

# Commision on Explosive Volcanism Newsletter - April 2003 2004

At last the Newsletter for the Commission on Explosive Volcanism returns! During the last year we have worked mostly on the implementation of the Large Volume Database Project which we use as a major feature of this Newsletter, as this is now ready to receive data. We urge you all to submit data on eruptions to this website. The databases generated will be made public for all to use and query.

Sharon Allen reports of the 1902 eruption at Mt Pelee 100 year anniversary Meeting, that took place in Martinique last May. The meeting was attended by one of us (GG). Supryati Andreastuti's report covers the meeting generally. The Meeting was an excellent occasion for the volcanological community to discuss the issues of dome collapses and related pyroclastic flows, among the most hazardous volcanic phenomena. We would like to thank the Organising Committee of the Meeting for their effort at making a successful conference and field workshops...not to mention the sumptuous french style lunches in the garden...



Mt. Pelee and Saint Pierre today, viewed from the south. Photo-PDC

Graham Leonard reports on the AGU Chapman Conference on 'Volcanism and the Earth's Atmosphere' held in Santorini, Greece in June of last year. Jocelyn McPhie has proposed a short CEV field workshop on Milos, Greece in September. This takes place before the international conference 'The South Aegean Active Volcanic Arc: Present Knowledge and Future Perspectives (SAAVA2003)'. Those interested in participating should contact Jocelyn directly. (see below for details)

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## Large eruption database

As a major initiative of the Commission on Explosive Volcanism, we have been developing a mechanism for the generation of a database on large eruptions. This has inevitably taken a lot longer than we anticipated. However we are now glad to announce that the interface by which people can submit eruption data is now operative.

Data input is through a web page that has been devised by a working group including Ben Mason, David Pyle, Clive Oppenhiemer (at Cambridge), and the two of us. Ben Mason kindly put the web page together. Although we initially were to limit the database to eruptions of VEI 7 or greater, given the large uncertainties on data we decided to include all eruptions greater than 10 km cubed.

Data input is by one of three methods:

1. Deposit,
2. Caldera only (where deposit data is not present), or
3. Core data (for submarine data).

The site can be found <http://www-volcano.geog.cam.ac.uk/database/>

We encourage you to enter data area that you know well. Periodically the database will be reviewed to identify deposits already entered and remove such repetition.

Those of you who will attend to the forthcoming conferences in Nice (EGU, April), Sapporo (IUGG, July) and Hilo (Cities on Volcanoes 3, July) will see a poster on the database. For those who won't be able to attend, there it comes this newsletter. Please [click here](#) to see the poster!

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## Conference reports

### Mount Pelée CEV Workshop

The Explosive Volcanism in Subduction Zones International Congress was held at Martinique to mark the one-hundred-year anniversary of the 1902 eruption of Mount Pelée. The meeting was preceded by a three-day Field workshop on Mount Pelée starting on May 9, just one hundred years and one day after more than 28000 people died at Saint Pierre from the famous May 8 nuée ardente. The workshop was lead by Georges Boudon and Anne Le Friant (both from the Institut de Physique du Globe de Paris) and Jean-Louis Boudier (Universite d'Orleans). There were forty-three participants from several countries including USA, Indonesia, Russia, France, Mexico, Italy, Germany, Canada, New Zealand, Australia and Japan. I was one of several participants that were escaping the grey skies or cold winter days for a pleasant reprieve in the tropical Caribbean. We stayed at the spacious Plantation Leyritz in an old rum distillery amongst banana and pineapple plantations with ample supplies of food and rum. The reptile and animal life kept us amused with their bright colours and daring food pinching routines. The workshop concentrated on the "Stage 3" products of Mount Pelée that were erupted 650 yrs B.P., and in 1902 and 1929.

