IAVCEI *News* 2008 No: 1

INTERNATIONAL ASSOCIATION OF VOLCANOLOGY AND CHEMISTRY OF THE EARTH'S INTERIOR

FROM THE PRESIDENT

The arrival of the New Year 2008 was welcomed with an eruption of Llaima Volcano, Chile. Volcanoes in Central and South America also were active this January. The current environment surrounding basic science, including volcanology and related research fields, demands that we be accountable to the public. We should welcome such an environment, because IAVCEI contributes to reducing risks from volcanic disasters around the globe with results from our research. Outreach on volcanism and its manifestations is indispensable for education of people living near active volcanoes. In addition to outreach, forums such as the Cities on Volcanoes and workshops for the purpose of mitigating volcanic disasters can serve to complete the requirement for public accountability.

I was elected as the new president last July, and am being supported by our new secretary general, Joan Martí, and the past president, Oded Navon. Other new officers are the vice presidents Anita Grunder and Hugo Moreno, and executive committee members Piero Dellino, Juan Espinola, Marta Calvache, and James White. In this issue, I would like to discuss IAVCEI's membership and the issue of increasing the budget of IAVCEI in order to promote its activities.

Present number of IAVCEI members:

The number of IAVCEI members was 720, from 52 countries, as of the end of 2007; the USA contributes 32%, Japan 9%, United Kingdom 8%, Mexico 7% and Italy 6%. Our membership has not increased over the last four years, and is small in comparison with the number of scientists listed in the Volcano-listserv; only 30 % of the listserv members. Another illustration of IAVCEI's unmet potential is that, although the Volcanological Society of Japan includes about 1,200 scientists, only 5% of them are IAVCEI members. Although the ratio of IAVCEI members to all attendees at major meetings is not known, that ratio in COVs can be reported. COV meetings have become the second largest among meeting series organized by IAVCEI, but only about 18 % of the participants, for both Quito and Shimabara, were IAVCEI members. Even if about half the contributions to COV were from non-volcanologists, the proportion of IAVCEI members seems too low.

Why do people become IAVCEI members?

One should not feel that little is gained from paying the membership fee. The membership fee directly benefits individual members through discounted registration fees for IAVCEI meetings, receipt of newsletters, and discounted prices for the Bulletin of Volcanology and other IAVCEI publications. However, BV is now accessible online in many institutions without any personal subscription fees. Individuals may not attend international meetings often enough to realize the discounting benefit. Although the IAVCEI commissions and working groups are engines of IAVCEI, non-members can join them. Volcano-listserv, the most rapid and widely received information source for our community, is also available to non-members.

One of the important things that IAVCEI provides is support for young scientists studying volcanology, by providing funding to help attend meetings, and awards that recognize and encourage their accomplishments. A second is IAVCEI's contribution to mitigating volcanic hazards, especially in developing countries. This is done through our cooperative observation and risk-management plans prepared for volcanic crises, support for education of young scientists in these countries, and outreach for enlightenment of residents around volcanoes. We should persuade non-members close to us to join us in IAVCEI, helping them to understand that membership is not just for the member's benefit, but also for the reasons just outlined. To maintain and further develop the above activities of IAVCEI, we need to strengthen our financial foundations.

Importance of having IAVCEI members participate in IUGG meetings:

Did you know that our participation in the General Assemby (GA) of the International Union of Geodesy and Geophysics (IUGG) controls the main source of income for IAVCEI? IAVCEI is one of eight associations comprising the IUGG, the funding for which is provided by annual contributions from member countries. The number of participants in IUGG-GA from individual associations becomes the basis for money distributed by IUGG to the associations for the following four years. In this case, the IAVCEI personal membership is not required; volcanologists need only select the IAVCEI box on the web registration of IUGG-GA. Money from IUGG currently makes up about half of the total budget of our association. Therefore, our income can be substantially increased by increasing the number of

volcanologists listing IAVCEI affiliation at IUGG. Further gains can be made by increasing IAVCEI membership, and by merchandising IAVCEI publications and other products.

When and where is the General Assembly after Iceland?

To avoid having small numbers of our participants at IUGG-GAs, we should consider the timing of our IAVCEI GA; our present cycle is 2000, 2004, 2008 and 2012. Other associations in IUGG hold their GAs midway between the IUGG-GAs; that is, 2005, 2009 and 2013. The problem with the present cycle of our GA is shown by overlapping of two major IAVCEI meetings within one year, too; for example, Sapporo IUGG and Hawaii COV in 2003, and Perugia IUGG and Shimabara COV in 2007. IAVCEI participants in the Sapporo and Perugia IUGGs were about 350 and 300, respectively. These numbers are much smaller than the 936 participating in the IAVCEI 2004 GA in Pucon. Furthermore, our cycle is the same as that of IGC. Both IAVCEI Iceland and IGC Olso take place this August, and dates for conference excursions partly overlap one another. Having IAVCEI GA and IGC meetings in the same year clearly reduces the number of IAVCEI participants in each meeting because of limits to time and funding available to attend meetings. For example, young scientists and even USGS scientists commonly cannot attend multiple international meetings in a single year. Of course, just having a large number of participants does not make a meeting good. Separating IAVCEI GA years from those with IUGG meetings is, however, the best way to increase IAVCEI's income from IUGG, and offers the added benefit of not having to listen to identical presentations in successive large meetings.

Considering the above background, the new officers have decided to move the present cycle of GA one year later, in keeping with the schedules of other associations' GAs. Here, we invite your entries for hosting IAVCEI-GA in 2013. I would like to add that commemorating anniversary dates of historical eruptions will not be considered at all essential in deciding the venues for the GAs.

FROM THE SECRETARY GENERAL

Dear IAVCEI members,

In my first letter as SG I would like to inform you about some technical issues and projects that the new officers want to take on during this period with your collaboration.

IAVCEI promotes the detailed study of volcanic processes and of their potential impact on the society and the environment. Modern society is progressively increasing the differences between rich and poor countries and this is clearly visible, among other ways, in the resources available to face against the volcanic threat. IAVCEI should contribute to reducing these differences by providing scientific and technological help to the less advanced countries, in order to increase their preparedness in hopes of improving their fate when volcanoes act. To achieve this objective IAVCEI needs to become a widely and well-known organisation. This requires making an extra effort to introduce IAVCEI to those international organizations and governments that could have to deal in various ways with volcanic risk. In other words, this implies that we must popularise our knowledge of volcanoes and their effects, and also to be able to offer solutions and help where problems related to active volcanoes appear.

As already stated by the President, we need to increase the number of members of our association. It is curious that the volcano list is distributed among more than 2500 people while there are only 700 IAVCEI members, making it one of the smallest IUGG associations. Sometimes, I have the sensation that many of our colleagues who are not IAVCEI members do not really know the role of our association. A lot of people ask what IAVCEI could do for them and what they could do for IAVCEI in case of becoming members. Certainly, there is not a quick and clear answer to this question. We definitely need to emphasise the societal value of IAVCEI and convince people that by increasing our number we will be able to do more for volcanology and for society.

