ILP Proposal for the ys 2010-2014:

Volcanoes and society: environment, health and hazards

***Leader Task Force**:*
Prof. A. Tibaldi, Department of Geological Sciences, University of Milan Bicocca, Italy;
***Co-Leaders:** Prof. A. U. Dogan, Dept. of Chemical and Biochemical Engineering, The University of Iowa, USA; Prof. B. Van Wyk de Vries, Lab. Magmas et Volcanos, Université Clermont Ferrand II, France; Dr D. Tormey, ENTRIX, Ca, USA.*

Project summary: Due to the successful development of the last five years of ILP Task Force II, it is now possible to develop and propose a broader approach to the study of the volcanic environment that incorporates its relevance for society. We envisage four main topics to be addressed in the next five years under the umbrella of ILP and other national and international grants, some of which have already been obtained: 1) Study of the relationship between volcanism and tectonics. Several recent works, including a publication by Task Force II in the ILP's IYPE book, highlight the wide gamut of tectonic settings that can accompany crustal magma emplacement, spanning from transcurrent to contractional and extensional deformation. Collection of field data coupled with numerical and analogue modelling will be conducted in order to better understand this topic that has also implications in terms of seismic and volcanic hazard/risk assessment. 2) Analysis of lateral collapses in volcanoes. This represents the continuation of the main topic that has been successfully developed by the past Task Force II, and is related to the study of the causes that trigger lateral instability and failure of volcanoes and the phenomena that accompany this process, including impact assessment and mitigation strategies. 3) Magma intrusion mechanisms. This is of main concern for the understanding of magma chamber formation and magma propagation to the surface and has a major relevance for volcanic risk assessment and for geothermal resource exploration. We plan to develop field studies on eroded volcanoes in order to collect evidence of magma paths below and into volcanic edifices, as well as to carry out field surveys on more recent/active volcanoes and volcanic-rift systems. These data will be combined mainly with cutting-edge analogue modelling. 4) Diagenetic-hydrothermal minerals and human health; this represents a new topic of major concern at the international level. It is well known, in fact, that the air pollution derived from minerals like asbestos can produce severe human diseases; these minerals have been widely studied under both the geological and medical aspects, but in the last years several other minerals have been identified as presenting a significant human health risk, in some cases even more carcinogenic than asbestos. These minerals (e.g. erionite series, fluoroedenite, etc.) can form under specific conditions of P, T, and pH, during geologic processes that involve tectonic motions, volcanism and hydrothermal fluids, which are not yet well understood. The dispersion in the air of these minerals is caused by anthropogenic activities as well as by natural geologic phenomena, also linked to climate changes, such as enhanced erosion. The risk posed by these minerals is related to aspects that are transitional between Earth Science and Medicine: hence, the research will develop and implement a procedure for preventing possible outbreaks of mineral-induced cancer by favouring collaborations between Earth scientists and physicians, and proactive identification and mapping of hazard zones. As society addresses issues related to energy, water, and the environment, Earth scientists must play a wider role and have a seat at the decision-making table in order to provide our perspective and knowledge.

1. Rationale of the project

This project will involve an interdisciplinary team of scientists that has already been established and expanded during the past five years of development of ILP Task Force II. During this time, several projects have been successfully conducted by integrating ILP's funding with other grants, including NATO-LG, IGCP, European Union, and others at the international and national level. Some grants are presently active (such as NATO-SfP, EU-Atlantis, etc.), and will last for the next five years, ensuring an important financial support. We established several new contacts during regional, national and international meetings held under the auspices of ILP, and new topics of concern for volcanic hazard and risk assessment have been discussed and proposed at these meetings. Several new scientists from different countries expressed the desire to join Task Force II; their diverse background and research activities will allow our new Task Force to pursue an interdisciplinary approach linking volcanism and society. We believe this broader theme is of main concern for the international Earth Science community, as

we seek to elevate the relevance of Earth Science to government agencies and the public. Further topics included in this project come from well established studies and are related i) to the magma intrusion mechanisms, and ii) to the analysis of the relationships between tectonics and volcanism. We think that collaboration on these two issues enables us to connect deeper, crustal processes, with magma emplacement to the surface, and extending the focus to processes occurring along volcano slopes. Besides these areas of research for this new project, there is also another new issue that represents innovative fields of potentially wide interest. This is the topic linking minerals formed by diagenetic-hydrothermal processes and human health: this new effort stems from contacts with scientists from other disciplines, such as biology and medicine, and the involvement of some proponents of the present ILP project in a new Italian project studying the hazard posed by a mineral, erionite, that preferably forms in volcanic environment. This suggests that the study of minerals that pose a human health risk can benefit from collaboration between geologists and physicians. This issue already received the aegis of IAVCEI, WHO and IUTOX. IAVCEI in particular, has a commission named "International Volcanic Health Hazard Network" (IVHHN) whose focus is the implementation of research dedicated to the health problems caused by volcanic emissions. Her Coordinator, Claire Horwell, recognized that there is no duplication of focuses between our Task Force and IVHHN, but on the contrary the two initiatives are complementary, and declared the availability to cooperate. We believe that the creation of a new broader focus on volcanism, and the related Task Force, will lay the foundation within ILP for a more complete outlook on the issues related to the interface between volcanism and society. Our group has successfully worked across ILP Task Forces, and we believe that this broader project will enhance those interactions.

