also made of explosive littoral cone activity at the seaward edge of prehistoric Mauna Loa lava flows. Faculty involved in this work have been George Walker (who retired in mid-1996), Emilio Herrera-Bevera, Jeff Taylor, and Steve Self, with research associates Scott Rowland and Laszlo Keszthelyi, and graduate students Zinzuni Jurado-Chichay (MS 1994), Edgardo Canon-Tapia (MS 1993, PhD, 1997), Thorvaldur Thordarson (PhD 1996), and Rachel Friedman (PhD 1998).

The magmas involved in the 1924 and 1790 explosive eruptions of the usually placid Kilauea volcano are being studied by Mike Garcia and graduate student

View of Diamond Head tuff ring with part of University of Hawaii at Manoa campus in foreground.

(Self continued on page 18)

new study by undergraduate Okubo and Steve Martel has prop revised mechanism for pit formation on Kilauea.

Recently a study has begun on th Koko Fissure (or rift) volcan Oahu, which are thought to be 30,000 years old and range phreatomagmatic tuff rings to cones and lava flows. Mike Garci Rubin, and student Kierstin Sv (MS) will address the questions c volcanic hazards were associate this rift, what potential risks are to residents of Honolulu by future eruptions, and how the than 13 vents along the rift are by comparing the products fro various vents. This work will als fundamental implications for for the cause of the relatively post-erosional, highly alkalic Ho volcanism, the origin of which r a mystery.

The eruptive and collapse history Waianae volcano on Oahu and fissure volcanism on Maui's SV zone have been studied by John S Todd Presley (MS 1996), and gr student Eric Bergmanis (MS, 199

Submarine Volcanism

The underwater shield volcano off Hawaii, had its first docu eruption in 1996 and several stud

(Self continued from page 17)

ies have been undertaken, one to look at the magma produced in the underwater explosive eruption at 1050 m depth. Recent dives on Loihi in submersibles have shown that the vent may have been covered by subsequent summit collapse, and have revealed the nature of the explosive ejecta. These are the topics of on-going work by Rodey Batiza, Mike Garcia, Ken Rubin, and others. The seismic record of the eruption, which produced the largest earthquake swarm ever recorded on a Hawaiian volcano, is being analyzed by Fred Duennebier and PhD student Jackie Caplan-Auerbach. Ken Rubin has dated the lavas of every known, sampled submarine eruption that has occurred in the past few years by the ^{210}Po method, and is working on a new technique for dating lavas between 10 and 100 years old.

group graduate students. The geology of Taal caldera and the volcanology of a large, possibly caldera-forming, phreatomagmatic eruption that generated widespread pyroclastic flow and surge deposits at about 5,600 ^{14}C years ago are also being worked on by Torres and Self. Pyroclastic flow mechanisms in general were also studied by Joan Hayashi (PhD 1994).

Studies of the Andean silicic lava flows, calderas and debris avalanche deposits are being conducted by Steve Self in collaboration with Shan de Silva (Indiana State University) and Peter Francis (Open University, UK and visiting scientist at HIGP).

New Zealand rhyolitic explosive eruptions from Okataina caldera are being revisited in a new study by George Walker and Zinzuni Jurado-Chichay (PhD student) of the eruptive history and eruption dynamics of the 30-40,00-year-old group of pyroclastic deposits. A new study beginning in

Hawaiian shield volcanoes have a history of edifice collapse, forming huge submarine debris avalanche and landslide deposits. New seismic studies of those around Hawaii and Oahu are being made by Greg Moore, SOEST Young Investigator Juli Morgan, and graduate student Stephen Leslie (MS). Other deep sea work by Jill Karsten and ex-graduate student Sarah Sherman (PhD 1998) is uncovering the segmented nature of the Chile Ridge in the SE Pacific. whereas another on-going project involving submersibles and deep-tow sonar by John Sinton Rodey Batiza, and Ken Rubin concerns the volcanologic and petrologic processes on the super-fast spreading East Pacific Rise at 17-18^{o} S. Karsten and graduate student Nathan Becker has also investigated recently erupted lavas on the Juan de Fuca rift.