One of the most important aspects of being a IAVCEI member should be to have the opportunity to participate in programmes addressed to reduce volcanic risk, particularly in less favoured countries. As explained above, IAVCEI should promote programmes on cooperative research with scientists in these countries, education for young scientists there, and enlightenment of residents around these volcanoes by scientists educated in this cycle. This is in addition to offering travel funds for IAVCEI-related meetings so that the young scientists will grow to share the association's goal of reducing risks from volcanic disasters worldwide. I think that it is important to let non-members understand that this kind of activity is promoted most effectively by increasing the number of IAVCEI members.

It is necessary also to think about initiatives that can popularise volcanology and the role of IAVCEI. We should be able to explain in a simple and clear way the advantages and disadvantages of living with volcanoes, and how to be prepared against their threat. As a first step, we have started redesigning our webpage in order to make it much more approachable and informative for us and for the general public. Please, take a look at the webpage, become familiar with it, and let us know about any errors or inaccuracies you see there. Suggestions for new sections, general information, advertisements for IAVCEI members, etc, will be more than welcome

We would also like to make our webpage a major tool for exchanging information among us and also for publishing databases and additional information that IAVCEI members consider relevant for all of us. From now on, the webpage will be used to publish the newsletters, to advertise all relevant events we are aware of, to offer access to all forms for IAVCEI activities (applications, reports, membership renewals, etc.) and also to perform voting in elections.

Obviously, another important aspect we need to improve is IAVCEI funding. It is no secret that the funds available to IAVCEI are limited and that without money we cannot do nearly as much as we would like. Most funds available to IAVCEI come from the proportional distribution of funds from IUGG and from the membership subscription payments; some additional funding is derived from related foundations and the sale of IAVCEI products such us DVDs or calendars. Funds from IUGG are

distributed among its constituent associations according to the number of people from each association who attend the IUGG General Assemblies. With these funds IAVCEI helps the organisation of meetings and also offers some travel grants to students and researchers from less favoured countries. At present, the IAVCEI funds available for these purposes are very limited, so we need to think hard of ways to increase the income to IAVCEI.

Now I would like to focus our attention on two aspects related to the day-by-day functioning of IAVCEI: Commissions and Working Groups, and Statutes and By Laws.

The information concerning IAVCEI Commissions that was out of date has been removed from our webpage and we have asked the corresponding Commissions' leaders to update it as soon as possible. From the commissions' reports received for the Perugia IUGG meeting and from what was included in the former webpage, we have seen that some commissions have not been very active during the last few years. Commissions and working groups really are major driving forces of IAVCEI. Because of commissions' and workgroups' importance, the new officers feel that we should help and promote those that are really active, but will be reviewing those with waning activity with an eye to terminating unproductive ones.

With regard to the information on commissions that the IAVCEI main webpage should contain, I would like to recommend that the commission webpages be brought directly into into the main IAVCEI site, not just linked to it. This would allow visitors to immediately be exposed to other IAVCEI things when they enter the website. Consequently, much more useful information would be offered to the visitor without having to navigate among dispersed and variably linked websites, while also reducing the too-common problem of having the same, or worse, different, information on the same event repeated on two or more websites. At the same time, commissions would benefit from this system, as they would not need to provide and maintain their own pages. This would probably also help to reduce or eliminate the delays in updating the commissions' information that we have so far observed.

Continuing with commissions, I am pleased to announce the creation of two new ones, arising from two very active working groups. These are the Commission on Volcano-Ice Interaction, led by Magnus Tumi Gudmundsson and Chris Waythomas, and the Commission on Caldera Volcanism, led by Joachim Gottsmann and Gerardo Aguirre.

Finally, it is also time for a new revision of the IAVCEI Statutes and By-Laws. Some statements definitely need to be updated. A first revision will be undertaken by the EC, and our recommendation for changes and amendments will be published on the webpage and left there for free inspection until June 15th, 2008. Approval of the new Statutes and By-Laws will require approval by the IAVCEI membership, and the voting process will be completed before the end of July. The new Statutes and By-Laws will be uploaded onto the webpage and officially presented at the IAVCEI General Assembly in Reykjavik this August.

I do not want to end this first letter without kindly asking for all of you to be patient with the new EC, as we are just initiating our endeavour as IAVCEI representatives. I am sure that with your help and our enthusiasm we will be able to successfully accomplish all our objectives.

Joan Martí

Secretary-General for IAVCEI (2007-2011)

Aerial view of Santa Margarita volcano, Garrotxa Volcanic Zone Natural Park, Olot volcanic field, Spain

Cities on Volcanoes Conference (COV5) Shimabara, Japan 2007

The fifth Cities on Volcanoes conference (CoV) was held in Kyushu, Japan, November 19-23, 2007, under the sponsorship of Shimabara City and the Volcanological Society of Japan. CoV is the international forum organized every two years by the Cities and Volcanoes Commission of IAVCEI, in which volcanologists and non-volcanologists, including city-planners, engineers, citizens and members of the mass media, discuss reduction of risks from volcanic eruptions and related phenomena. Unzen volcano erupted during 1991-1995, generating pyroclastic/ debris flows, one of which took the lives of Katia and Maurice Krafft and Harry Gricken. Six hundred participants registered and attended from 31 countries and regions. One hundred nine IAVCEI members benefited from their registration-fee discounts. IAVCEI provided funding of USD $5,000 to this conference.

The main theme of the conference was "Coexisting with Volcanoes", and this theme was exemplified and advanced with support from citizens, pupils and volunteers in Shimabara. For example, on the first day's morning, all attendees were welcomed by many kindergarteners who were waving conference flags on both sides of the pathway to the venue entrance (below). The intra-conference excursion was concluded by communication with pupils of two elementary schools and one junior high school in Shimabara; they presented results of their studies of volcanoes and volcanic disasters through drama and songs. In addition to 10 scientific sessions, the organizing committee prepared several forums and outreach activities that citizens, pupils, authorities, and mass media could attend. In addition to the registered participants, about 2,100 people attended scientific sessions and these forums. The attendees could enjoy several performances, night events within the city, and free flights over Unzen with the helicopter of the Ground Self-Defense Force.

Five hundred fifty-one papers were presented in ten sessions within three symposia (Knowing Volcanoes, Volcanoes and Cities, and Living with Volcanoes). Newsletters, which reported both introductions and summaries of scientific sessions together with information on daily events, were issued every day during the conference. The official statement for the conference was presented as the Heisei-shinzan appeal in the closing ceremony.

The summary of this conference is as follows,

- In our meeting, we discussed the latest results from a wide spectrum of volcanological research, and realized the necessity of sound interpretation of volcanic phenomena based on real-time, multi-sensor observations. A probabilistic approach to volcanic disaster assessment is indispensable. Therefore, we must create databases for eruptions and related phenomena, including WOVOdat.
- It is important that information from scientists and disaster agencies is integrated and reflected in risk management, and that long-term land use planning considers future risks. It was suggested that recovery processes are considered not only for infrastructure but also for communities.
- Disaster preparedness, well in advance of an emergency situation, was cited as a key point. This is an important addition to creating thrusting relationships among scientists, officials, residents and mass media. The development and implementation of outreach and education activities provide a means to improve community awareness about volcanoes.
- COV5 has attempted a new style of international conference, with participants not only from research, administrative and disaster management backgrounds, but also ordinary citizens themselves.

