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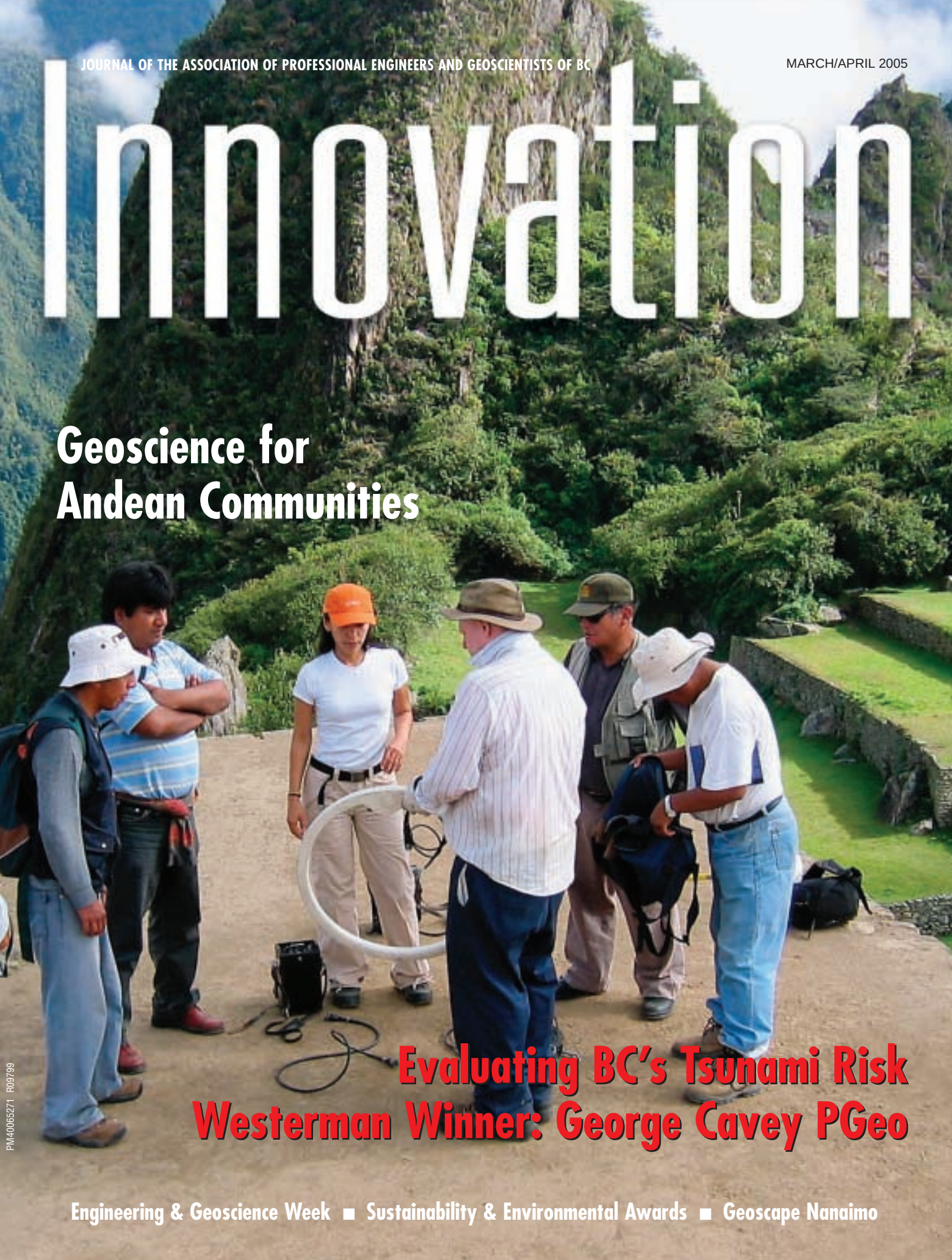
Geoscience for Andean Communities



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Geoscience for Andean Communities

BC Experts Help Make a Difference

Richard L Rogers

The tragic fatality resulting from last January's North Vancouver landslide triggered an outpouring of shock, sadness, and intense public and professional scrutiny. Yet the human cost of landslides in BC stands in stark contrast to the Andean region of South America, where similar events have killed tens of thousands.

A region of physiographic extremes, the Andes pose an ever-present threat of death by geological hazard to millions living in their craggy shadows. It's a situation that a team of Canadian experts — among them many BC geoscientists — is working hard to change through one of the biggest international geohazard projects ever undertaken.

Working out of the Geological Survey of Canada (GSC) Vancouver office, Dr Lionel Jackson PGeo and Monica Jaramillo PGeo are part of the Multinational Andean Project: Geoscience for Andean Communities. A six-year, CDN $35 million program, MAP:GAC aims to contribute to improving the quality of life for people living in the Andes by reducing the negative impacts of natural hazards like landslides, earthquakes and volcanoes.