Subaerial evolved composition volcanism

An assessment of the depositional mechanisms of the Pinatubo ignimbrite by pyroclastic flows on June 15 1991 is being conducted by Ronnie Torres (PhD student) and Steve Self. Earlier they made a study of the secondary (deposit-derived) pyroclastic flows that were first documented at Pinatubo in 1991-1993. Continued formation of secondary pyroclastic flows at Pinatubo are the topic of further research on the initial conditions and triggering mechanism. The atmospheric impact of the Pinatubo eruption was also described by Steve Self, post-doctoral fellow Jing-xia Zhao. and a 1999 will also examine the latest rhyolitic eruption from the Tarawera center in Okataina, which is now realized to be only 600 years old. This will be a collaborative effort between Ian Nairn (New Zealand), other NZ researchers, and Steve Self, with post-doctoral fellow Ceinwen Scutter and a graduate student.

Remote Sensing Studies

Research Associates Luke Flynn and Andy Harris, and several others at the HIGP Planetary Geosciences Division (PGD) have now implemented real-time satellite observations of several volcanoes in Hawaii, Central, and South America. They use the GOES-8 and GOES-10 spacecraft to monitor for thermal anomalies associated with eruptions. The most notable recent success has been the monitoring of the September-October 1998 eruption of Cerro Azul, Galapagos Islands. Other volcanoes studied include Kilauea, Colima, Montserrat, Lascar, Popocatepetl and Santa Maria. These data are made available every 30 minutes (within 15 minutes of data acquisition) at the following web site: http://volcano1.pgd.hawaii.edu/

Considerable attention in the group led by Peter Mouginis-Mark is being focused on the uses of airborne and satellite radar data sets to study volcanoes.

(Self continued on page 19)

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An example is the estimate of lava production rates by thermal imaging of the active flows at Kilauea by Andy Harris, Scott Rowland, and others. Particular emphasis is being laid on data that is collected with the Hawaii ground station, which provides unique access to the JERS-1 and ERS-2 radar data these data are being used to study surface change and deformation on Kilauea and Mauna Loa.

The PGD group have also collected a large amount of radar data for volcanoes in the Philippines, the Galapagos Islands, Central Africa, and NE Chile. Recent results have included the detection of the magma body that produced the January 1995 eruption of Fernandina (Galapagos), the production of digital elevation models for position and after a delay in beginning the search for a replacement, SOEST began the task in August 1997. We are pleased to announce that the new Macdonald Professor will be Bruce Houghton (IGNS - New Zealand), who will join SOEST in Spring 1999. George Walker is active as an emeritus professor of UH.

Courses, degree programs, and analytical facilities at University of Hawaii

UH-Manoa offers MS and PhD programs in volcanology, petrology, geochemistry, and seismology. UH-Hilo is initiating an undergraduate degree in volcano monitoring. Both campuses offer BS degrees in Geology and Geophysics with tracks enabling an emphasis on volcanology. The Center for Study of Active Volcanoes , led by Don Thomas with Steve Self and

Socompa (Chile) and Karisimbi (Rwanda), and the monitoring of lahar production on Mt. Pinatubo. In collaboration with the Jet Propulsion Laboratory, California, new 10-m resolution topographic data have also been collected for Mauna Loa (Hawaii), and Mt. Pinatubo, Taal, and Canlaon (Philippines); a new structural and geomorphic study of Taal has been completed by Selima Siddiqui (MS 1998). Dynamical analysis of the 1991 Mount Pinatubo eruption clouds using weather satellite data was completed by Rick Holasek (PhD 1996) with Steve Self and collaborator Andrew Woods (Bristol University, UK).

Shiv Sharma and his group at HIGP are developing a LIDAR system capable of analysis of volcanic gases and aerosols.

Extra-terrestrial volcanism

A group at HIGP involving Klaus Keil, Jeff Taylor, visiting professor Lionel Wilson (Lancaster University, UK), and several post-doctoral fellows and graduate students are modeling explosive volcanism on asteroids which have provided the source for meteorites that they have been studying petrologically. Also, the eruptive conditions of extensive lava flows on Mars have been investigated by Peter Mouginis-Mark and graduate students.