Tenerife of Spain was selected as the venue for the next CoV, which is scheduled for November 2009. The products of the Shimabara meeting, including abstract volumes (English/Japanes), meeting program, newsletters, and useful meeting data can be seen at:

http://www.citiesonvolcanoes5.com

Setsuya Nakada

Commemorating the 25th Anniversary of the 1982 Eruption of El Chichón Volcano, Chiapas, Mexico

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Twenty-five years ago, a strong explosive eruption of El Chichón Volcano, in Chiapas State, southern Mexico began abruptly near midnight of 28 March, 1982, terrifying local inhabitants and prompting a confused, poorly executed evacuation of most villagers. Relatively minor intermittent activity ensued for the next five days, and then the two most powerful and lethal eruptions occurred during 3-4 April—unfortunately and tragically, after many evacuees were allowed to return to their homes. The eruptions killed about 2,000 people, mostly because of pyroclastic flows and surges that devastated nine villages near the volcano. Ashfalls downwind caused severe socio-economic hardships and disrupted the daily lives of many more thousands of people in the distal, surrounding regions. The March-April 1982 eruptions of El Chichón caused the worst volcanic disaster in Mexico's recorded history.

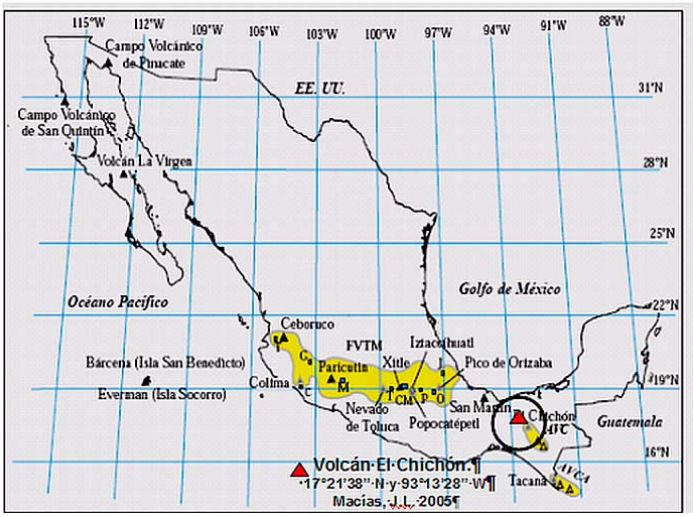
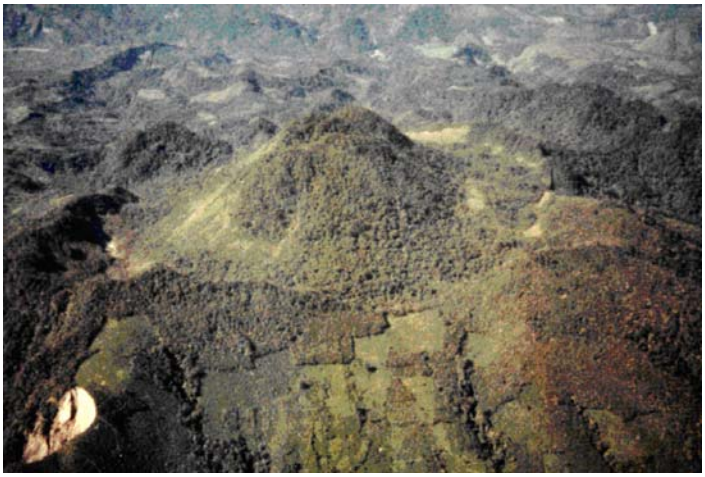


Fig. 1 (a; above) Inset map shows location of El Chichón Volcano with respect to the Trans-Mexican Volcanic Belt, (b; top of right column) Aerial view in March 1981 of the summit dome and somma crater (photograph by René Canul, CFE), (c; 2nd in right column) Aerial view of the new summit crater produced by the 1982 explosive eruptions (photograph taken by Robert I. Tilling on 2 June 1982)



During 1980-1981, increased fumarolic activity and earthquakes felt by local inhabitants went unheeded, and El Chichón's deadly eruptions came almost as a total surprise to scientists and authorities alike. Moreover, the specific mention of the volcano's possible reawakening contained in an official internal report of Mexico's Comisión Federal de Electricidad (CFE) assessing the geothermal potential of El Chichón—completed by two CFE scientists (Canul and Rocha, 1981) six months before the eruption— only became known after the eruption. In retrospect, however, the apparent nonchalance of government officials to possible precursors of an impending eruption is understandable, because, before 1982, it was believed that this small, obscure volcano with no known historical eruptive activity posed no threat. This prevailing mindset simply reflected the fact almost nothing was known at the time about El Chichón, which remained very little studied following its "discovery" in 1928. Also, more importantly, in 1982 there was not a single official body in Mexico, regional or national, responsible for managing volcanic or other natural-hazards emergencies; the current national Civil Protection organization was created in 1985.

While the 1982 eruptions constituted an immense human tragedy for Mexico, they also sparked intense international scientific interest in multidisciplinary investigations of the processes, products, and impacts (environmental and social) of eruptive phenomena at El Chichón as well as at other explosive volcanoes. For example, for the half century preceding 1982, only a few rudimentary studies were done at El Chichón, but, in the quarter century since 1982, even a casual survey of the

scientific literature would document many hundreds of publications specifically about this volcano or containing discussions/comparisons of it with other volcanoes. Clearly, the time was ripe to revisit the 1982 eruptions given the vastly increased knowledge about El Chichón Volcano now available in particular, as well as the many advances achieved in recent decades in the science of volcanology in general. Thus, the idea of convening an international conference on occasion of the 25th anniversary of the El Chichón eruptions was born. With the co-sponsorship of IAVCEI and the Chiapas Government, several institutions in Mexico—notably the Universidad Nacional Autónoma de México (UNAM) and the Universidad de Ciencias y Artes de Chiapas (UNICACH)—in 2005 began organizing such a conference. The culmination of the Organizing Committee's efforts was a scientific forum called the El Chichón Volcano: Twenty-five Years Later. A Commemorative Conference, recently convened in the colonial city of San Cristóbal de las Casas (Chiapas, Mexico) during 19-25 March 2007.

