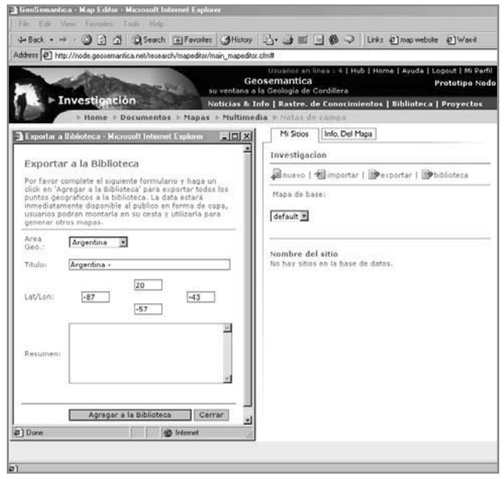
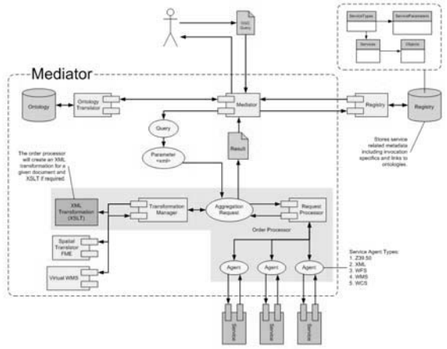
GeoSemantica Update

GeoSemantica continues to attract interest from government, universities and industry in South America and Canada. Queens University in Kingston, Ontario, will be running a GeoSemantica mirror site. This site will be used by industry and academic researchers to assess GeoSemantica's capability as a tool to manage natural hazards information for transportation corridors throughout Canada. The GeoSemantica development team continues to refine the prototype and add additional functionality requested by members of the working group and other stakeholders. Earlier this month functionality was added to enable users to export data created in Field Notes to the Library directly. This feature will allow scientists and researchers to easily share information with other stakeholders in the community.



Left: GeoSemantica's new feature: Exporting Field Notes to the Library.

The development team has been busy designing next generation GeoSemantica code named "Phoenix". The next generation system will include a state of the art semantic interoperability engine, cascading style sheet layout and presentation, configurable modules, multilingual support, an improved architecture, and much more. The development team is developing and testing several



Right: Preliminary design for Semantic Interoperability engine.

prototype components based on the new architecture which is being built on Microsoft's .NET framework. Preliminary results indicate an improvement in performance and the maintainability of source code.

The GeoSemantica development team is continuing to explore the potential of providing "near real time" data, such as earthquake epicenters, and is working with other government agencies in Canada to develop a prototype for review by members of the GeoSemantica working group.

For more information about future developments and technologies please contact Mr. Joost van Ulden by email at: jvanulde@nrcan.gc.ca.

Mr. Joost van Ulden

Landslide Hazards and Remote Sensing Updates

From February 1–5, MAP:GAC will hold a multinational workshop in landslide hazard assessment methodologies and standards at the Venezuelan Geological Survey (INGEOMIN) and Central University of Venezuela. For five days, international experts, geoscientists and engineers from the seven countries of the Andean region and Canada will be presenting and reviewing the various methodologies and classification systems applied by MAP:GAC partners in their landslide hazard assessments. The workshop will be guided by Dr. Oldrich Hungr (landslide expert from the University of British Columbia, Canada), Dr. Reinaldo Garcia (Coordinator of the Environmental Disaster Research Center [CEDA] Central University of Caracas) and Ms. Monica Jaramillo (MAP:GAC Landslides Sub-Project Coordinator). The event includes the participation of Mr. Alain Grignon from the Geological Survey of Canada's Landslide Project and of Ms. Virginia Jimenez from the Simon Bolivar Geographical Institute of Venezuela.

Furthermore, from February 6–10 there will be a workshop in Remote Sensing at INGEOMIN. Remote Sensing techniques applied in geohazards will be presented. Participants at this workshop will be INGEOMIN and its Venezuelan guests such as Fundación Venezolana de Investigaciones Sismológicas –[FUNVISIS] (*Venezuelan Institute for Earthquake Research*), Ministerio de Minas (*Ministry of Mines*), Universidad Central de Venezuela (Caracas), Universidad de los Andes (Mérida), and the Instituto Geográfico "Simón Bolivar" (*Simon Bolivar Geographical Institute*). The workshop will be given by Dr. Vern Singhroy (Canadian Centre for Remote Sensing –[CCRS] and chair of the Landslide Hazards Team at the Committee on Earth Observation Satellites [CEOS]), Ms. Katrin Molch (contractor), and Dr. Sergio Espinosa (MAP:GAC Remote Sensing Sub-Project Coordinator).