2. Novelty of the project

This project will benefit from the combination of well developed research themes with innovative, cutting-edge topics. The presence of classical lines of research with an already established international network of collaborative scientists will allow for a basis upon which to create a successful Task Force. However, we wish to include an added value that derives from two new topics that are at the frontier between Earth Sciences and other disciplines. A major new topic is represented by the application of geological methodologies to the assessment of the human health risk posed by hazardous minerals to society. Apart from asbestos, in fact, there are no systematic studies of the diffusion of other dangerous fibrous minerals in developed and developing countries. This is primarily due to the absence of a multi-disciplinary approach linking geology and medical research; previous work has been conducted only by physicians and only after there had been an anomalous incidence of mesothelioma, such as in Turkey. Some projects have been undertaken in Europe and the USA, but they are once again conducted by physicians with a focus on clinical analyses testing the effects, for example, of erionite fibres on human cells. They have not addressed the occurrence and transport of erionite and the other dangerous minerals, and they have not sought to develop mitigation measures to reduce the health threat in a proactive manner. We believe that a proactive strategy based on prevention must be put forward, with the purpose of identifying the natural sources of the hazardous fibrous minerals, determining the environmental factors favouring transport in the immediate area, and developing mitigation measures to reduce or eliminate the health risk. Time is of the essence in addressing this crucial issue, because the ban of asbestos-containing products is leading to the development of new natural and synthetic replacement materials. Perhaps the most groundbreaking aspect of the research is that we are proposing an innovative approach to problems of this type: past studies, including the work in Turkey, started from the recognition of a major outbreak of pleural mesothelioma, and only later were the geological and environmental causes investigated. In this proposed issue instead, we will take the opposite approach, proposing to determine hazard zones around the natural deposits, and mitigation or avoidance measures to protect public health prior to an outbreak. In this groundbreaking interdisciplinary study, the geological information would be overlain on environmental information. This represents another novelty: The data on the presence of the dangerous minerals in the deposits will be combined with the assessment of the local climatic, vegetative cover, and erosion conditions that contribute to the transport of fibres in the atmosphere.

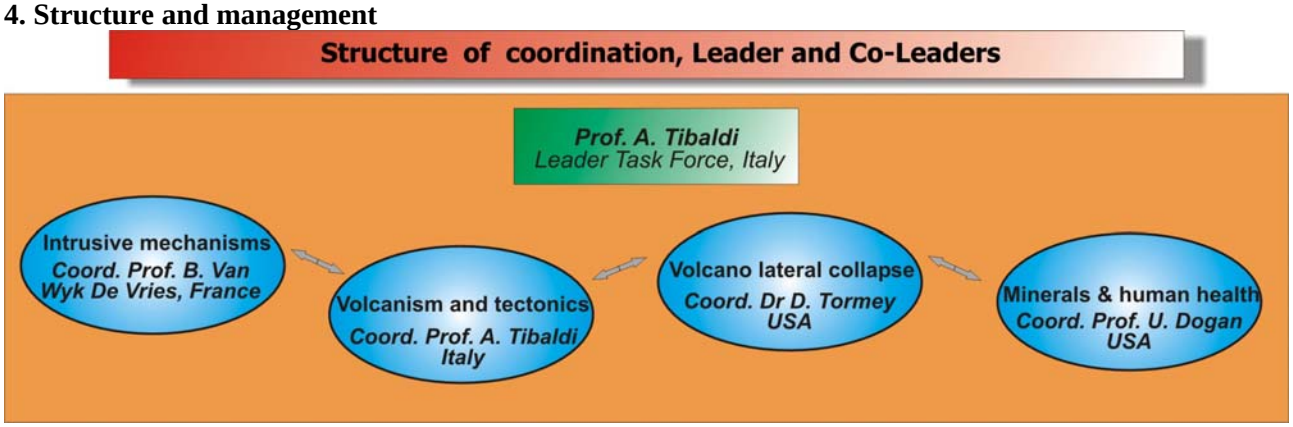
The new issues will be encompassed under a more general umbrella that links surface phenomena with crustal processes. These processes are the propagation of magma through the crust, magma intrusive mechanisms, and the relationships between tectonics and volcanism. These are more classical topics that deserve further development based on the synergy between new field data in different tectonic settings, and analogue and numerical modelling. These areas have been successfully presented across the ILP Task Forces, and we expect this interdisciplinary aspect to continue. Another novelty is of this project is the development of a holistic framework on most of the main aspects related to the propagation of magma from the crust to the emplacement at the surface, and then the relationships between volcanic deposits, surface gravity instability, and exogenous