The first day was spent climbing the 1902 and 1929 lava domes and getting an overview of the main morphological and structural features of the volcano. On an island with 10 m/year rainfall, we were very fortunate to have fine weather and were treated to patches of clear skies that were invariably accompanied by the sound of clicking cameras. There were also several groups of local people climbing Mount Pelée perhaps to pay homage to the volcano lying dormant in their backyards. Anne Le Friant discussed three large-scale flank-collapse events that scar the southern flanks of Mount Pelée and have produced debris avalanche deposits that were discovered by offshore high-resolution bathymetry and geophysical data. The upper part of Mount Pelée includes the pre-1902 Morne Macouba ancestral caldera rim and Etang

Sec crater to the north that protected the northern part of Mount Pelée from main bulk of the devastating 1902 nuées ardentes. From several vantage points during our traverse of Mount Pelée we could see the town of Saint Pierre with traditional sailing boats moored offshore including one that escaped the devastation of May 8. We also drove through Le Morne Rouge a town on the eastern flanks of Mount Pelée that escaped the May 8 devastation, only to be destroyed by a later nuée ardente. The 1902 and 1929 domes enlap and spill-out over the southern upper part of Mount Pelée where they periodically collapsed and produced block and ash flows that were flowed down the Rivière Blanche valley.

The next two days were spent on the business side of the trip, the type peléean nuées ardentes. On the second day we saw three relatively distal sequences of the 1902 nuées ardentes including those thought to be from May 8, May 20, June 6, and August 30. Sequences were often complexed by reworked and eroded horizons attesting to the difficulties of deciphering the stratigraphy of fresh friable deposits in areas of high rainfall. The May 8 deposit was distinctive in being relatively thin (commonly <10 cm in thickness) and rich in black andesitic sand (juvenile). Anthropogenic material, mainly floor or roofing tiles, and carbonized wood littered the upper part; although a molar tooth also sparked interest.

In general the stratigraphy of many of the nuées ardentes included three main layers: a basal fines-poor part, a relatively thick massive poorly sorted middle part, and a finer grained and diffusely stratified upper part. However, we also saw a very coarse and thick facies of May 8 that was present in the Rivière Seche. In this case the deposit included andesitic clasts up to 15 cm in diameter in a sand matrix. Throughout the day we were attested to the dramatic variations in thickness and grain size of the nuées ardentes deposits. The evening discussions complemented the days excursion and focussed on the transport and depositional processes of nuées ardentes in general, and the causes of the explosive phase of May 8 in the absence of any significant volatile phases.

On the final day we saw a range of pyroclastic deposits from Mount Pelée. We started at Depaz plantations to observe a moderately coarse (0.5-1.5 cm diamter) and thick (30 cm) May 8 nuée ardente deposit which clearly showed a sheared and irregular basal contact. A prominent feature of the outcrop at Depaz planations was the >1 m-thick, plinian fallout deposit of P1 (650 yrs. B.P.). P1 is also andesitic in composition (similar to the 1902 and 1929 products) and shows variable ranges of vesicularity with stratigraphic height. One of the highlights of the day was tens of metres of continuous exposure of the nuées ardentes associated with the P1 eruption at Fond Corré. Here we could trace local variations in lithofacies character including presence of gas-segregation structures and concentrations of carbonized wood coinciding with thicker fines-poor layers. Along the coast was a spectacular exposure of the 1929 block-and-ash flow deposits that had traveled down the Rivière Blanche valley. In contrast to the nuées ardentes deposits, the block-and-ash-flow deposits were very poorly sorted with blocks up to 1 m across and white. Several clasts showed interesting textures including xenoliths with vesicle halos, or cooled jointed margins. We wrapped up the workshop with a tour through the ruins of Saint Pierre where more than 28000 people died from the devastating May 8 nuée ardente. I'm sure that each one of us came away with a greater appreciation for the products of dome-collapse events. The trip was exceptionally well organised with many thanks to Georges, Anne and Jean-Louis.

Sharon Allen



Pyroclastic surges from Soufriere Hills Volcano, Montserrat travelling over the sea 5 km south of the lava dome - November 6 1997. Photo-PDC

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### **MT. PELEE 1902-2002 CONFERENCE, AN OVERVIEW**

The legendary Mt Pelee eruption of the 8th of May 1902 can be regarded as a milestone of volcanological science. The terms *nueé ardente* and Pelean eruptive style were first used after that eruption. The 1902 eruption of Mt Pelee caused over 28,000 casualties, even though, this eruption was smaller than the Plinian style eruptions of 1300 or 1600 AD. Before the 1902 eruption, the 'Fire' Pelee Mountain, according to Caribbean people, produced the large crater of Etang Sec (Dry Tarn) in 1300 AD. Subsequently, there were two less violent eruptions occurred in 1792 and 1851. The eruptive style of Mt Pelee varied between Plinian and Peleean style. The conference, organised by the Institute de Physique du Globe de Paris and supported by the IAVCEI Commission on Explosive Volcanism, was to commemorate the event of 1902 eruption and to gather the scientific community around the topics of explosive volcanism, volcano monitoring and forecasting.