Beginning with the First Circular, announcement of the conference was received enthusiastically within the volcanological community, and conference itself was well attended, with 170 participants representing 15 countries. The format of the conference involved both oral and poster presentations, and about 120 abstracts were submitted (Espíndola et al., 2007). A principal objective of the conference organizers was to reexamine and extend the findings of and lessons from the initial post-1982 studies in the light of new data and ideas generated during the past quarter century. Another key aim was to showcase the wide diversity of disciplines encompassed by studies of El Chichón and other explosive volcanoes, as well demonstrated by the themes of the 11 conference sessions:

- The 1982 eruption: History and lessons
- Explosive volcanism
- Tectonics and regional geology
- The 1982 eruption: Advances, new aspects and perspectives
- Stratigraphy and eruptive mechanisms
- Chemistry and petrology of sulfur-rich magmas
- Volcano monitoring
- Geochemical monitoring and volcano hydrothermal systems
- Risk assessment
- Social impacts of volcanism
- Volcanoes and archaeology

Most of these sessions included one or more oral presentations by invited keynote speakers. Jim Luhr (Smithsonian Institution, Washington, D.C.) was originally scheduled to give a keynote presentation, but unfortunately this could not happen because of his unexpected, untimely passing on 1 January 2007. Claus Siebe (UNAM) read a moving obituary to Jim, in recognition of his petrological studies and career-long love of Mexican volcanoes (Siebe, 2007). Mexican scientists who had studied the eruption and also passed away were also recognized. Some papers presented at the conference, along with other studies, will be published in a Special Issue of the *Journal of Volcanology and Geothermal Research* (JVGR), currently in preparation and being edited by Yuri Taran (UNAM). Authors of papers presented at the conference but who are not already involved with the JVGR Special Issue were encouraged to submit their contributions for a proceedings volume for publication in Geofísica Internacional. The conference ended with the inaugural showing of the video "Chronicles of the Volcano" about the 1982 eruptions, specially produced for the conference by Silvia Ramos from unpublished images of the Chiapas Television and beautifully accounted by the 1982 texts of the poet Jaime Sabines.

In addition to the conference proper, there was a pre-conference workshop (17-18 March) on volcano monitoring and a post-conference field excursion to El Chichón (23-25 March). The workshop, which focused primarily on recognition of eruption precursors, was organized by Servando de la Cruz and Silvia Ramos, with the participation of Ramón Ortiz (CSIC-Madrid, Spain), Philippe Lesage of the Savoie-University and currently visiting UNAM, María Aurora Armienta from Instituto de Geofísica, UNAM, and Rodolfo Van der Laat from OVSICORI, Universidad Nacional (Heredia, Costa Rica) as the principal instructors.

Twenty seven (27) of the Conference participants took part in the field excursion to El Chichón Volcano (23 -25 March). This field trip was prefaced by an interesting cultural program organized and hosted by the mayor and people of the village of Chapultenango, the starting point for the excursion. Chapultenango was severely impacted by ashfalls from the 1982 eruptions, and the program included the recounting (in Spanish and local indigenous languages) of volcano legends and personal experiences during the 1982 eruptions, performance of native dances, and the showing of the "Chronicles of the Volcano" video. This program provided a unique and educational interaction between scientists and the people living within the shadow of El Chichón. During the following two days, the conference participants examine deposits and impacts of the 1982 eruptions well described in the field-trip guidebook (Macías et al., 2007). In addition to giving information about the field-trip route and stops, the guidebook also contains a summary of the regional geology and structures, an account of the 1982 eruption, and a comprehensive bibliography of works pertinent to El Chichón. A memorable highlight of the excursion was the ascent to the rim of the new crater (Fig. 2) formed by explosive destruction of the summit dome complex during the 1982 eruption. For those participants who had first witnessed the barren, desolate scene soon after the 1982 eruptions, seeing the changes in the landscape (e.g., extent of post-eruption erosion, rapid revegetation) left an

Fig. 2. View of the acidic lake within the summit crater of El Chichón Volcano (photograph taken by Silvia Ramos during the field excursion on 25 March 2007)

indelible impression. Some of participants scrambled down the crater wall to refresh themselves in the greenish-blue water of the acidic lake.

The commemorative conference as well as the pre-conference workshop and post-conference field excursion brought together not only the "veterans" who made the early studies and observations of El Chichón before, during, and immediately after the 1982 eruptions, but also many of the subsequent investigators who have made major advances in improving our understanding of El Chichón in particular and of explosive volcanism in general. Finally, it was especially gratifying to see many young university students in attendance at the conference. We hope that their experiencing the productive interaction between conference participants—of all ages and specializations—will serve them well in furthering their educational and research pursuits. They are the next generation of researchers who will be at the forefront of scientific advances to be presented at some future conference commemorating El Chichón Volcano. Perhaps on occasion of the 50th anniversary of the 1982 eruptions?

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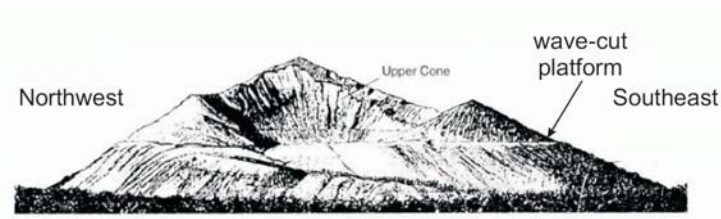
Fig. 2 (column right). Line drawing of Pahvant Butte from the southwest, taken from the classic USGS Monograph on Lake Bonneville by G.K. Gilbert [1890].



IAVCEI Workshop on Surtseyan Volcanism

James D.L. White and Bruce Pauly, leaders
October 2-9, 2007

by Larry Mastin, USGS Cascades Volcano Observatory

From October 2 through 9, 2007, sixteen hardy volcanologists visited five Surtseyan eruptive centers of Pleistocene and Holocene age in the western U.S., examining deposit structures and exchanging views on their origin. The occasion was the Workshop on Surtseyan Volcanism, sponsored by IAVCEI via the Commissions on Explosive Volcanism and Volcaniclastic Sediments, and the workgroup on Volcano-Ice Interactions. It was organized by James White of the University of Otago, NZ, and Bruce Pauly of the University of California, Davis. The objective was to view a range of hydromagmatic deposits and to test our skills at interpreting eruptive styles, environments of deposition, and processes of eruption or alteration.