The Macdonald Professorship

In 1996, Professor George PL Walker retired from this others, also offers two courses per year in monitoring active volcanoes: an advanced international course intended for persons who are actively engaged in monitoring, such as observatory staff, and a domestic course intended for undergraduate level students. The former is 6 weeks long and runs in May-June and the latter is 3 weeks long and runs in late July-August.

Laboratories for the following volcanological and geochemical work are available in the VGP group at UH Manoa: full lab for physical volcanology including fine grain size analysis and image analysis; radiogenic isotope facility (Nd, Sr, Pb, Po, and U-series); electron microprobe and x-ray fluorescence facilities; instruments for measuring physical properties of rocks (e.g., electrical conductivity, thermal conductivity, porosity and gas permeability); 1 atm gas-mixing furnace and hydrothermal pressure vessels; full sample preparation labs. This list is, of course, exclusive of the research vessel, submersible, and underwater imaging systems runs by SOEST, and of the image processing systems run by HIGP/PGD.

Support for the work described above has mainly come from the US National Science Foundation and NASA.

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Diamond Head

Credit Peter Mouginis-Mark

Volcanology Research at Bristol University

by Stephen Sparks

Volcanological research at Bristol includes scientists in both the Earth Science and Mathematics Departments united by a new University Research Centre for Environmental and Geophysical Flows. There are 14 members of academic staff, over 20 postdoctoral scientists, research assistants and research students in the Research Centre. I am currently the Director of the Centre and Andy Woods is Deputy Director. Research efforts of the Centre are broad, concerned not only with geological processes such as to describe the eruption in any detail but readers are referred to the recent special issues of Geophysical Research Letters which contain some of the early research results from Montserrat.

From the perspective of explosive volcanism, the highlights are the unprecedented detail in which the vulcanian and subplinian eruptions have been documented and the dramatic volcanic blast of 26th December 1997. As might be expected, several Bristol Ph.D. projects are devoted to Montserrat with Eliza Calder studying the dynamics of the pyroclastic flows; Costanza Bonadonna, the tephra fall; Rob Watts',

volcanism, sediment transport, glaciology and geothermal systems, but also with applications of fluid mechanics, including oceanography; meteorology; and industrial topics such as ventilation, flow in aquifers, and traffic flow. This diversity of interests within the new Research Centre emphasizes the diversity of applications of fundamentals of fluid flow. For example, the flow laws that govern traffic flow on highways are similar to those that control explosive volcanic flows. Research is pursued in the field by analogue experiments and by theoretical modelling

Explosive volcanism is a major interest of research at Bristol. Members of staff include individuals who may already be familiar to CEV members, such as Andy Woods, Heidy Mader, Gerald Ernst, Jeremy Phillips and Colum Caulfield, who have all published on aspects of explosive volcanism. Recently, we have also been fortunate to have George Walker join us. George has retired from Hawaii and now lives in Gloucester, 30 miles north of Bristol, so is a frequent visitor. The volcanologists enjoy close collaboration with the experimental petrologists at Bristol, in particular Mike Carroll's group, who have developed strong interests in volcanic volatiles and in applying experimental petrology to investigate volcanological problems. The major preoccupation of field studies over the last three years has been the eruption of the Soufrierre Hills Volcano, Montserrat. I have been one of the Chief Scientists of the Montserrat Volcano Observatory (MVO) and Bristol people have been prominent on the MVO staff. This eruption has been an outstanding opportunity to document in detail a major andesite eruption. There have been over 80 explosive eruptions and many pyroclastic flows generated by collapse of the growing lava dome. This is not the place

dome growth; and Chloe Harford, the geochronology of Montserrat and stable isotopic compositions of the new ejecta. Anne-Marie Lejeune (EC Postdoc) has carried out experiments on the rheology of the lava. In the experimental petrology group, Jenni Barclay (now at Berkeley) documented the phase equilibria of the andesite and Susan Couch just started a Ph.D. to study the kinetics of microlite growth in the Montserrat magma.