processes such as erosion, transportation of volcanic dusts, up to the human health aspects. All these issues bear implications to hazard and risk assessment, hazard and risk communication, and hence to the society as a whole.

3. Specific objectives

- understand the tectonic stress conditions and fault pattern that guide the propagation of magma through the crust;
- contribute to understanding the mechanisms that produce the growth of volcanic edifices through sheet intrusions underneath and inside volcanoes;
- conduct interdisciplinary study of the deformation pattern and structures that accompany large scale volcano lateral instability, including societal risks and mitigation;
- conduct interdisciplinary geological and medical surveys aimed at investigating the connection between erosion and air dispersion of specific minerals and the geographic incidence of mesothelioma cancer;
- exchange knowledge and data between European and non-European senior researchers, and provide a training in research methodologies for young researchers and students;
- contribute to the dissemination of ILP initiatives at media and international meetings, and at other institutions;

4. Structure and management



5. Methodologies

As regards the methodologies, described in the following paragraphs, we propose a series of key sites mainly related to ongoing or foreseen granted research projects. Other active and non-active volcanoes will be proposed, during the successive phases of this project, based on increasing co-operation with other international research groups.

5.1. ***Methods for studying intrusive mechanisms***

This issue will be developed by integration of field surveys with numerical and analogue modelling. Field data will be collected in eroded volcanic complexes that preserve evidence of magma paths. These are represented by sheets, spanning from vertical dykes to inclined sheets and sills. Classical field mapping and structural geological surveys will be carried out in different regions and tectonic settings, in order to filter magma paths guided by magma forces from paths guided by tectonic forces or mixed cases. Candidates for such studies are various igneous complexes in Iceland, the Skye complex in U.K., various centres in Sardinia (Italy), the French Massif Central and Little Chief Stock in USA. We will develop specific models representing magma propagation at the margin and above magma chambers under different boundary conditions represented by the different key sites distributed worldwide. Accordingly, it will be possible to determine individual parameters that control the feeding system at each key site, and individuate common geometries and conditions that guide magma propagation towards the surface. By recognizing the geometry of magma-filled fracture paths under different stress fields, rheology of the host rock and of the magma, depth and geometry of the magma chamber, magma flowage orientation. We will have a series of boundary conditions that will be used to guide numerical and analogue modelling of the feeding system. Integrating these data, we will produce models depicting the state of stress/strain around the magma chamber, the effects of magma chamber overpressure combined with far-field stresses, and determination of the most plausible trajectories for magma propagation, eruption, or arrest conditions.

5.2. ***Methods for studying volcanism and tectonics***

In this case there will be an integration of geophysical data, field data, and modelling. Geophysical data will be mainly represented by focal mechanisms, earthquake distribution, Radar interferometry, aimed at depicting the present state of stress and faulting in areas of active volcanism and tectonics. These data will be integrated with the study of other more ancient regions through the application of field structural surveys in order to reconstruct

the kinematics and paleostress tensors of regional and local faulting. These data will be compared with the evolution, morphometry and location of volcanoes. Candidate key sites are: Mt Etna region and Aeolian archipelago (Italy), Tenerife (Spain), various sites in Iceland and in Africa, and East Carpathians (Romania).

5.3. ***Methods for studying volcano lateral collapses***

This will be addressed by studies on the deformation structures present on a series of key volcanoes, namely Mt Etna, Stromboli, and others in France, European and overseas territories and Philippines, all of which are very prone to develop surface landslides as well as deep-seated slope deformations. At Stromboli, in particular, on-shore data will be merged with offshore data coming from recent oceanographic studies. Analogue scaled experiments and numerical modelling will be based on cooperation between different laboratories on an international basis, in order to improve knowledge of procedures, data base, and techniques. This will allow for enrichment of knowledge of the various research groups and training of researchers and students. The stability analysis will be performed by both limit equilibrium methods and deformation analysis through numerical modelling. Limit equilibrium analyses codes will be used to explore the shape of critical slide surfaces within a cone-substrate system, and to explore factors such as critical values of cone height, critical seismic acceleration due to earthquake tectonic events, and magma forces due to the propagation of dykes within the cone. We will use the commercial geomechanical finite difference codes FLAC 4.0 (Itasca) for large-strain simulations of the alternating building and destructive phases represented by growth of distinct volcanic edifices, geometries and their collapse under the effects of internal pressures, different geometries for the substratum and the cone, and thermal anomalies. Modelling will include "ground truth" on rock mass properties resulting from several years of geomechanical surveys and geotechnical tests on volcanoes. The group will also investigate the effect of glacial melting on volcanic cone stability, as glaciated volcanoes in the temperate zones are expected to experience relatively rapid deglaciation and increased landslide/collapse behaviour is expected. Our group will develop risk assessment and mitigations strategies for this phenomenon.