The conference was held in the 'Habitation la Montagne', a beautiful mansion facing the sea and the volcano, surrounded by a green-lush landscape and located near the Depaz rum distillery. About two hundred and forty people participated in the conference, from 20 different countries, such as Australia, Canada, Colombia, Costa Rica, China, Czech, Ecuador, French, Germany, Indonesia, Italy, Japan, Mexico, New Zealand, St. Augustine, UK, USA, Romania, Russia, St. Augustine (West

Indies).

The emphasis of the Mt Pelee conference was on explosive volcanism in subduction zones, covering: Sessions included: Eruption dynamics (several sessions), Lava domes growth and explosivity, Volcanism and tectonics; Genesis and evolution of calc-alkaline magma; Stability and instability of volcanic edifices; Volcanic risk mitigation. Most of the presentations dealt with the eruption dynamics.

### **Eruption dynamics**

Many talks related to lava dome growth and explosivity (keynotes by S. Nakada and H. Shimizu on the 1991-1995 eruptions at Mt Unzen in Japan and by D.B. Dingwell on progresses and challenges of the research on dome magma properties), modelling of lava dome emplacement, growth and collapse, as well as behaviour of magmas from the magma chamber to the surface (keynotes by A.W. Woods on magma mixing, by K. V. Kashman and S.R. McConnell on transitions from sustained eruptions to short explosive pulses; by H.E. Huppert and A.W. Woods on magma chamber evolution during slow effusive eruptions, by J.E. Gardner, J. Larsen and A. Burgisser on Bubble nucleation, growth and permeability in magmas). Special attention has been paid to the dynamic factors influencing dome destruction such as changes in effusion rate, modification of summit morphology, conditions of the slope underlying a dome, surface and internal structure related to dome growth, internal dome overpressure, and condition related to magma cooling. The increase of instability of dome can be caused by intensity of dome growth, rising of internal pressure. The combination of cooling condition and high internal pressure may intensify surface and internal structural deformation that induces weakness areas parallel to the topographic slope.

New data and ideas on directed blasts and block and ash flows have been discussed during the session related to the origin and deposition of pyroclastic density currents (keynotes by O. Roche, M. Gilbertson, J. Phillips, R.S.J. Sparks on the mobility of pyroclastic flows and by A. Belousov, B. Voight, M. Belousova on the comparison of directed blasts from Bezymianny 1956, Mt St. Helens 1980 and Soufriere Hills, Montserrat 1997). Presentations on the 1997 eruption at Soufriere Hills, Montserrat, were very interesting, where field data, visual and instrumental observations were combined with numerical simulations of conduit flow, fragmentation and dispersal of pyroclasts.

### **Volcanism and tectonics**

La Soufriere (Guadeloupe) and Soufriere Hills Volcano (Montserrat) are located at the intersection of two fault sets. These were shown by major prehistoric sector collapses and pyroclastic avalanches of these areas which were directed southwestwards into the Caribbean Sea, or southeastward into the Atlantic Ocean. The tectonic, volcanic and petrologic consequences of glacial loading and rebound in Iceland have been discussed during the keynote by G.E. Sigvaldason, N. Oskarsson, H. Karlson.

Activation of fault can also influence eruption progress, as discussed in the keynote by M. Bursik, C. Renshaw, J. McAlpin, M. Berry on the triggering of volcanic eruptions by local faulting. The evidence of volcanic eruption triggered by local fault rupture was described from the North Mono-Inyo eruptive sequence that is 600 years old, in the western United States. Strong

earthquakes took place at the end of the North Mono explosive phase and at the beginning of the Inyo explosive phase. These events were assumed to relate to each other. The North Mono and Inyo vents were located along the Hartley Spring Fault. Propagation from the north of Inyo Dike along the plane of the fault allowed the seismic energy release and triggered the slip observed on the fault. The slip reduced the horizontal confining pressure in a region near the southern tip of the fault. The presence of the main Inyo vent in the region of the southern tip of the fault suggests that the reduction in confining stress may have triggered the Inyo eruption.

