

**Measuring and modelling of Volcano Eruption Dynamics (*MeMoVolc*)
Launch meeting, Clermont-Ferrand 17-18 January 2012
(organiser T. Druitt)**



Summary

The launch meeting of MeMoVolc brought together 31 participants from 9 countries of the network. Presentations were followed by a discussion session in which key scientific problems in the field of volcano eruption dynamics were subdivided into a number of categories. A number of proposals were made for networking activities (workshops and scientific exchanges) for 2012 and subsequent years within the context of these categories. Progress was also made in firming-up arrangements for the three summer schools. The meeting was followed immediately by the first open call for participation in networking activities.

Description of the scientific content and the main conclusions from the meeting

The launch meeting of MeMoVolc was held on the 17-18 January in Clermont-Ferrand. It was attended by 31 researchers from 9 countries. All the attendees were either founding participants of the network, or were representatives from the founding groups.

The aims of the meeting were

- To activate the MeMoVolc network;
- To identify some key scientific problems, strategies and deliverables of the network;
- To prepare for the first open call for 2012 activities immediately after the meeting.

The meeting consisted of 23 presentations (originally 25, but two people pulled out at the last moment), each lasting 15 minutes, with 5 minutes of questions. The meeting terminated with a 2-hour-long session of discussion and conclusions.

The talks varied significantly in aim and content. Some speakers focussed on key scientific problems. Other speakers presented techniques available in their laboratories. Some speakers made concrete proposals for networking activities over the next 1 to 2 years of the network.

Summer schools

The titles, organisers, locations and contents of the three summer schools were discussed in some detail.

The 2012 school 'Volcanic ash: from magma to aviation hazard' will be held in Catania (Italy) and organized by A. Neri (Italy), M. Coltelli (Italy) and T. Druitt (France). A provisional list of speakers was drawn up (these have subsequently been confirmed), and the dates were fixed as 25-31 June. An open call for participation will be made in April.

It was agreed that the 2013 school on ‘Magmatic volatiles: from magma to atmosphere’ will be held in Iceland. Care will be taken to avoid a conflict of dates with the IAVCEI Scientific Assembly in Japan, and with another Icelandic meeting on volatiles also planned for 2013.

Proposals for the hosting of the 2014 school on ‘Volcanic unrest: from processes to signals’ were offered by the Azores (Portugal) and, possibly, by la Réunion (France). Both these sites would involve high travel expenses, and the cost estimates will be explored for both locations.

Some specific initiatives were approved for summer schools:

- The reservation of some places for observatory personnel;
- Students bring posters for presentation and discussion;
- Brainstorming a problem by students, with preparation of a manuscript on the topic.

Closure meeting

It was proposed to hold the 2016 closure meeting of the network 'Measuring and modelling volcano of eruption dynamics 2' at the Osservatorio Vesuviana (Italy), hosted by the INGV.

Scientific initiatives

Initiatives for scientific collaboration and networking were subdivided according to the following scientific categories, which arose naturally from the various presentations. Networking initiatives (excluding summer schools) focused mainly on workshops and scientific visits. Emphasis was placed on multidisciplinary initiatives.

Eruption precursors and triggering

Although somewhat marginal to the main theme of the network, a better understanding of eruption precursors and triggering mechanisms was considered to be very important. Three specific proposals were made on this topic.

- A workshop on volcano unrest and eruption precursors to be organized in 2013 by T. Druitt, possibly with colleagues from the IGP (Paris). One important component of such a meeting would be relating data on eruption precursor phenomena (recharge, mixing) to signals via models (P. Papale). This meeting would pave the way for the 2014 summer school on this topic.
- Scientific visits to volcano observatories for the analysis of data pertaining to eruption precursors. This initiative was proposed by S. Tait (absent at the meeting), head of the French volcano observatories..
- The importance of CO₂ flushing as an explosive eruption trigger was stressed by V. Troll (Sweden). This subject will form the basis of networking activities.

Eruption states and regime transitions (mechanisms and signals)

This is a large theme, and is central to the network. Specific proposals within this field were:

- Scientific visits to volcano observatories for the analysis of data pertaining to phreatic systems. This initiative was proposed by S. Tait, head of the French volcano observatories.
- A large Penrose-type workshop on this topic (perhaps co-organised with European, US, etc. colleagues outside of MeMoVolc) in 2014 or 2015.

Importation of research expertise to the observatories

Several participants stressed the importance of importing research into European Volcano Observatories, in particular through the hosting of students (short and exchange visits) and research personnel. Such visits should clearly be at the invitation of the observatory.