On February 5, there will be a joint field trip to the Estado de Vargas, north of Caracas, where massive rain-triggered landslides and mudflows took place in December 1999. Participants on this field trip will be all attendees at both workshops in Caracas (Landslide Hazards and Remote Sensing).

In order to support the ongoing activities in Remote Sensing in all MAP:GAC project areas, the *PCI* licenses for Argentina, Bolivia, Chile, Ecuador, and Venezuela will be delivered to the users, the latest during the meeting of the Geoscience Working Group (GWG) during the first week of March in Vancouver.

Ms. Monica Jaramillo and Dr. Sergio Espinosa

For further MAP:GAC information please consult the project Web page at http://www.pma-map.com
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Internal Newsletter of the Multinational Andean Project: Geoscience for Andean Communities
Vancouver, Canada, February 2004 www.pma-map.com Vol. 3 - No. 11

Geoscience contribution to risk management

From the Manager's Desk

February 2004

The new year has brought a flurry of activity for MAP:GAC staff. The first trip of the year for me was to Chile. I was invited to Santiago to help SERNAGEOMIN make the case for the importance of geoscience to their government. I was able to meet with their Minister of Mines as well as other high ranking officials in other departments. As I write this, I am on my way to Bolivia to meet with the new head of SERGEOMIN to help them make a similar case. These trips have emphasized for me the importance of ensuring that senior government officials both within ministries responsible for natural hazards and other ministries understand the role geoscience plays in hazard mitigation and risk management.

Each of the MAP:GAC countries is signatory to a number of recent international declarations (Summit of the Americas, UN/ISDR, CAF, UNESCO) stating the importance of strengthening work in natural hazard mitigation for disaster reduction. However, the message that has not yet been conveyed upward well (within most governments) is the contribution that geoscience information makes to disaster reduction, and how the country's support of geoscience helps it contribute and meet its international obligations under these declarations.

Geoscience is part of the foundation information a community needs in order to address land use and emergency planning needs. The community must know the full range of hazards they face. From earthquakes to landslides to volcanic eruptions to train derailments and flooding — how great are each of those threats? Only geoscience can answer the question, "What is the frequency and magnitude of hazardous geological events?" Once this information is known, then geoscientists, working in collaboration with other institutions, can weigh the risk to the community and place natural hazards into a community context for risk management.

Usually few dollars are available for mitigation. Despite evidence of the economic payback of mitigation, few politicians are willing to set aside money to help lessen the impact of an event that might occur decades in the future (when they are unlikely to be in office). However, we must always remember that mitigation includes such basic and low cost items as raising public awareness about hazards through public meetings, visiting schools, or meeting with local authorities. When funds for mitigation activities are available, geoscientists and geoscience information can help prioritize the spending of this money. Where will the community get the most "bang for its mitigation buck"? Where is effort in policy decisions such as building codes and zoning bylaws best focused? Geoscience can make a lasting and substantial impact on community planning; as geoscientists we have to work hard to ensure that this critical element is not forgotten.

Dr. Catherine Hickson

Community Communications

Dr. Fernando Munoz and Lic. Roberto Page at the Community Communications Workshop at GSC Vancouver (January 14, 2004).

The Community Communications Sub-project continued work during the month of January in Vancouver. On January 14, Mr. Don Howes, Assistant Deputy Minister of Sustainable Resource Management of the Province of British Columbia, Canada along with Dr. Craig Weaver, Pacific Northwest Coordinator for Earthquake Hazards Program at the U.S. Geological Survey, Ms. Carolyn Driedger of the US Geological Survey Canscades Volcanoe Observatory, Ms. Rosanna Von Sacken Emergency Planning consultant from British Columbia met with MAP:GAC management team as well as Dr. Fernando Munoz (Community Communications contractor) and Lic. Roberto Page (MAP:GAC Technical Coordinator) to discuss the roll of geoscience in land-use planning and emergency planning. The objective of the meeting was to help the Community Commincations subproject coordination team elaborate on its strategies for integrating geoscience knowledge into land-use planning and emergency planning organization procedures. During the month of February Munoz and Mr. Mike Ellerbeck will visit Venezuela to continue the Case Study country visits.

Mr. Mike Ellerbeck

Volcanic Ash – A Hidden Health Hazard

For millennia, humans have known that volcanic ash is immensely fertile, giving great agricultural productivity around the world. In fact, almost 10% of the world's population (455 million people) lives within 100 km of an active volcano, and many take advantage of this rich resource. There are concerns, however, that volcanic ash could cause health problems for people exposed to it for decades. Although eruptions are often short-lived, volcanic ash can remain airborne for years, being remobilized by human activity, wind and debris flows.