### **Stability and instability of volcanic edifice**

A review of flank collapses at New Zealand stratovolcanoes was discussed in the keynote by V. E. Neall. Collapses may or may not relate with volcanic activity. Flank collapse events are for example rarely associated with significant activity at Soufriere of Guadeloupe. By contrast, sector collapse of Soufriere Hill Volcano, Montserrat was followed by a lateral blast on 26 December 2001. The event was caused by rapid dome growth and instability of steep southern English crater. Aside hydrothermal alteration and intense fracturing, intense rain-falls and frequent seismic activity may also be important factors triggering collapses, as discussed in the keynote by D. Elsworth et al. Dome collapses at Soufriere Hills Volcano, Montserrat occurred on 3 July 1998 and 20 March 2000 and 29 July 2001 associated with heavy rainfall. The last event was also preceded by local felt earthquakes. The dome was modeled as hemispherical with superposed collapse geometry and subjected to loading of both rain-water induced water pressure and trapped effusive gas pressure. The results suggest that the peak of gas overpressure is uniform throughout the dome, and overpressures are sufficient to trigger failure.

### **Genesis and evolution of calc-alkaline magmas**

This session provided a window into magmatic processes at lithospheric scale occurring in active subduction zones. The origin of volcanic fluids was discussed in the keynote by M Javoy and F. Pineau by the study of stable isotopes. The role of ascent vs mixing and cooling in the evolution of arc magmas was discussed in the keynote by M.J. Rutherford, J.D. Devine and M. McCanta with reference to both field and laboratory experiments. A closer look into the mantle genesis of primitive calc-alkaline basaltic liquids from the Lesser Antilles arc was discussed in the keynote by M. Pichavant and R. Macdonald.

### **Volcanic risk mitigation**

Volcanoes with long repose periods have drawn attention of researchers, for the evaluation of hazard and risk. These volcanoes have become more hazardous as the quiescence allowed the development of densely populated and economically rich areas along the slopes. Mt Fuji is one example. To mitigate the hazard, researchers have prepared hazard maps and risk management program to provide possible scenarios of expected eruption, and risk mitigation strategies.

Effective communication among researchers is the key to obtain accurate volcanic hazard assessment. Interactive relational databases that can be accessed updated and maintained is an innovative choice to solve the problem. The WOVOdat database was presented in the keynote by C. Newhall.

Experience teaches that aside the uncertainties in eruption predictions, volcanic risk mitigation

is essentially complicated by the local political, economic and social structure of the area exposed to the volcanic hazard. Level of volcano understanding, population density, strategy of evacuation during volcanic crises are among the principal problems in densely populated country. Comparison among different experiences regarding responses during volcanic crises clearly reflects the different cultures where volcanoes are located. An example was the Montserrat eruption when communication among scientist, decision makers and the public revealed the lack of common criteria for acceptable or tolerable level of risk of natural hazards, which is a common problem during volcanic eruptions. An example of obstacles was mention by Martha Calvache. The drawing of hazard zonation, for example, became more complicated because of the misunderstandings between public and volcano experts in anticipating the volcano behavior and defining the danger zone. People living around the volcano were expecting a high level of precision, such as how many meters should they be away from the line of hazard zone, which is really a qualitative value. Similar problems also occurred in Indonesia, in areas with different economic potential. Improvement in science and technology combined with development in communication strategy among scientists leading to a better understanding of the behavior of volcanoes were discussed in the keynotes by C. Oppenheimer et al. On optical sensing technologies for volcanic gas surveillance, by M. Martini on the study of fumarolic gases and by S.R. McNutt, W. Marzocchi and J.A. Power McNutt on earthquake swarms and eruptions in Alaska. The combination of different methods of ground deformation monitoring with seismic monitoring has been described in several presentations. However, the design and establishment of baseline measurements for volcano monitoring and eruption forecasting vary according to the type of volcanism. GPS, leveling profiles, dry-tilt station, tiltmetric, and extensimetric monitoring coupled with seismic data have proven to be powerful tools during volcanic crises.