A possible suggestion was also raised (by J. Pacheco, Portugal) for a future workshop on observatory cooperation protocols and European standards for observatories.

Multiparameter measurements on pyroclastic products and inversion techniques

Several participants noted the great progress made in our ability to quantify pyroclast textures (vesicles, crystals, particle shapes, etc), and independently proposed a large workshop on this topic. The workshop would bring together experts in new characterization techniques (e.g., tomography) with experimentalists and modelers capable of extracting quantitative information on eruption parameters from such measurements. The topic could also be the focus of student sharing through scientific visits. This initiative will be piloted by M. Polacci (Italy), and will be proposed probably in 2013 or 2014, with contributions from many people including U. Kueppers (Germany), Caroline Martel (France), Edouard Kaminski (France), V. Troll (Sweden), Lucia Gurioli (France), Olgeir Sigmarsson (Iceland).

Multiparameter remote sensing and inversion techniques

There was general agreement in the need for :

- Greater synergy between different techniques of remote sensing (radar, FTIR, IR, UV camera, etc);
- Better constraining the grain size distributions of eruption plumes for the inversion of Doppler radar data;
- The coupling of ground and satellite constraints on mass flux, etc;
- Advancing our ability to invert remotely sensed gas data.

Two specific ideas for workshops were raised

- A workshop bringing together experts of volcanic gas remote sensing using different techniques and inversion models, in order to increase our ability to extract quantitative information on conduit processes. This was proposed by P. Allard (France) and C. Oppenheimer (UK).

- A workshop on the modelling and inversion of satellite remotely sensed data was proposed by A. Harris (France) for 2013.

Multiparameter measurement experiment

An important initiative proposed in the original MeMoVolc initiative was the organisation of a large field experiment involving a range of multiparameter remote sensing instruments, as well as studies of products. The aim of this idea was to bring together much of the expertise present in the network in one field experiment, or series of experiments, and to provide a stimulus for scientific visits between participating institutions.

At the request of the MeMoVolc chairman, an experiment of this sort was proposed at the meeting by A. Harris (France), who suggested Stromboli as a good target. However this idea received criticism from some of the participants, on the basis that enough multiparameter experiments had already been done recently. It was therefore agreed to delay such an experiment until there has been further discussion on this question by the network steering committee.

Models of volcano dynamics (plumes/conduits) and experimental validation

There was general agreement of the need for better models for the ascent and eruption of magma, and for the experimental validation of those models. One problem of particular importance is the real-time estimation of magma flux during eruptions, from measurements of plume height. The difficulties and challenges of this were emphasized by M. Gudmundsson (Iceland) and E. Kaminski (France), who also emphasized the importance of testing plume models using remotely sensed field data. Another challenge is the coupling of models of reservoirs, conduits, and plumes to explore interactions between these parts of the system (M. de'Michieli, Italy).

MeMoVolc has world-class expertise in numerical modelling, as well as excellent facilities for experimentation in the field of volcanic processes (Bari, Geneva, Munich). One important approach will be the integration of experiments of conduit flow with geophysical measurements.

A specific proposal was made by L. Pioli and I. Manzella (Switzerland) for a workshop on modelling of volcano eruption dynamics and associated hazards, to be held in Geneva.

Involvement of MeMoVolc in emerging volcanic crises

It was considered important at the meeting that MeMoVolc should actively seek involvement in volcanic crises in Europe. T. Druitt (France) and L. Francalanci (Italy) proposed participation of selected network participants at a forthcoming meeting on 'Unrest at Santorini Caldera 2011-2012'. Santorini Volcano is in a state of unrest since January 2011. The aim of the meeting is to bring together Greek scientists, overseas scientists and local authorities to assess the hazards and risks associated with the unrest. Greece is not a contributing member of MeMoVolc. It was felt, however, that it was important for MeMoVolc to offer its expertise to our Greek colleagues, and that the meeting provided the opportunity for MeMoVolc to become involved in this emerging crisis. Participation at the meeting would be by invitation only, and would focus on MeMoVolc participants already working on the volcano or solicited by the Greek authorities. ESF funds would be used to cover the travel and subsistence of scientists from MeMoVolc contributing countries or organizations. This meeting will take place on 27 and 28 March on Santorini.

Open calls for participation in networking activities

It is important to note that the many proposals for networking activities now await concrete initiatives from MeMoVolc participants. The first open call will immediately follow the launch meeting in order to benefit from the ideas and synergy created between participants.

A second call for 2012 will follow later in the spring. This call will include applications for participation in the 2012 Catania summer school.