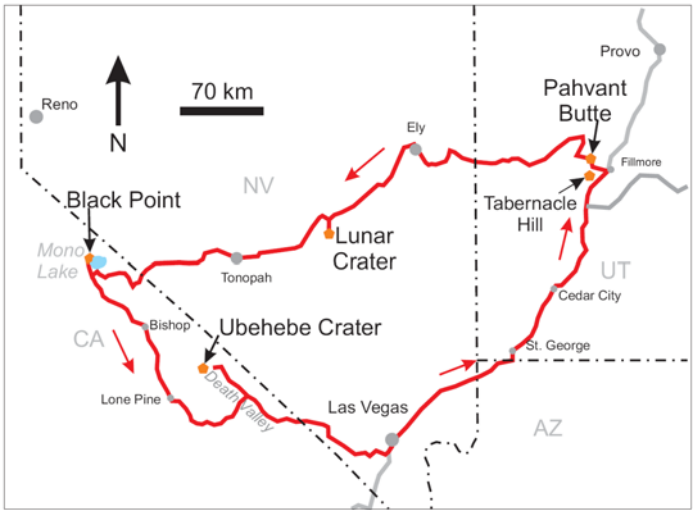


Fig. 1. Map showing the route of the IAVCEI workshop and locations of the Surtseyan features we visited

Despite its arid climate, the western U.S. displays a variety of well-exposed hydromagmatic centers that resulted from interaction with both ground and surface water. During this workshop we visited (Fig. 1) Pahvant Butte, a 15 ka emergent Surtseyan cone in western Utah that erupted through Pleistocene Lake Bonneville; Tabernacle Hill, a smaller 14-17 ka Strombolian/hydromagmatic cone and lava field in the southern Lake Bonneville basin; Lunar Crater, a Pleistocene maar within a cluster of Plio-Pleistocene cones and flows in central Nevada; Black Point, a 13 ka Surtseyan cone that rose through Pleistocene Lake Russell (now Mono Lake) in eastern California; and Ubehebe Crater, a late Holocene maar in Death Valley. About 80% of our time was spent at Pahvant Butte and Black Point.

At Pahvant Butte and Black Point, lacustrine features of contemporaneous late-Pleistocene age lie within their respective basins and show convincingly that these features erupted through pluvial lakes. The water level during the Pahvant Butte eruption is clearly marked by a wave-cut platform midway up the cone (Fig. 2; left). Above this level the cone is pervasively palagonitized and average dip angles of 20-25º approximate the current slope of the cone. Below, deposits are mostly unaltered and dip angles

shallower. At Black Point no wave-cut platform exists, but a 13,610 14C yr. B.P. bathtub ring of basaltic pumice, deposited at the shore of Lake Russell at ~2095m elevation [Benson, et al., 1998] suggests that the contemporaneous lake level was about

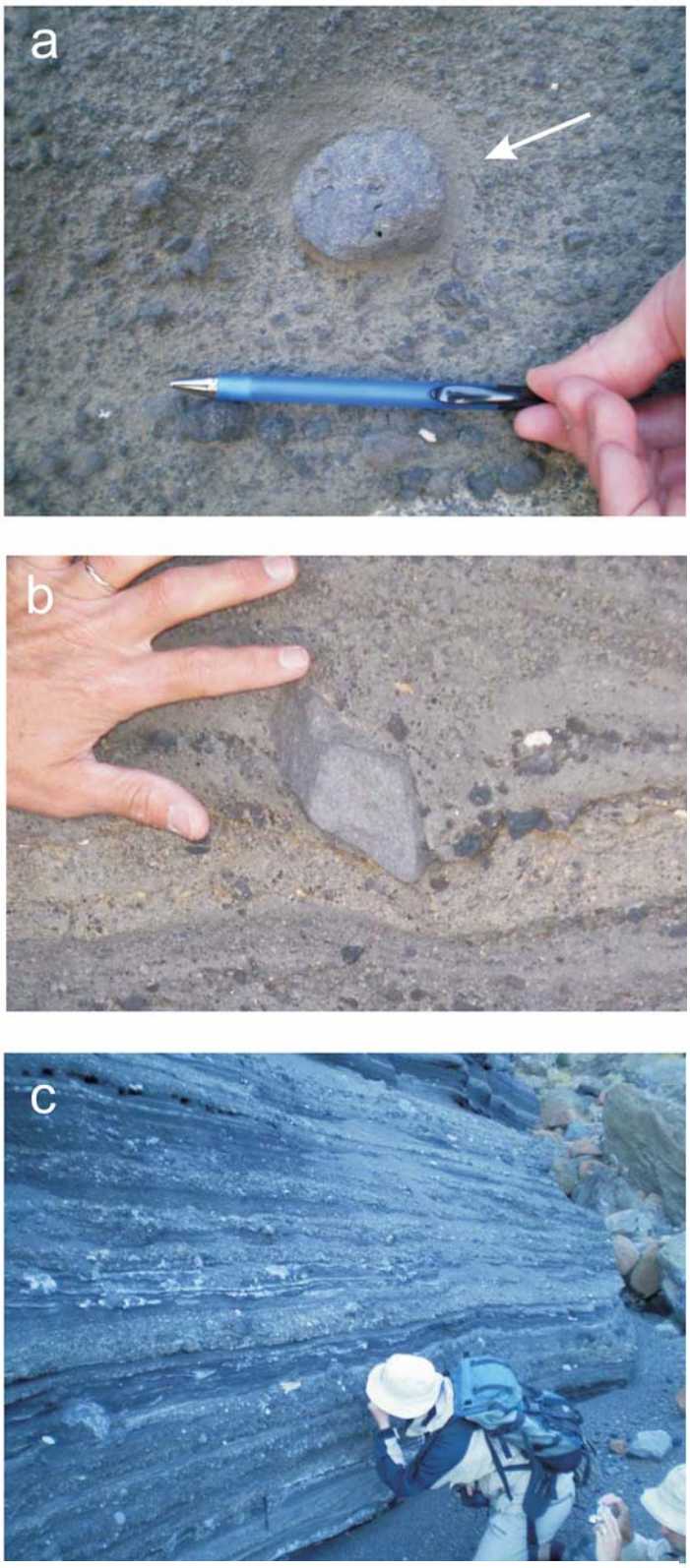


Fig. 3. (a) armored lapils (arrow point to outside of mud armor) and (b) a bomb sag from the subaerial section of Pahvant Butte. (c) Subaqueous M1 deposit near the base of Pahvant Butte.

20m below the current summit elevation (2115m). Beds above ~2095m elevation are generally more palagonitized and steeper dipping than lower beds.