As recent advances in volcanology have been made, interest has grown in the impacts of volcanic emissions on human respiratory health. The issue is particularly pertinent in parts of Central and South America where large cities are rapidly expanding close to highly-active volcanoes, for example, Mexico City and Quito.

Recently, the need for assessment of the respiratory health hazard of volcanic ash was recognized following the discovery of cristobalite, a type of crystalline silica, in the volcanic ash of the Soufrière Hills, Montserrat (Baxter et al. 1999; Horwell et al. 2003a). Cristobalite is considered to be a human carcinogen (International Agency for Research on Cancer 1997) and is also capable of causing silicosis, a potentially-fatal fibrotic respiratory disease. Cristobalite is considered to have a greater potential to cause lung disease than the more common silica polymorph, quartz, which is also common in volcanic ash. The pathogenicity (disease-causing potential) of cristobalite has been proven through industrial studies mainly from mining and quarrying investigations. Although volcanic ash contains these silica polymorphs it is still not clear whether it is capable of causing silicosis and lung cancer and by which mechanism the toxicity would occur.

Volcanic ash is re-mobilised by various human activities including driving and gardening. Photos from Montserrat, West Indies., taken by P. Baxter.

The eruption of Mt. St. Helens in 1980, provided the first opportunity for the detailed study of the potential respiratory health hazard of volcanic ash. This opportunity arose because the eruption took place in a wealthy country and affected several major population centres. Over forty papers were published on the health hazard of volcanic ash from Mt. St. Helens. Most of the work carried out has been either medical (epidemiological and clinical studies) or toxicological (using cells or animals). Most of the epidemiological work to date showed that the ash is capable of causing short-term problems such as asthma, bronchitis and inflammation of the lung but few studies have addressed the long-term problems because of difficulties involved with following populations over decades. Toxicological studies have varied greatly in design, samples used and controls chosen. The Mt. St. Helens studies showed great variation in results, with some finding the ash to be highly toxic whilst others found it to be completely inert. Results often depended on dose administered and duration of exposure. As with smoking-related disease, duration of exposure is crucial, with disease symptoms not expected to occur for years or decades from initial exposure. Vital clues about the toxicity of ash are obtained from mineralogical characterisation of samples giving information about the size and composition of particles – if particles are too coarse, they simply can not reach the deep lung, and, therefore, can not initiate toxic reactions.

Since the eruption of Mt. St. Helens, the Soufrière Hills volcano, Montserrat and Mt. Sakurajima, Japan have been studied in detail. The Soufrière Hills ash not only contains cristobalite, but significant amounts of respirable material (particles of < 4 μm diameter which are capable of reaching the gas-exchange area of the lung where toxic reactions take place). The cristobalite is, in fact, concentrated in this respirable fraction, suggesting a significant health hazard (Horwell et al. 2003a). To compound the difficulties in assessing the health hazard, analysis of the Soufrière Hills ash gave clues that crystalline silica may not be the only harmful mineral in the ash. The surface of ash particles also contain reduced iron, which is capable of reacting with hydrogen peroxide to form hydroxyl radicals (Horwell et al 2003b). If these form in the lung, they can wreak havoc by attacking DNA and lipids, causing great damage, which could be a catalyst for cancer or silicosis. The respirable fraction of the Soufrière Hills ash has been better characterized than Mt. St. Helens samples, and toxicological studies were better calibrated between laboratories by using similar samples and controls. In general, these studies have found the ash to have a similar toxicity to coal mine dust but not be as toxic as pure crystalline silica samples. The ash from Mt. Sakurajima was not well characterized until recently (and was found to contain less than 1 % respirable particles). Despite this, many epidemiological studies and a couple of toxicology studies were carried out here due to the proximity of a large population centre and the fact that airborne ash is present for much of the year. None of these studies found the Mt. Sakurajima ash to cause chronic toxicity.

Apart from these few cases, only a small number of other studies have been carried out, and a number of major eruptions have had no studies published at all (e.g., Mt. Pinatubo, Philippines, 1991). The lack of research means that it is impossible yet to generalize about whether volcanic ash can cause long term health problems in populations exposed for many years. The problems are compounded by the fact that volcanic ash is different in composition and size distribution, and, therefore, potential toxicity, for every volcano. Ash characteristics may even vary for a single volcano since they can change with eruptive style.