5.4. ***Methods for minerals and human health***

This topic will be addressed through the integration of geological and mineralogical data with epidemiological medical evidence. Researches are currently underway in USA, Turkey, and Italy. Here, geological investigations are aimed at identifying areas that might contain deposits with dangerous minerals such as erionite. Once the most promising rock units are identified, systematic sampling for a statistically valid representation of the rock mass is conducted to verify the actual presence of these minerals. The analyses include: conventional and phase contrast (OM/PCM) optical microscopy, powder X-ray diffraction, inductively coupled plasma-mass spectrometry, Scanning Electron Microscopy (SEM), Energy-Dispersive Spectroscopy (EDS) and Transmission Electron Microscopy (TEM). Such detailed analyses will be conducted to positively identify the presence and type of dangerous minerals. Once the fibrous minerals have been identified, their abundance in the host rock will be evaluated; to this end, it will be necessary to carry out a detailed stratigraphic/structural analysis of the deposits in order to detect the actual extension of the strata containing the natural contaminants. Such stratigraphic/structural studies will be useful for reconstructing the 3-D geometry of the contaminated layers which, during future underground excavation works, open-pit mining, etc., might be inadvertently exposed. Medical investigations will be devoted to verifying in the areas where the dangerous minerals have been found, the human exposure in the form of their actual airborne concentration and of the incidence of cancers classically related to fibrous minerals. This research will also take into account the possible contacts of these individuals with industrial processes where health hazard mineral(s) have been processed. This will allow to establish a possible causal relationship between the incidence of mesothelioma and the presence of the various minerals in the area.

6. Relevance of the project for goals and program themes of the ILP and ICSU scientific unions

Processes such as tectonic deformation, magma upwelling, and crustal state of stress, are all themes classically developed under the umbrella of ILP. These themes will be here studied with emphasis on the relations between magma intrusion, volcanism, tectonics and related hazards. Key sites will be selected from most of the continents, representing all the possible geodynamic settings. The new issue on dangerous minerals and human health is also of global interest, and the diffusion of mesothelioma cancer is increasing in most countries. This means that the results of this project will be useful at the same time in different nations and will represent a valuable data source for scientists and administrative and government panels. Most fibrous dangerous minerals form during lithospheric-crustal processes that might include tectonism, metamorphism, hydrothermalism, as well as more surface processes such as alteration. These also are among the main themes of the IUGG and of the IUGS. Moreover, the dispersion in the air of these minerals is also influenced by other geological processes such as erosion and landsliding, as well as interaction phenomena between the geosphere, hydrosphere and atmosphere.

Hence, we believe that the objectives here proposed address practical problems that involve different program themes of the ILP, notably: Continental dynamics and deep processes, and Continental lithosphere. At the same time, this project will also foster mutual cooperation between IUGS and other ICSU scientific unions like the International Association of Volcanology and Chemistry of the Earth's Interior (IAVCEI), the International Union of Toxicology (IUTOX), as well as with the World Health Organization (WHO), all of which expressed interest in this proposal.

End users of a successful outcome of the proposed work would include national and international government agencies, and the international Earth science and teaching communities, as well as the medical community. This project is international, really interdisciplinary, and inter-institutional. It will promote basic and applied science, providing results of worldwide significance and applicability.

7. Timetable and plans of the research

We propose a five-year Task Force project, during which the five coordinators of the main themes will foster collaboration and exchange of ideas and data. Most of the efforts in the first two years will be devoted to launching and developing the issue of "Minerals and health". From the third year on, it is expected that this new issue will be able to attract presenters at international/national meetings and papers in scientific journals at the same high level as the other, already established issues. More in detail we plan the following schedule:

- *I year:* field data collection at some of the volcanic key sites; analogue and numerical modelling of the various phenomena. Set up of a web site dedicated to the project. 1/2010, in Milan start-up meeting with Leader and Co-Leaders of the present Task Force. Participation and organization of sessions at the ILP workshop planned at St Petersburg. Organization of sessions at the EUG and AGU meetings. 11/2010, meeting with Leader and Co-Leaders of the present Task Force for coordination and verifying of the advancements. Preparation of joint research projects.
- *II year:* field data collection; improvements to modelling. Publication of results. Web site updating. Organization of sessions at the EUG, AGU, and other meetings. Workshop in summer 2011. Preparation of joint research projects.
- *III year:* field data collection within an expanded international co-operation; improvements to modelling. Publication of a special issue of an international journal. Web site updating. Organization of sessions at Earth Science meetings, and at congresses of other science domains such as Medicine, and Communication. Workshop in summer 2012. Preparation of interdisciplinary research projects.
- *IV year:* field data collection and modelling within an expanded international co-operation. Publication of results. Web site updating. Organization of sessions at various meetings. Workshop in summer 2013. Preparation of joint research projects.
- *V year:* field data collection and modelling within an expanded international cooperation. Publication of a special issue of an international journal. Updating and maintenance of the web site. Session organization at various meetings. Concluding workshop.

8. Potential researchers and countries involved (most have already accepted):

Argentina

Dr Andres Folguera, Universidad de Buenos Aires.

Armenia

Prof. G. Bazikyan, Dept. Nat. Centre Oncology of Ministry of Health, Kanaker, Yerevan;

Dr K. Meliksetian, Inst. Geol. Sciences, Armenian Nat. Acad. of Science, Yerevan.

Azerbaijan

Dr Mirza Kazimov, Azerbaijan State Medical University, Baku;

Prof. Musa Mamedov, Geology Institute of Azerbaijan, Baku.

Finland

Prof. Kai Savolainen, Finnish Institute of Occupational Health, New Technologies and Risks.

France

Prof. Benjamine Van Wyk de Vries, Universitè Blaise Pascal, Clermont Ferrand ;

Dr Vincent Cogliano, International Agency for Research on Cancer Monograph programme, World Health Organization, Lyon.

Georgia

Prof. L. Sturua, Non-infective Disease Epidemiology and Health Promotion Department, Tbilisi;

Dr P. Imnadze, National Center for Disease Control and Public Health of Georgia, Tbilisi;

Dr Simon Kuloshvili, Geological Institute, Tbilisi.

Hungary

Dr Ferenc Molnár, Department of Mineralogy, Eötvös Loránd University, Budapest.

Italy

Dr Bianca Rimoldi, Italian Worker's Compensation Authority (INAIL), Milan;

Prof. Alessandro Tibaldi, Dr Alessandro Cavallo, Dept. Geological Sciences and Geotechnologies, University of Milan Bicocca, Milan;

Dr Giuseppe Castellet e Dr Achille Marconi, Istituto Superiore della Sanità, Roma;

Dr Alba P. Santo, Dept. Earth Sciences, University of Florence;

Prof. A. Gianfagna, Dr Paolo Ballirano, Dr Giovanni B., Dept. Earth Sciences, Univ. of Rome "La Sapienza";

Dr Federico A. Pasquarè, Dept. Chemical and Environmental Sciences, University of Insubria, Como;

Dr Filippo Camerlenghi, Proteus Association for Environmental Education, Como;

Dr Tiziana Apuani, Prof. Giorgio Pasquarè, Dipartimento di Scienze della Terra "A. Desio", Università di Milano;

Dr Valerio Acocella, Dipartimento di Scienze Geologiche, Università di Roma Tre, Roma;

Prof. Alberto Renzulli, Istituto di Vulcanologia e Geochimica, Università di Urbino.

Kirghizstan

Dr Andrey Koryenkov, Institute of Communication and Information Technologies, Bishkek.

Mexico

Dr Gerardo Carrasco-Núñez, Centro de Geociencias, Campus UNAM Juriquilla.

Philippines

Prof. Alfredo F.M. Lagmay, University of the Philippines, National Institute of Geological Sciences, Quezon City.

Romania

Dr Alexandru Szakács, Ioan Seghedi, Olimpiu Pop, Anna Paula Vinkler, Sapientia University, Dept. of Environmental Sciences, Cluj-Napoca.

Russia

Dr Alexander Strom, Institute of Geodynamics, Moscow;

Dr Vera Ponomareva, Institute of Volcanology and Seismology, Russian Academy of Sciences, Petropavlovsk-Kamchatsky.

Spain

Dr Angelo Camerlenghi, ICREA, Istitució Catalana de Recerca i Estudis Avançats, and University of Barcelona, Facultad de Geología.

Switzerland

Dr Paolo Oppizzi, Director of the Gole della Breggia Park, Southern Ticino.

Turkey

Prof Meral Dogan, Department of Geological Engineering, Hacettepe University, Ankara.

Prof Y. Izzetin Baris, University of Hacettepe in Ankara, Turkey;

Prof Salih Emri, and Dr Murat Tuncer, Hacettepe University School of Medicine in Ankara.