Impact of the meeting on the future directions of the field

The aim of the meeting being mainly to seek out key problems and networking initiatives, the results of the meeting impact more on the future evolution of MeMoVolc than on the scientific field. It is rather the workshops that have been proposed, or are at the planning stage, that will impact the scientific field. We do not therefore elaborate further in this section.

All presentations given at the meeting, plus a full summary of conclusions, will be made available on the MeMoVolc website at www.memovolc.fr

Annexe 1. Meeting programme

Tuesday 17 January

Introduction to the network

09.00–09.20 Druitt, T. What is MeMoVolc?

09.20–09.40 Neri, A. The first MeMoVolc summer school in Catania, 2012. ‘Volcanic ash: from magma to aviation impact’.

Participation of the volcano observatories

09.40-10.00 Allard, P. IGP's Transverse Research Programme in Volcanology in connection to French volcano Observatories and European perspectives

10.00-10.20 Macedonio, G. Implication of the Italian volcano observatories.

10.20-10.40 Pacheco, J. Implication of the Azores Volcano Observatory

10.40-11.00 ----- Coffee-----

Scientific issues and ideas for networking activities

11.00-11.20 Allard, P. Cross-correlations between high-frequency volcanic gas sensing, geophysical parameters and eruptive activity: examples and perspectives.

*11.20-11.40 Barsotti, S. 1. Data-assimilation from remote sensing retrieval. 2. Numerical modelling of volcanic ash dispersal, from injection in the atmosphere to deposition on the ground (**absent**)*

11.40-12.00 Dellino, P. and Zimanowski, B. Integrating interlaboratory experiments on fragmentation, transportation and sedimentation of explosive eruptions: the challenging task of standardizing procedures and measurements

12.00-12.20 de'Michieli Vitturi, M. Dynamics of magma ascent. Disequilibrium processes (degassing and crystallization) and the comparison and validation of modelling results with field and/or laboratory experiments

12.20-12.40 Donnadieu, F. Doppler radar monitoring of the explosive activity at Etna's summit craters with VOLDORAD 2B: toward an integrated approach.

12.40-14.00 ----- Lunch-----

14.00-14.20 Druitt, T. Some proposals for MeMoVolc activities.

14.20-14.40 Francalanci, L. Applications of micro-Sr isotopes to Stromboli and Eyjafjallajokull volcanoes

14.40-15.00 Lavalée, Y. Facilities to monitor the physical and petrological properties of transient magmatic flow and fragmentation

- 15.00-15.20 Gudmundsson, M. 1. Use of high rate GPS measurements and plume observations to link subsurface magma movements with eruption rate and plume dynamics. 2. Methods of defining eruption rate from observations of vent and plume activity
- 15.20-15.40 Harris, A. 1. Integrated geophysical and physical measurements of explosive eruptions (mild and basaltic). Multiparameter networking campaign on Stromboli? 2. Extraction of physical and chemical parameters from satellite remote sensing data.
- 15.40-16.00 Kaminski, E. Monitoring and modelling of volcanic plumes: combining constraints from field studies, direct monitoring and lab+numerical modelling
- 16.00-16.20 -----Tea-----
- 16.20-16.40 Manzella, I. Ongoing experimental researches at the geophysical fluid dynamics laboratory of the University of Geneva.
- 16.40-17.00 Martel, C. Retrieving magma ascent and deformation rates from magma permeability measurements and microlite crystallization in experimental products
- 17.00-17.20 *Métrich, N. Basaltic dike propagation bridging magma properties and dike propagation modeling: toward the organization of a workshop (absent)*
- 17.20-17.40 Oppenheimer, C. Some initiatives for pushing back current limitations in interpretation of volcanic gas composition and emission rate data.
- 17.40-18.00 Papale, P. The FP7 NEMOH network, and possible interactions with MeMoVolc.
- 18.00 -----Retire to the bar, followed by evening meal-----

Wednesday 18 January

Scientific issues and ideas for networking activities (continued)

- 09.00-09.20 Pioli, L. Analogue modeling to understand the conduit dynamics of basaltic magmas.
- 09.20-09.40 Polacci, M. Physical and textural measurements of volcanic rocks to improve rheological models and better constrain models of magma degassing, conduit magma ascent and fragmentation, transition of eruptive style etc
- 09.40-10.00 Sigmarsson, O. Understanding time scales and dynamics of magma mingling/mixing
- 10.00-10.20 Troll V. and colleagues. Petrological and geochemical indicators of volcano behaviour: Merapi volcano, Central Java, Indonesia.
- 10.20-10.40 -----Coffee-----

10.40-12.40 Discussions and conclusions

- 12.40 -----Lunch and end of meeting-----

Annexe 2. Participant list

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|---------------------|------------|--|-------------------------------------|
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