Improving quality of life depends on numerous factors, two of the most fundamental being personal safety and economic development. Both are closely linked not only to political and social factors, but to natural hazards: that is, only safe, sustainable communities can experience economic development. In this regard, MAP:GAC is helping Andean nations to develop and integrate updated local geoscience information for land use planning and natural hazard mitigation.

A project of this scope is a multidisciplinary undertaking, notes Jackson, a former American who took his PhD at the University of Calgary and has worked with the GSC since 1977. "It's not just geology that's involved; we're collaborating with experts in fields ranging from civil defense to social science," he says.

A Hemispheric Priority

Begun in 2002 under the direction of the GSC's Dr Catherine Hickson PGeo, a widely known volcanology expert, MAP:GAC brings together teams from Argentina, Bolivia, Chile, Colombia, Ecuador, Peru and Venezuela to work closely with Canadian geoscientists.

Using CDN $12 million from the Canadian International Development Agency (CIDA) and in-kind contributions from geoscience organizations in each participating country, the project seeks to increase local knowledge of geological hazards, boost onsite expertise and ability to assess the risks of those hazards, provide better tools for grassroots-level decision making, and improve communications both among and within affected countries.

The goals of MAP:GAC are directly related to the outcome of the 2001 Summit of the Americas in Quebec City and the 2002 followup meeting in Costa Rica, where it was agreed that disaster management is one of the hemisphere's highest priorities and that a more community-oriented approach to disaster reduction is needed.

In keeping with those conclusions, MAP:GAC is addressing the need for community-based strategies on two fronts: 1) improving the capacity of collection,

Facing page, from left: **Geological Survey of Canada landslide specialists Monica Jaramillo PGeo and Dr Lionel Jackson PGeo with colleagues from INGEOMIN (Geological Survey of Venezuela) beside a large block in a rock avalanche in the upper Río Montalban Basin, Venezuela that they sampled for cosmogenic dating.** ***Above and inset:*** **training Peruvian geologists in the use of state-of-the-art shallow geophysics technology at the archeological site in Machu Picchu, Peru in May 2004 (photo: Dr Peter Bobrowsky PGeo).**

interpretation and management of geohazard information, and 2) improving risk communication and institutional cooperation within and between countries so that geohazard information can be disseminated to decision makers and targeted communities.

Jaramillo, who graduated with a degree in geology from the National University of Colombia in 1993, emphasizes the need to make practical use of the life-saving data that geoscience can generate.

"A lot of effort has gone into widening the scope of geoscience from its technical and scientific aspects to the decision-making process. MAP:GAC is very focused on that aspect because, even though geosciences have been important in defining the hazard component of the risk equation, the overall results in terms of risk reduction have been disappointing," she says.

Contrasting Risk

It's difficult for someone living within BC's relatively stable cordillera to imagine how risky life can be amid the geologically active Andes. The area is sprinkled with active volcanoes, often overshadowing large population concentrations; earthquakes regularly rattle the entire region (two of the largest ever recorded occurred there); and the steep, unstable slopes and canyon walls mean that landslides are frequent and very often deadly.

Over the last 100 years these events have killed more than 200,000 in the participant countries, affected over 13 million people and caused more than US $12 billion in damage (data from the OFDA/CRED International Disaster Database). A single event — the combination earthquake and landslide that hit Ancash Department in Peru on May 31, 1970 — killed more than 66,000, injured 143,000 and affected three million people.

By contrast, during the past century there were no recorded deaths attributa-

ble to earthquakes or volcanic eruptions in BC and, according to landslide hazards expert and UBC earth sciences professor Dr Oldrich Hungr PEng/PGeo (writing in *Innovation,* April 2004), between 1880 and 2001 less than 150 people died as a result of landslides here.

Hungr posits three reasons for this disparity: 1) BC's low population density keeps development away from the most exposed lands, 2) Pleistocene glaciers scoured BC's mountain slopes clear of unstable weathered rock, and 3) better and more safety-conscious development policies and control.

Jackson and Jaramillo work specifically in the area of landslides and Jackson cites a fourth factor — disruption of traditional settlement patterns. He has been working in the small city (pop 5,800) of Matucana located on the Rimac River floodplain about 75 km east of Lima, Peru. He says that although preconquest native people may have irrigated and farmed the valley bottom, they would have lived higher up the slopes, with villages and trails well out of harm's way.

"When the area was conquered, and people came in with wheeled vehicles, they needed roads — and it's just not practical to run roads up and down the sides of mountains," he says. "With highways and railroads and so on, all the development and settlement gravitates to the valley bottoms."

Facilitating Local Capabilities

Participants in MAP:GAC include geologists, volcanologists, seismologists, risk communication specialists, remote sensing experts, and even archeologists and social scientists, among others.