United Kingdom

Prof Ken Donaldson, FRC Path ELEGI Colt Laboratory, Queen's Medical Research Institute, 47 Little France Crescent, Edinburgh EH16 4TJ;

Dr Tracey Jones, Respiratory Department, St Mary's Hospital, Parkhurst Road, Newport, Isle of Wight;

Prof. Derek Rust, Dr Nick Koore, University of Portsmouth;

Prof. Agust Gudmundsson, Department of Earth Sciences, Royal Holloway University of London, Egham, Surrey.

U.S.A.

Prof. A. Umran Dogan, Department of Chemical and Biochemical Engineering, The University of Iowa, Iowa;

Dr Dan Tormey, ENTRIX, Ventura, California;

Prof Michele Carbone, and Dr Haining Yang, University of Hawaii;

Dr Nancy Cox, and Dr Ian Steele, University of Chicago;

Dr Harvey Pass, NYU School of Medicine and Clinical Cancer Center;

Dr Joseph Testa, Fox Chase Cancer Center;

Dr. Nels F. Forsman, Department of Geology and Geological Engineering, University of North Dakota, Grand Forks.

Curriculum Vitae, Leader
Prof. Alessandro TIBALDI, Ph.D.

Date of birth and Nationality: 26 January 1961, Italian
Address: Department of Geological Sciences and Geotechnologies, University of Milan-Bicocca, Milan, Italy; e-mail: alessandro.tibaldi@unimib.it, tel. 0039 02 64482052

Degrees: 1985 - Msc in Geological Sciences, Univ. of Milan; 1990 - PhD in Earth Sciences, Univ. of Milan.

Present positions: Associate Professor, Dept. Geological Sc. and Geotechnologies, Univ. of Milan-Bicocca, Italy; Erasmus Professor at Portsmouth University, U.K.

Past positions:
2006-07 Erasmus Professor at Brunel University, United Kingdom;
2005-08 Vice-Director of Milan Bicocca University Dating Center;
1998-1999 Assistant Professor, Dept. Earth Sciences, University of Milan I and Milano-Bicocca;
1993-1997 Researcher, University of Milan I;
1991-1992 Fellowship of the Italian National Institute of Geophysics - NGV;
1990 and 1991 Visiting Scientist, Inst. Earthquake Prediction Theory and Mathem. Geophys. of Moscow and Inst. Volcanol. and Geochemistry of Petropavlovsk-Kamchatski (Russia).

Languages: English (fluent), Spanish (fluent), Italian (mother tongue).

Coordination of research groups and research grants:
2009-14 Italian Coordinator of transatlantic project **USA-UE** Atlantis-INVOGE; 2009-10 Coordinator of project "Assessment of potential exposure to erionite for Italian workers in central-southern Italy", Italian Worker's Compensation Authority (**INAIL**); 2008-10 Co-Director of **NATO**-SfP project "Geo-environmental security of the Toktogul hydroelectric power station region, central Asia"; 2009 Coordinator of **MIUR** "Earth Sciences for renewable energetic resources: Italy-Argentina"; 2005-09 Leader **International Lithosphere Program**, Task Force II; 2005-07 Member of the Italian National Committee of coordination of all the Italian research projects on active volcanoes under the **INGV** – Civil Protection Agency agreement; 2005-07 Coordinator of national **INGV-DPC** project on "Assessment of volcanic hazards at Stromboli and Panarea volcanoes, Italy"; 2006-07 Coordinator of **MIUR** project on Nisyros (Greece) resurgent caldera; 2003-05 Leader **NATO** project "A multidisciplinary approach to recent geologic catastrophes at subduction zones"; 2003-04 Coordinator of **MIUR** project on Cotopaxi (Ecuador) collapse; 2001-05 Leader of **IGCP** project n. 455; 2003-04 Coordinator of Project of **National Civil Protection** for the Stromboli volcano emergency "Analysis of magma paths and dykes"; 2001-04 Coordinator of **FIRB-MIUR** project on volcano collapses; 2000-07 Coordinator of National Research Council (**CNR**)-National Group Volcanology projects on "Lateral collapses at Stromboli Volcano"; 1998-02 Coordinator of **CNR** National project on: "Paleoseismic investigations on active deformations in central Italian Alps"; 1998-02 Coordinator of **National Geological Survey**-CNR project on prototype geological map of Stromboli Volcano; 1996-00 Italian coordinator of **CNR** International Program "Reconstruction of neotectonics for seismic hazard in the Southern Andes of Colombia".