In wider application, investigation of the effect of wind on plume rise height must be considered when assessing risk to aviation. Interaction between plume and wind lead to higher entrainment of air and horizontal momentum, plume bending and decrease in plume height. The result suggests that mass eruption rate may be misevaluated in high wind speed. Wind speed and direction changes could largely alter the plume height, without clear changes in eruption rate at the vent. Another interesting strategy in developing volcano monitoring and research is to gather near real-time remote sensing data from various present and future satellite system, which cover different aspects, such as ground deformation, ground temperature, chemical composition of volcanic plumes. The aim of this work is to provide first global data base that also contribute to the global study of terrestrial volcanism.

A new technology has been developed by P. Briole and the Robovolc consortium project which allows a remote sensing survey near volcano vents using digital visible and thermal camera. This equipment, which can be dropped-off and picked-up, is expected to have several advantages, such as to approach volcanic vent, collecting samples of erupted products, measuring physical and chemical data during eruptive process. Well, this is really what volcanologists need!

As a whole, the sessions held in Martinique were very interesting. However, the time provided always seems too short. The last thing I would like to mention is the perfect organisation and the superb food. Martinique, is a nice and beautiful environment. Unfortunately, I could not speak French.



Supriyati Andreastuti

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**AGU Chapman Conference on Volcanism and the Earth's Atmosphere, Fira,  
Santorini, Greece, June 17th – 22nd, 2002.**

I recently had the pleasure of attending an AGU Chapman conference on the island of Santorini, Greece. The theme was 'volcanology and the earth's atmosphere' and attendees were mostly volcanologists and climatologists. Santorini is one of the most stunning and inspiring places in the world and it owes its beauty to its raucous volcanic history. Chapman conferences are intended to allow intimate discussion in an environment that provides focus with minimal distraction - Santorini was the perfect venue.

The meeting was convened by Alan Robock of Rutgers University and consisted of four days of lectures and poster presentations and a day of field trips. All of the oral presentations were by invitation and covered a wide range of topics from background volcanology and climatology to more innovative collaborations between the two disciplines. A regular theme was comparing modelled and observed climate effects due to the Laki and Pinatubo eruptions.

Recent research topics included volcanic ash and aerosols in ice core records, atmospheric circulation models, climate models, aerosol chemistry, archaeology and effects of super-eruptions. As a volcanologist I found looking at eruptions from an atmospheric perspective quite refreshing. It let me look at own research in a new context. Most presentations were pitched well for everyone to follow, which was difficult with such a scientifically varied crowd.

Authors introduced posters daily to the group in three-minute talks. These were interesting and it was a good way to get to know all of the other participants and their work.

The third day was used for field trips. In the morning we all sailed to Nea Kamini, Santorini's central island. It's a small shield volcano that is barely poking its head through the sea that fills the caldera. An afternoon field trip took some to enjoy the geology of the caldera wall, lead enthusiastically by Steve Sparks. The rest were treated to a guided tour of the ancient Minoan settlement of Akrotiri (destroyed by the ~1650 BC Santorini eruption). Passionate archaeological debate ensued.

It was a busy week packed with science. On the final day morning sessions were re-arranged to allow the English delegates to see the World Cup on the big screen at a local bar. England's defeat clouded the summary session a little, but we managed to agree on some good results from the conference and drew up resolutions for important future paths. These mostly involved continued collaboration between climatologists, volcanologists, and modellers' ever-increasing thirst for computer grunt. An AGU monograph of papers, covering a range of topics addressed at the meeting, is now in review for publication.



The week was a satisfying mix of great presentations, productive discussion, a stunning volcano, and vibrant local culture. The session by the same name at IUGG2003 in Sapporo should be an interesting follow-up meeting.

Graham Leonard

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### **Book Announcement**



Dome collapse at Soufriere Hills Volcano, Montserrat on 4 November 1997 viewed from the north. Pyroclastic flows are moving south out of sight behind the lava dome. Photo -PDC

< volume thematic large the was 2002 late in Society Geological The by>  
**‘The Eruption of Soufriere Hills Volcano, Montserrat,  
 from 1995-1999’.**

**edited by T.H. Druitt and B.P. Kokelaar**

This volume contains 30 papers many of which address the chronology. Dynamics, products and associated hazards of the eruption. It also includes papers specifically on the associated geophysics and geochemistry. Four introductory papers provide overviews of the eruption chronology and consequences, of the scientific results, of the evolution, organisation, role and activities of the Montserrat Volcano Observatory, and of the Volcanic evolution of Montserrat through time. A large photographic record of the 1995-1999 eruptive period is included.