Joint pilot projects between Canadian and South American (or among South American) teams are conducted that integrate the latest investigation techniques, enhance the capabilities of national geoscience agencies, and build stronger ties between Andean countries.

One such project is Matucana, which shares the 300 m wide floodplain with, and is separated from the Rimac River by, a main highway and a railway. Debris flows have devastated the city in the past (notably in 1959, when 90% of it was destroyed and some residents killed), and local emergency preparedness organizations have laid out evacuation routes to safe areas on the surrounding hillsides.

During several weeks in the area, Jackson and his MAP:GAC colleagues surveyed and mapped the path of past debris flows and identified potential sources/paths of future events. This involved not only classic geological field traverses, but also archeological surveys and often extensive interviews with local people about conditions surrounding past events (necessary because of a lack of data such as historical rainfall records). He says the lessons learned at Matucana have wide application.

"You can go down or up the valley and you'll find exactly the same types of geohazard situations," he says. "The way you approach the problem in one area, and the elements you have to consider, can essentially be applied to dozens of similar settings in other areas."

Although the survey and mapping work does generate new data, the main goal is to allow the potential that presently resides within the local practitioners to come to the forefront. "It's an opportunity for us to facilitate local capabilities by providing scientific counsel and offering specialized expertise," says Jackson. "Part of our role is to act as teachers and mentors as well as collaborators and colleagues."

Information Integration

Jaramillo, whose interest in geological hazard reduction was spurred by a number of catastrophic geohazard events such as the 1985 Nevado del Ruiz eruption and lahars/debris flow in Colombia that killed 23,000, coordinates the Landslide Subproject of MAP:GAC.

Participating in country-specific activities in the seven project countries, she also integrates international institutions (such as the University of BC, International Consortium on Landslides, Pennsylvania State University, UNESCO, UN's International Strategy for Disaster Reduction and others) and/or international landslide experts to support specific elements of the project.

Jaramillo says a crucial element of the project is risk communication and the exchange of information among Andean

The city of Matucana (pop 5,800) is located in Peru's Rimac River basin (3,398 km^2) in the western Andean Cordillera. The basin holds one of the most important agricultural, mining and commercial areas of Peru as well as the capital city of Lima. Matucana has been partially devastated in the last century by debris flows such as the one from Quebrada Payhua, one of the pilot areas of MAP:GAC.

Left: **Monica Jaramillo and colleagues from INGEOMIN interview Don Luis, a survivor of the 1947 debris flow disaster that dammed Río Chama near Mérida, Venezuela. Because eyewitnesses to this and similar events during the 20th century are reaching the end of their lives, it is important to record their observations of catastrophic events before they are lost.** *Right:* **Dr Lionel Jackson and Peruvian colleagues from INGEMMET (Geological Survey of Peru), the Peruvian Society of Archeology, and Peruvian Civil Defense surveyed the Payhua basin to identify and map potential sources/paths of future debris flows. This data will be used for hazard mitigation and land use planning.**

countries and among their respective geoscience organizations, institutions and local communities.

"Risk communication is a science in itself," she observes, "and an important part of the project is integrating the local community in the decision-making process.

"Once local decision makers are provided with high quality geohazards information in an understandable format, they are better equipped to guide growth and development into safer areas."

One of the tools the project has developed to break down the barriers between science and decision makers is GeoSemantica, a collaborative, web-based and user-friendly digital library. It is designed not only to make hazard-related geoscience information easily accessible to the area's scientists, politicians, emergency management organizations, municipalities, land use planners and local communities at risk, but also to foster partnerships among them.

A Catalyst for Change

For Jackson, MAP:GAC has given him a rare opportunity to work in a part of the world he finds "endlessly fascinating" (not the least because of his personal interest in archeology and the plethora of archeological sites scattered throughout the area). More importantly, he is sharing his knowledge in an area where it can make a crucial difference.

"I've had a long career with the GSC and one of the most gratifying aspects of my work is passing on my experience to other people. I have a chance to share my expertise at the same time that it is growing," he says.

Jaramillo finds the most satisfying part of the work is the positive impact it has, and will continue to have, on communities in the Andes. "There is great satisfaction in collaborating with South American geoscientists and seeing them develop strategies best suited for the Andean environment," she says.

Both believe that MAP:GAC is just a start and that their efforts will continue to affect people throughout the Andean region long after the project is completed.

"We have what you would call, I guess, a catalyst role. Most of the work is being done by the locals in our partner countries," says Jackson, pointing out that those people will continue to work and transfer their expertise to others in the future.

"It's a very long-term task," adds Jaramillo, "but I think if the communities and institutions at least get a taste of how we can contribute, and how to use geohazard information for disaster prevention, that will be a big achievement."

Rick Rogers, a White Rock-based freelance writer, can be reached at www.wordsmithing@telus.net.