Despite the tight constraints on water level, the occurrence of

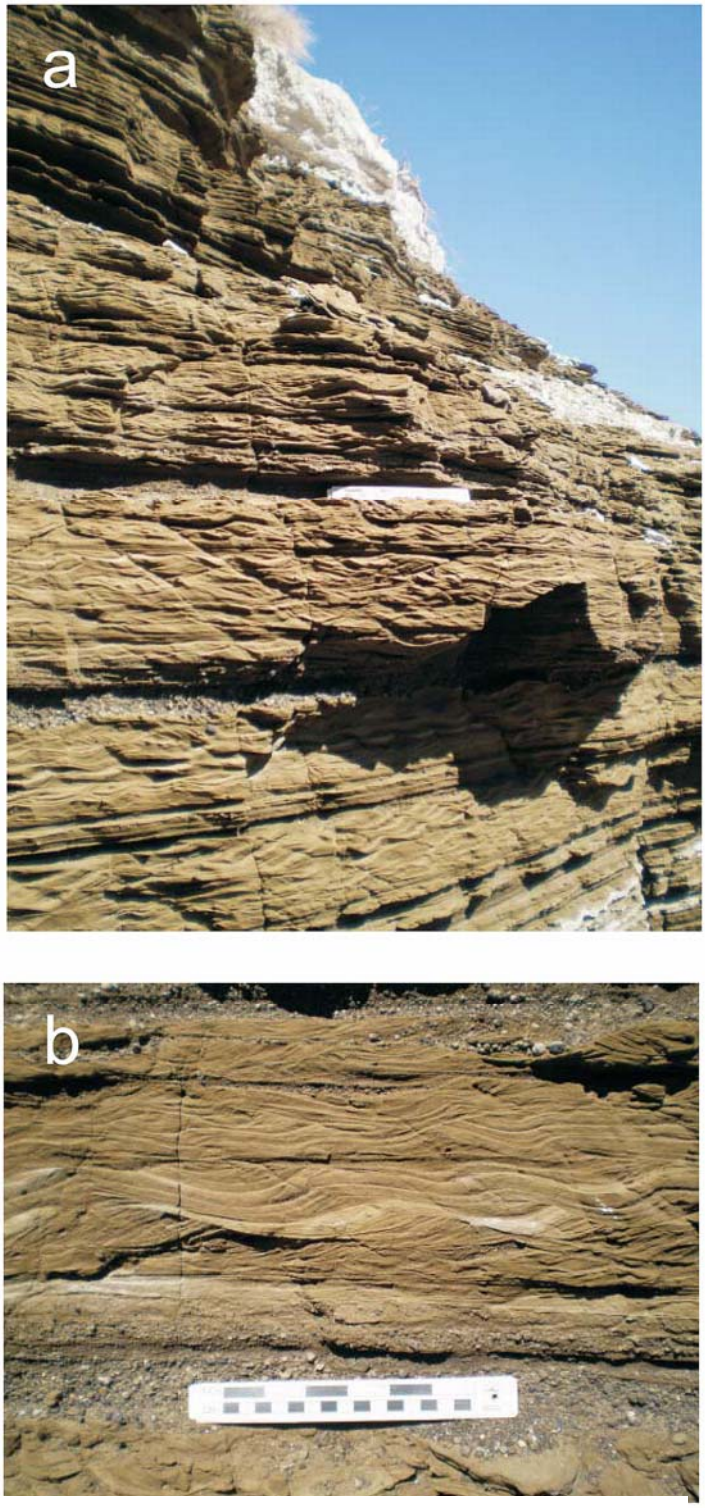


Fig. 4. (a) Outcrop on the north bank of Wilson Creek, 1.8 km WNW of the summit of Black Point. The scale in bright sunlight is 15 cm long. White deposits at the top of the photo are lacustrine beds that overlie these layers. (b) Close-up of ripple beds from Wilson Creek.

subaerial or subaqueous deposits could not usually be discerned by elevation alone. Subaerial beds had frequently slumped below water level; subaqueous beds may have acquired subaerial characteristics within dry near-vent exclusion zones [Kokelaar

and Durant, 1983]; and in at least one location at Black Point, primary beds having distinctive subaqueous characteristics were located above the syn-eruptive water line, perhaps deposited within a crater lake. At Pahvant Butte, tephra was reworked to form lacustrine volcaniclastic beach spits along with lagoonal and local deltaic deposits, both above and below the syn-erupted water level.

With these complexities in mind we spent a great deal of time discerning and discussing depositional features that distinguished subaerial from subaqueous deposition. Subaerial deposits at Black Point, and most deposits on the west and north sides of the Pahvant Butte cone [unit UCw of White, 2001] consist of coarse, lenticular pinch-and-swell beds of decimeter thickness that are discontinuous over distances of meters. Broad dune forms with wavelengths of tens of meters on the north side of Black Point also suggest energetic base surges which deposited only briefly on land before traveling over open water. Common armored lapilli (Fig. 3a) suggest an abundance of condensed water within dusty steam clouds, and bedding sags (Fig. 3b) were often visible below coarse blocks or lapilli. These features were frequently used as indicators of subaerial deposition although members engaged in running discussions as to whether such features could survive if deposited in very shallow (<1 m) water and immediately buried. More variable and, to some participants, surprising was the range of subaqueous deposit characteristics. At Pahvant Butte, immediately overlying lacustrine sediments are nearly flat-lying millimeter- to decimeter-thick beds of plane-parallel to broadly lenticular or low-angle cross-bedded ash and lapilli [unit M1 of White, 1996] (Fig. 3c). Bedding sags in these deposits are noticeably absent as are armored lapilli and fine ash in the coarser layers. Broad lenticularity and low-angle cross-stratification likely reflected the outward propagation of horizontal density currents from the subaqueous eruptive vent. At Black point we saw analogous deposits in both more proximal and distal locations. One puzzling exposure was located about 1.9 km WNW of the Black Point summit and 100 m below the syn-eruptive water level (Fig. 4a). Here, intercalated within lake beds on the banks of Wilson Creek, is a ~3-meter thick section of very well-sorted ash beds containing climbing ripples with regular ~10 cm wavelengths (Fig. 4b) and consistent paleocurrent directions that did not point WNW, away from the vent, but roughly SW, away from the paleo-shoreline. The short wavelength and very good sorting suggest low energy, but the consistent paleocurrent orientation and significant water depth suggest ash-laden basal traction currents, probably associated with eruptive activity but influenced perhaps by lake currents.

Back at Pahvant Butte, several meters below the syn-eruptive lake level we encountered still more puzzling deposits of subaqueous origin. In a gully on the north flank of the butte [Fig. 10 of White, 2001] are broadly cross-stratified ash- and lapilli-tuff layers with locally steep-foreset lenses and ripples (Fig. 5a). Composed of moderately vesicular coarse sideromelane, the undulatory cross bedding gives these deposits the gross appearance of dry subaerial surge beds; however at syn-eruptive water level they are overlain by ripple-marked shoreline beds that are in turn capped by subaerial tuff-cone deposits. They are thus subaqueous but were deposited within horizontally moving water currents of sufficient energy to develop wavelengths up to a few meters. These observations emphasized the importance of examining contact relations and environments of surrounding layers before interpreting depositional mechanisms or environments at a particular outcrop.

Fig. 5. subaqueous M3 deposit from Pahvant Butte. (a) cross bedding; (b) large-scale cross-beds, with bedding unconformity indicated by white line and arrow.. Palagonite alteration gives these beds their reddish coloration.

On the road between Pahvant Butte, Black Point, and our start-end point of Las Vegas, Nevada, the spectacular Ubehebe and Lunar Craters prompted animated discussions of how groundwater could mix with magma in arid environments. Death Valley is among the driest places on Earth, yet deposit structures suggest interaction with water throughout most phases of this eruption. Carbon dating and stratigraphic relationships suggest that Ubehebe Crater is only a few hundred years old [Klinger and Sarna-Wojcicki, 2001], making it among the youngest basaltic centers in North America. An early study of base surge deposits by Crowe and Fisher [1973] described such features at Ubehebe Crater and drew similarities with those at Capelinhos and Taal volcanoes.