The International Volcanic Health Hazard Network (IVHHN) was launched in February 2003 in order to bring together the diverse multidisciplinary international community working on volcanic health hazards, and speed improvements in our understanding of volcanic ash health effects. IVHHN will hold annual workshops and meetings and facilitate interaction through the website and mailing list, which anyone can join (see below for web address). IVHHN has lists of Expert Members, which the scientific or emergency community can draw on for advice or collaboration. Following the success of the first annual meeting, held at the Cities on Volcanoes conference in Hilo, Hawaii in July 2003, IVHHN has been made into an IAVCEI Commission (International Association of Volcanology and Chemistry of the Earth's Interior, www.iavcei.org). IVHHN will hold its second annual meeting at the IAVCEI General Assembly, which takes place in Pucón, Chile in November 2004. Further information can be found on IAVCEI's website.

IVHHN is initially concentrating on the long-term respiratory health hazard from volcanic ash, gas and aerosol emissions. One of the major goals of IVHHN is to write guidelines, formulated by a panel of expert members of IVHHN, on management of ash and gas hazards. Guidelines currently being ratified include information for scientists on how to collect and analyse volcanic ash, information for the public on how to protect oneself from exposure to ash and how to clean up following ash falls, and information for health practitioners on how to advise patients on likely short-term health problems following an ash fall event.

Although it is clear that much more research is needed, volcanologists and decision-makers should be aware that the current lack of consistent evidence for health effects does not mean that they do not exist. There is a sufficient amount known to indicate a reasonable possibility and so the health effects must be a vital consideration in volcanic risk mitigation.

Claire Horwell, International Volcanic Health Hazard Network

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The IVHHN website is :w
www.ivhhn.org

References

In addition to the following references, many appropriate references can be found in the Members section of the IVHHN website.

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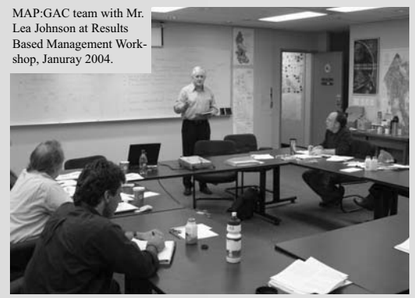
Results Based Management Workshop

Results Based Management is a management philosophy and set of tools that concentrates on the external effects of projects such as MAP:GAC at three levels of results: **outputs**, **outcomes**, and **impacts**. Outputs are short term, and are the concepts, relations, know-how, infrastructure, and resources delivered by and within the life of the project. Outcomes are medium term, and represent changes in behaviour, relationships, activities, and/or actions created by the completion of the Outputs, and can be logically linked to, but not necessarily caused by the project. Impacts are longer term, significant, and lasting improvements to the beneficiary's quality of life. For MAP:GAC our beneficiaries are the people of the Andes, and the expected **impact** is to improve the quality of life for peoples of the Andes by reducing the negative impact of natural hazards (volcanoes, earthquakes, and landslides) by providing updated and integrated geoscience and geospatial information on natural hazards for: 1. Land use planning and, 2. Natural hazard mitigation.

The **outcomes** MAP:GAC is anticipating are: 1. Position the geological surveys so that they can provide to the governments, communities, and planners geoscientific information fundamental to good decision making with respect to the placement of public works (infrastructure), and human settlements; 2. Contribute to mitigation of the effects of natural hazards on the local population and public works (infrastructure), supporting sustainable development by creating less vulnerable communities; 3. Increased capacity of the national geoscience agencies in the evaluation of geological hazards; 4. Ability to assist other government organizations such as civil protection agencies to incorporate geoscience information into emergency plans; and 5. Enhance international and national horizontal cooperation between geoscience agencies and other government departments leading to natural hazard mitigation and risk reduction.



MAP:GAC team with Mr. Lea Johnson at Results Based Management Workshop, Januray 2004.

The course was held to ensure that everyone on the MAP:GAC team understood the RBM concepts and the impact MAP:GAC is trying to achieve. Vancouver staff were joined by Dr. Fernando Muñoz (Consultant, Community Communications) and Lic. Roberto Page (Technical Coordinator) for the two day workshop (January 12–13) given by RBM specialist and long-time CIDA consultant, Mr. Lea Johnson. CIDA adopted RBM in order to have greater rigour in determining what they wanted to accomplish, and how to define it more clearly.

The group reviewed how the sub-projects contribute to the impact and outcomes and discussed how the concepts could be introduced into the country work plans. The work plan format was revised last year, but will need some modification to make the RBM aspects of the project clearer and outputs and outcomes more easily reportable. MAP:GAC team members will be following up with country project leaders to update their work plans for the new fiscal year. **Updated work plans are due February 16.**

Dr. Catherine Hickson