Awards:
2003-07 **Elsevier Award** on the most cited Author, Tectonophysics; 2000 "**Alessandro Volta Award** for Scientific Researches in the European and extra-European mountain belts"; 1999 **Fellow** of the Society for Quaternary and Alpine Geodynamics of Italian National Research Council; 1991 "**Edward A. Flinn Award**" of the International Lithosphere Program - IUGG; 1988 "1987-1988 **Mario Oxilia Award** on Geology and Structure of the Alps" of the Geological Society of Italy.

Publications:
Author/co-author of **2 scientific books**, **102 refereed papers** in international journals, and **4 geological maps**, most on volcanic areas.

Curriculum Vitae Co-Leader
Prof. A. Umran Dogan

Present positions: Professor, Dept. of Geological Engineering, Ankara Univ., Turkey; Adjunct Professor, Dept. of Chemical & Biochemical Engineering, University of Iowa, USA, umran-dogan@uiowa.edu

Education

1974 BS & MS, Geological Engineering, Istanbul University, Istanbul, Turkey; 1979 MS, Geology, Ohio University, Athens, Ohio, USA; 1984 PhD, Geology, University of Iowa, Iowa City, Iowa, USA

Positions and Employment

- 1974-75 Geological Engineer, Mineral Research and Exploration Institute, Ankara, Turkey.
- 1983-89 Post-Doctoral Research Assistant, Central Electron Microscopy Facility, Univ. of Iowa, USA.
- 1989-90 Research Scientist & Assistant Prof., Res Inst King Fahd Univ. Petroleum and Min., Saudi Arabia.
- 1991-93 Instrument Research Facilities Manager, Dept. Geol. Geophys. Sc., Princeton University, USA.
- 1993-05 Assistant/Associate Professor, Department of Geological Engineering, Ankara University, Turkey.
- 2005-Present Full Professor, Department of Geological Engineering, Ankara University, Turkey.
- 1995-00 Adjunct Assistant Professor, Department of Geoscience, University of Iowa, Iowa City, USA.
- 2000-03 Adjunct Assistant Professor, Dept. of Chemical and Biochemical Engin., Univ of Iowa, USA.
- 2003-05 Adjunct Associate Professor, Dept. of Chemical and Biochemical Engin., Univ. of Iowa, USA.
- 2005-Present Adjunct Full Professor, Dept. of Chemical and Biochemical Engineering, Univ of Iowa, USA.

Honors & Awards

1980 The First Place Team in PL/C Programming Contest, University of Iowa, USA; 1982 Graduate College Fellowship, Department of Geology, University of Iowa, USA; 1988 Cecil Award, the 46th Annual Meeting of the Electron Microscopy Society of America, USA; 1995 Golden Hammer Award, Geological Chamber of Turkey; 2005 Vera Wenger Award, College of Public Health, University of Iowa, USA; 2008 Landon Foundation-AACR INNOVATOR AWARD, American Association for Cancer Research.

Professional Experiences

- 1985-present Extensive experiences for field work for mineralogy-petrology-geochemistry at the Western Interior of the USA, Central Anatolia of Turkey, and some part of Europe.
- 1985-present Quantitative mineralogy of rock forming minerals and biominerals using state-of-the-art techniques including electron microscopy, x-ray microanalysis, and powder x-ray diffraction.
- 1990-present Quantitative aspects of Medical Mineralogy including zeolite, asbestos and clay minerals.

Research Grant coordination or co-coordination

1981 Energy Reserve Group, Houston, Texas. Diagenetic history of the Parkman Formation, Powder River basin, Wyoming**;** 1988 The University of Iowa. Indian fly ash characterization using electron microscopy and x-ray microanalysis techniques**;** 1990 Rolls-Royce and Research Institute of the King Fahd University of Petroleum and Minerals. Sulphidation mechanism in coated and uncoated turbine blade materials**;** 1990 Aramco Petroleum Company and Research Institute of the King Fahd University of Petroleum and Minerals. Determination of electrical parameters for resistivity log interpretation**;** 1991 Fuisz Technologies. Characterization of spun oil - sugar systems; 1991 The University of Iowa. Paragenetic sequences of diagenesis of the Shannon Sandstone, Powder River basin, Wyoming**;** 1996-98 Turkish National Petroleum Corporation. Evaluation of hydrocarbon potential of the Tuz Golu basin, Turkey; 1998-99 Ministry of Health of Turkey, Division of Fight Against Cancer. Arsenics in water and soils of Kutahya, Turkey**;** 2000-02 Ankara University Research Foundation. Fluorites in Central Anatolia, Turkey**;** 2004 CGRER Funding, The feasibility of using optical microscopy for characterization zeolite group minerals that may be causing fatal mesotheliomas in genetically predisposed individuals**;** 2004-06 American Cancer Society, Characterization of initial samples containing erionite group minerals from Cappadocian region of Turkey; 2005 ARAMEC Funding. Relationship between mesothelioma and erionite, Part-I**;** 2006-10 National Institute of Health PO-1, Genetic/Environment Interaction in Mesothelioma Pathogenesis; 2011-12 NASA NSPIRES Testing Hypotheses of Formation for Home Plate at Gusev crater, Mars.