For many participants this was a first in-depth look at Surtseyan deposits. Nearly all of us learned something about structures, environments or processes we had not previously

appreciated. Palagonitization, for example, which is commonly scorned because it obscures primary textures, became the subject of considerable interest through the insights of trip co-leader Bruce Pauly. Similarly, the little-known relevance of Surtseyan volcanism to kimberlite occurrence was lucidly explained by participants Bruce Kjarsgaard and Nathalie Lefebvre in an evening PowerPoint-and-beer seminar. The small group size (17) and trip length (8 days) allowed for extensive outcrop time and long discussions that are unavailable in large single-day or weekend-long conference field trips. IAVCEI was able to provide support for two students otherwise without aid, which both enriched the trip and benefitted the students.

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IAVCEI Field Workshop
Phreatomagmatic volcanoes of Jeju Island, Korea
13 -17 November, 2007

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A major scientific field workshop sponsored by two commissions (Commission on Explosive Volcanism – CEV and Commission on Volcanogenic Sediments - CVS) of IAVCEI took place on Jeju Island, South Korea between 13th and 17th of November 2007. The field workshop was organised by Prof Dr Young Kwan Sohn (Gyeongsan National University, Jinju) and Dr. Ki Hwa Park (Korea Institute of Geoscience and Mineral Resources, Daejon). The "Phreatomagmatic volcanoes of Jeju Island, Korea: Morphology, architecture, lithofacies, and processes" field workshop was part of the Cities on Volcanoes 5 IAVCEI conference as an optional pre-conference field trip. Field workshops such as that to Jeju Island are an important part of the scientific activities of IAVCEI commissions. The successful Jeju field workshop provided a good template for the organisation of similar field workshops in the future where the objective is to facilitate detailed field discussion on specific areas of volcanology and sedimentology by practitioners with particular interests in the topic (Fig. 1). This field workshop was supported by the Jeju Special Self-Governing Province.

Fig. 1. Group photo of the participants of the IAVCE-CEV-CVS Jeju Island field workshop front of a phreatomagmatic pyroclastic sequence of the Yongmeori tuff ring

The field workshop was intended to bring together researchers interested in eruptive processes of phreatomagmatic volcanism, transportation and depositional processes of pyroclastic density currents, and the reworking and geomorphic evolution of phreatomagmatic volcanoes. Pyroclastic density current evolution, transport and depositional mechanisms are current areas of frontline research in volcanology and also contribute significantly to our understanding of other, non-volcanic gravity current processes. The field workshop further provided an opportunity for discussion of scientific problems arising in the identification of evidence of key eruptive processes from the stratigraphic record of tuff rings, tuff cones and scoria cones. The well exposed sections made Jeju Island a perfect place to study primary mafic explosive eruption generated pyroclastic successions and their reworked counterparts in the distal areas in detail. The great diversity of volcanoes of phreatomagmatic origin and their well-exposed primary and associated secondary volcaniclastic successions catalysed some excellent field discussions about phreatomagmatism. The discussions generated during this field workshop suggest that much more work is needed, in spite of the general perception that small volume, mafic phreatomagmatic volcanic systems are well understood. The Jeju field workshop demonstrated clearly that such systems can be very complex and are a significant potential volcanic hazard in densely populated areas such as Jeju Island.

The multidisciplinary approach of the field workshop program resulted in participation of researchers from diverse areas of expertise such as sedimentology, volcanology, numerical and analog modelling, experimental volcanology and volcanic hazard studies. The field workshop was also an ideal vehicle to disseminate research on Jeju Island over the last 20 years to a wider audience. Further, it provided a window into Korean earth

science that allowed Korean scientists to interact with leading experts in sedimentology and volcanology, and to exchange ideas as well as plan future joint volcanological research in Korea.

Jeju (formerly Cheju) Island is a volcanic edifice located in the sea southwest of the Korean peninsula (between Long. 126'10" and 126' 58", Lat. 33' 12" and 33' 34") between Korea and China. Jeju is 73 km from east to west, 41km from north to south, has 263 km of shoreline and is 1,845km2 in area in the shape of an oval. Mt. Hallasan rises up to 1,950 m in the centre of the island and dominates the landscape. The surrounding plains are occupied by numerous scoria cones and in the near shore areas erosional remnants of phreatomagmatic volcanoes form the dominant volcanic landforms.

Jeju Island comprises extensive mafic lava flows and hundreds of monogenetic volcanic cones with rare and thin sedimentary deposits. The island is poor in surface water; no perennial streams exist and the water resources on the island are dependent almost entirely on groundwater (Won et al., 2006). Early hydrogeological studies drew attention to the importance of understanding the sedimentary facies architecture of Jeju and the need to also understand the various volcaniclastic facies of the island.

The basement of Jeju Island is a Jurassic to Cretaceous granitoid and silicic volcanic rock succession (Sohn and Park, 2004). The U Formation, predominantly a Pliocene marine sand and mud succession (Sohn and Park, 2004), overlies the basement. It is in turn overlain by the the Seoguipo Formation, comprising multiple, superposed hydromagmatic volcanoes with intervening, marine or nonmarine sedimentary sequences of Early to Middle Pleistocene age (Sohn and Park, 2004). A thick succession of Middle to Late Pleistocene basaltic to trachytic plateau-forming lavas overlies the Seoguipo Formation (Sohn and Park, 2004). The youngest volcanics are Late Pleistocene to Holocene primary pyroclastic and reworked volcaniclastic rocks that are well exposed in coastal sections. The most recent mafic explosive volcanism is considered to be as young as Holocene in age, probably only few thousand years old (Cheong et al., 2007; Cheong et al., 2006) and therefore Jeju is considered to be a potentially active volcanic field.

Fig. 2. Group discussion inside the preserved crater of the Ilchulbong tuff cone.

The primary mafic explosive pyroclastic successions are dominated by base surge and phreatomagmatic fall deposits associated with tuff cones, such as Seongsan Ilchulbong (Fig. 2) (Sohn and Chough, 1992), Dangsangbong and Udo (Sohn and Chough, 1993), as well as with tuff rings such as Suwolbong (Figure 3) (Sohn and Chough, 1989), Yongmeori, Songaksan

Fig. 3. Block- and bomb-rich phreatomagmatic lapilli tuff sequence of the Suwolbong tuff ring.

(Chough and Sohn, 1990; Sohn et al., 2003), each formed by explosive interaction of magma and various sources of water. Jeju Island is also a perfect site to observed field and/or outcrop-scale features indicating vent migration, instability of vent zones, and evolution of a phreatomagmatic crater over “hard” and “soft” rock environments (Sohn and Park, 2005). The great variety of volcanic landforms from dry magmatic explosive scoria cones to subaerially formed tuff rings and subaqueously formed tuff cones played an important role in Jeju Island being placed on UNESCO’s World Natural Heritage site list in 2007. Volcanic features such as Mt.Hallasan, the Seongsan Ilchulbong tuff cone and several lava tubes are officially designated as components of the heritage site.