One personal project on Montserrat will be of interest to CEV members. I am working with a local filmmaker on Montserrat, David Lea, to produce an educational video on the eruption for University students. David and the MVO have arguably some of the most spectacular footage ever taken of explosive activity and pyroclastic flows. We have filmed all the deposits and effects of various phenomena, including pyroclastic flows, dome growth, volcanic blasts, lavas and vulcanian explosions so that the viewer will see the process, effects and deposits in sequence. The project is well underway, and we hope that the video will be available for distribution by the Geological Society of London in the first half of 1999. The Andes has been another major interest of Bristol. We enjoy excellent collaboration with the Chilean Survey (Sernageomin), in particular with Jose Naranjo, Hugo Moreno and Moyra Gardeweg. Projects on Lascar and Nevados de Chillan are now more or less complete. Montserrat has diverted us away from Chile, but a new research student, Jorge Clavero, sponsored by Sernageomin, starts at Bristol in the New Year. Experimental fluid mechanics is a major specialty at Bristol. We have been fortunate to have a large grant from a charitable foundation to refurbish and expand our laboratory facilities. This work has been underway over the summer. We have all the facilities for

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experimental studies with a rheological lab for characterising experimental fluids, a large flume, rotating table, a cold room for carrying out experiments at controlled temperatures down to 30°C, shock tube apparatus and an assortment of tanks, coolers and recording equipment.

Over the last few years we have built up expertise in analogue experimentation to investigate explosive volcanic flows in shock

year and will spend all of 1999 at Bristol. Russian modelling work on explosive volcanism is highly accomplished and has been neglected by modelling groups in North America and Europe. The work of Yuri Slezin, Mikhail Adilbirov and more recently Melnik and Barmin in particular has produced novel and important models which are rarely if ever cited. For example, Slezin recognised in 1982 that there were multiple solutions to the equations describing explosive flows so that eruptions could suddenly switch slates. Adilbirov in 1992 showed that

tubes, notably in collaboration with Brad Sturtevant at CalTech and through the efforts of Heidy Mader, Jeremy Phillips and Steve Lane. The work has been through a bit of a hiatus due to both a gap in funding and the lab refurbishment. However, this research is about to get going again with European Union funding supporting Catherine Mourtada-Bonnefoi as a postdoc and the project of Ph.D. student Jon Blower. Motivated by the problem of high speed bubbly flows, Heidy Mader and student Ed Llewellyn are investigating the rheology of bubbly liquids at high bubble concentrations, the conditions of greatest interest to understanding magma fragmentation. Mention should be made of Gerald Ernst's experiments using a large flume to investigate the inaction of crosscurrents with particle-laden plumes.

On the theoretical side, I doubt if many CEV members can have failed to notice the production of modelling publications of Andy Woods on fundamental fluid dynamics of explosive volcanism. My best efforts and the arrival of new twin sons for Andy have not been successful at checking the flow of models and papers! Andy and I are working together on models of the collapse of overpressured domes to generate volcanic blasts. The motivation is to understand the highly destructive volcanic blast of 26th December 1997 on Montserrat. Our theoretical work has been significantly enhanced by Dr Oleg Melnik of the Institute of Theoretical Mechanics at the University of Moscow. Oleg has been a visitor for 4 months this kinetic diffusion of bubble growth could cause periodic patterns of explosive volcanism. Oleg and I are planning to review the Russian contributions to make them more accessible and to give this work its due recognition. Oleg will be developing numerical models of explosive volcanic flows in collaboration with Andy and I.

We are glad to have recently started an interesting collaboration with the Centre for Nuclear Waste Regulatory Analysis (CNWRA) at San Antonio. The focus of the research is the interaction of a basaltic eruption with the proposed high level nuclear waste repository at Yucca Mountain in Nevada. The project with Chuck Connor and Brit Hill at CNWRA is in its early days but is certain to be interesting and very likely highly controversial, since it is already clear that these interactions are likely to be explosive and disruptive. The Research Centre at Bristol has also had a boost in the building of new rooms for staff and meetings over the summer. We now have excellent new accommodation for visitors and would welcome colleagues for study visits and sabbaticals. For example, Bill Rose will be spending 1999 at the Research Centre. We have weekly seminars in volcanology and fluid mechanics in our "Hot Stuff" series. Bristol is a stimulating place to visit. If any CEV members are interested in spending some time with us please feel free to contact me. Further information can be found at the WEB site: **http://www.cefg.bris.ac.uk/welcome.html** or through **steve.sparks@bris.ac**.

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