- 645 pages,
- 500 illustrations,
- Many stunning photographs of the eruption.

For further information go to <http://bookshop.geolsoc.org.uk/cgi-bin/geosoc.storefront>

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#### **Workshop announcement**

### **Shallow submarine felsic volcanism, Milos Greece Field workshop Preliminary program September 15 - 16, 2003**

**Presented by Jocelyn McPhie and Andrew Stewart**

#### **Day 1**

0900 Introduction to the volcanic geology of Milos.....Jocelyn McPhie

0940 An Upper Pliocene coarse pumice breccia generated by a shallow submarine explosive eruption.....Andrew Stewart

1030 Break

1100 Internal structure and endogenous growth of an Upper Pliocene shallow-water submarine dacite cryptodome.....Jocelyn McPhie

1140 Facies models of explosive rhyolitic submarine eruptions spanning three orders of magnitude: examples from the southern Aegean

Arc.....Andrew Stewart

1230 Lunch

**1330 -1800 Field: Filakopi Pumice Breccia, northeastern Milos**

The Filakopi Pumice Breccia (FPB) on Milos is an exceptionally well exposed Upper Pliocene coarse pumiceous volcaniclastic unit, and has a minimum bulk volume of 1 km<sup>3</sup>. Several key exposures along the northeastern coast of Milos between the small fishing villages of Mytikas and Pollonia will be examined. The componentry, lithofacies and context strongly suggest that FPB was the product of an explosive eruption from a shallow submarine vent. Excellent exposures through the 45-m-thick unit allow the genetic links between submarine eruption processes and deposit characteristics to be scrutinized.

**DAY 2**

**0900-1200 Field: Submarine felsic dome-cryptodome-pumice breccia volcanoes**

On Milos, the submarine volcanic succession is dominated by proximal, medial and distal lithofacies associations related to these volcanoes. This volcano type is regarded as a submarine analogue to subaerial felsic dome-pyroclastic cone volcanoes. The proximal facies associations of these volcanic centres on Milos are characterised by thick, moderate to large volume, syn-eruptive, felsic pumiceous volcaniclastic facies intruded by rhyolite or rarely dacite. Most of the outer cone is composed of thick intervals of felsic pumice breccia and lithic breccia, intercalated with and overlain by sedimentary facies.

**1200-1800 Field: Boat excursion**

The boat will depart from Kypos on the southern coast of Milos and examine the exceptional exposures through the thick, texturally diverse volcaniclastic sequences along the southwestern coast at Gerontas, Kleftiko and Sikia.

Cost yet to be decided, however student sponsorship by IAVCEI is anticipated. People interested in attending the workshop should contact Jocelyn McPhie e-mail- j.mcphie@utas.edu.au

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Forthcoming meetings

# Cities On Volcanoes 3

Hilo, Hawai'i

July 14-18, 2003



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<http://www.uhh.hawaii.edu/~cov3/>

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XXIII General Assembly of the IUGG - Sapporo, Japan

June 30 - July 11 2003

<http://www.jamstec.go.jp/jamstec-e/iugg/index.html>

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INTERNATIONAL CONFERENCE

## **The South Aegean Active Volcanic Arc: Present Knowledge and Future Perspectives (SAAVA2003)**

17-20 September 2003

Milos Conference Center - George Eliopoulos  
Milos Island, Greece

Under the auspices of the:  
International Association of Volcanology and Chemistry of the Earth's Interior  
(IAVCEI)

Geological Society of Greece  
Institute of Geology and Mineral Exploration of Greece

<http://milos.conferences.gr/?saava2003>

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The 32nd International Geological Congress (32IGC) 20 to 28 August,  
2004 Florence, Italy

## From the Mediterranean Area Toward a Global Geological Renaissance

Geology, Natural Hazards, and Cultural Heritage

<http://www.32igc.org/home.htm>

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## IAVCEI 2004 General Assembly Volcanism and its Impact on Society Pucón, Chile November 14-19 2004

<http://www.sernageomin.cl/iavcei>

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We would like to thank the contributors to this months newsletter.

Dr Sharon Allen

Supriyati Andreastuti

Graham Leonard