The field workshop started with a general presentation of introduction of the geology of Jeju Island on the 13th November. After the introduction the participants visited Ilchulbong tuff cone, a well exposed tuff ring that has officially become part of the UNESCO’s Natural World Heritage site. Ilchulbong tuff cone has well-exposed eruptive products of a growing Surseyan-style tuff cone. The 180 m high and 600 m across tuff cone remnant has a large preserved crater. The deposits of the tuff cone are grouped into 4 main lithofacies associations in accordance with the composition, texture and relative position to vent location. This site initiated good discussion about the growth of a tuff cone, its erosional processes, and lateral and vertical facies variations. On the second day, the group visited the Suwolbong tuff ring. In this coastal exposure the excellent cross section of the pyroclastic units exposed allowed the group to trace distal phreatomagmatic successions to the more proximal areas, and examine the facies changes from dune bedded base surge beds to more massive facies. This outcrop is certainly world class, and the group suggested its protection for future scientific reference. Discussion on the style of magma – water interaction and the explosion locus location were especially fruitful and suggested future research towards understanding the eruptive mechanism and the 3D architecture of this tuff ring.

On the same day the field workshop visited an older tuff cone. The Dangsanbong tuff cone exhibits erosional features, truncation surfaces and collapse textures suggesting that its vent sites may have been changed in the course of the eruption. On the third day the group spend long time examining the Seoguipo formation. This formation is a complex volcanic and shallow marine siliciclastic succession. During field discussion it became clear that this formation documents a significant time interval and records numerous volcanic and non-volcanic events. Facies relationships suggest that pyroclastic density currents may have entered the sea and/or fed volcaniclastic mass flows carrying volcanic clasts into the shallow marine basin surrounded the growing volcanoes. In the same day, a visit to the Yongmeori tuff ring presented an opportunity to examine a phreatomagmatic volcano in which pyroclastic sequences were dominated by base surges. Discussions about in situ versus post-depositional palagonitisation, as well as the transportation mechanism of pyroclastic density currents, were equally exiting. After the Yongmeori tuff ring the distal phreatomagmatic sequences of the Songaksan tuff ring were examined, including a close view of the reworked volcanic debris (Hamori Formation) apron around the tuff ring. On the fourth day a full day was taken to study the Udo tuff cone pyroclastic units. The Udo tuff cone is one of the type localities from where the in situ remobilisation of accumulating phreatomagmatic tephra is documented (Sohn and Chough, 1993) and this site allowed the field workshop participants to discuss the grain flow and debris fall processes involved in detail.

Beside the field visits to outcrops already considered to be classical in the volcanology and sedimentology literature, the field workshop provided a half day of conference time, during which invited field workshop participants gave presentations from their field of expertise. These were summarised in the Korean language to facilitate the understanding of the large number of non-specialist government officials, educators and other interested parties invited to this meeting.

Among the presentations, Prof Peter Kokelaar (University of Liverpool) gave a summary presentation about our knowledge of Surtseyan style volcanism in which he highlighted the similarities in the sedimentary records of classic Surtseyan eruptions to those sites the field workshop visited on Jeju Island. Dr. Tom Pierson (USGS) summarised the USGS volcanic hazard programs, and highlighted the relevance of volcanic hazard programs in regions not generally considered to be currently volcanically active, such as Jeju Island, in spite of the fact, that the activity may resume in the near future. Prof Dr Hans-Ulrich Schmincke (GEOMAR) provided two thematic lectures. One of his presentations summarised a new approach to understanding volcanic hazards in volcanic fields, where future phreatomagmatic eruptions (similar to those that may formed many of the sections visited in the field during the workshop) may disrupt the life of large communities such as the Managua City region in Nicaragua. He emphasised the need to pursue studies on volcanic fields similar to Jeju Island. The second presentation was a brief summary of the 969 AD eruption of Paektusan volcano located on the border between North Korea and China. This was a good summary of the type of large scale volcanic hazard on the Korean Peninsula that may have to be dealt with in the future. Similar sizes and styles of young (Holocene) eruptions are also known from other part of Korea such as Ulleung Island in the East Sea, where typical volcaniclastic sedimentation associated with silicic caldera systems are preserved in the geological record. A presentation by Dr. Shane Cronin (Massey University) about the 2007 AD lahars on Ruapehu in New Zealand, and Dr Shinji Takarada (Japan Geological Survey) about the 1991-95 Unzen block-and-ash flow events, provided demonstrations of two common types of volcanic hazard that could occur in volcanic regions in Korea. A presentation by Dr Roberto Sulpizio (University of Bari) provided an experimental demonstration of the formation of pyroclastic density currents, similar to those transporting and depositing pyroclasts around phreatomagmatic volcanic vents visited in the field during the workshop.

In addition to the oral presentations, numerous posters have been presented which showed a variety of volcanology research from around the world that has relevance to Korean volcanology. Posters from the Vanautu volcanic arc and Idaho by Dr. Karoly Nemeth (Massey University) showed a diversity of mafic explosive eruption products similar to those the field workshop visited on Jeju Island. A case study by Dr. Teresa Scolamacchia (UNAM) on the effect of pyroclastic density currents highlighted the potential hazards such events may pose to the environment. Geomorphological changes and volcanic hazards of breakout floods after major volcanic eruptions by Dr Kyoko Kataoka (Niigata University) made a point that large scale landscape evolution studies were needed on Jeju Island. Similarly, Dr. Mari Sumita (GEOMAR) demonstrated the importance of understanding volcanic processes in the land – sea interface where potentially dangerous pyroclastic flows can enter to the sea from the land. The poster session was completed by a selection of presentations by Prof Dr Young Kwan Sohn, Mr Jeong Gi Young and Dr Ki Hwa Park from the variety of volcanic facies and processes associated with phreatomagmatism on Jeju Island.

Overall the presentations served as a very effective link between international studies of volcanic processes and studies of the volcanic evolution of Jeju Island. The idea to involve the local community, government offices and non-specialists in this workshop was a very good move, and it is certainly consistent with the basic philosophy of UNESCO's International Year of Planet Earth. The Jeju field workshop also demonstrated clearly that scientific research on phreatomagmatism on Jeju Island is of high quality and the connection between governmental agencies, natural conservation projects and scientist is excellent. The quality of the field sites and the range of volcanic processes exhibited suggest that Jeju Island should be a strong candidate for hosting larger international thematic conferences in the near future, such as one of the IAVCEI – IAS International Maar conference series.

The organisation and scientific backbone of the field workshop was provided by Prof Young Kwan Sohn and Dr Ki Hwa Park, who are to be complimented for their excellent organisation. The field workshop field guide and abstract volume is available from Prof Dr Sohn upon email request (yksohn@gnu.ackr).

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FUTURE IAVCEI MEETINGS

IAVCEI 2008 General Assembly, Reykjavik, Iceland

Date: August 18-24, 2008

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FIRST CIRCULAR (pdf)

3rd International Maar Conference Malargue, Argentina

Date: April, 2009

Contact: Corina Risso-1, Miguel J. Haller-2, Ulrike Martin-3, Karoly Nemeth-4

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Cities on Volcanoes 6 - Tenerife 2009 (Canary Islands, Spain)

Date: November 16-20, 2009

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