Publications**:** 24 Peer-reviewed journ. papers; 7 Int. book & encyclopedia chapters; 9 Proceedings; 1 book editor.

Curriculum Vitae Co-Leader

Dr. Daniel Tormey

Date of birth and Nationality: 22 January 1960, USA

Languages: English (native) and Spanish (fluent, written and spoken).

Education

PhD in Geology and Geochemistry, 1989, Department of Earth, Atmospheric and Planetary Sciences, Massachusetts Institute of Technology

BS in Geology and Civil Engineering, Stanford University

Career/Employment

Executive in Residence, California Polytechnic University, San Luis Obispo, , 2006-Present;
Senior Principal, ENTRIX Inc., 1992-Present;
Manager of Remediation and Hydrogeology, Groundwater Technology, 1990-1992;
Research Scientist, Massachusetts Institute of Technology, 1983-1989.

Specialization

(i) current research interest: volcanology, environmental impact assessment, public outreach and facilitation, natural hazards;
(ii) main fields: Geology, geochemistry, volcanology, civil engineering, environmental science, air quality, water quality, sediment transport analysis;
(iii) other fields: Environmental restoration, ecology, geomorphology.

Honours, Awards, Member of coordination committees

- National Academy of Sciences: named by the Academy to the 7-person Scientific Advisory Board guiding the development of the Environmental Management Plan for the Giant Sequoia National Monument, and continuing monitoring, 2001 to present.

Membership of Professional Societies

American Geophysical Union; Geological Society of America; International Association of Volcanology and Chemistry of the Earth's Interior; American Association of Petroleum Geologists.

Scientific publications

- Number of papers in refereed journals: 9

- Number of communications to scientific meetings: 12

- Number of technical reports: >100

Curriculum Vitae Co-Leader
Benjamin van Wyk de Vries

Nationality: British, ***Date of Birth***: 19/04/1963

Affiliation and Address: Département des Sciences de la Terre, Laboratoire Magmas et Volcans, Observatoire de Physique du Globe de Clermont, Université Blaise Pascal, 5 Rue Kessler, 63038 Clermont-Ferrand, France, email: B.VanWyk@opgc.univ-bpclermont.fr

Professional Preparation
- Bedford College, London University, U.K., BSc. Geology, 1982-1985;
- Open University, Milton Keynes, U.K., PhD, 1989-1993 ;
- Université Blaise Pascale, Habilitation à Diriger des Recherches, 2001.

Appointments
- 9/2002-. Labor. Magmas et Volcans, Dép. sciences de la Terre, Univ. Blaise Pascal, Clermont-Ferrand. Full Professor.
- 9/1998-. Lab. Magmas et Volcans, Dép. sciences de la Terre, Univ. Blaise Pascal, Assistant professor.
- 1-9/1998. The Open University, Milton Keynes,UK, Research Fellow (Post Doc).
- 11/1985-1/1991, INETER, Managua, Nicaragua, Volcanology advisor.

Recent positions of responsibility and organisation
Vice president of the Department of Earth Sciences, Université Blaise Pascal (2001-2006)
Head of volcanology Research Group, Laboratoire Magmas et volcans (2002-2007)
Coordinator for International Relations, Laboratoire Magmas et volcans (2007- Present)
Associate Editor of Bulletin of Volcanology.

Synergistic activities
• ERASMUS visiting professor: Trinity College Dublin Ireland (2005 – 2009), University of Iceland (2008);
• Visiting lecturer: Peru 2003, 2005 (Porras Barranchea Network – Franco Peruvian University network);
• Lecturer and Coordinator (2003-2007), ALFA project CENRALRISK – a masters project set in Central America for the development of the Science base for Nicaragua, El Salvador and Mexico;
• Advisor on Natural hazards at Instituto Nicaraguense de Estudios Territoriales (INETER) 1985 – 1997: A Long Term commitment to the communication of natural hazard affair to the civil defence and planning sector of the Nicaraguan Government;
• Advisor of Scientific communication, 'Volcan au Ciel Ouvert' (2005-2009). This volcano-quarry in the Chaine de Puys, France is used as a teaching aid for baccalaureate and general public education about volcanic and geological processes.

Thesis Advisor and Postgraduate-Scholar sponsor
PhD: 1999- present 13 in total
Masters: 21 projects at UBP since 1999

Publications:
Over 40 since 1996.