

## Volcano Studied with Phoenix MT Equipment

**P**hoenix equipment has been used to study an “inflating” volcano in Bolivia.

In autumn 2011, a University of Alberta field crew led by Prof. Martyn Unsworth carried out an MT survey at the 6008-metre-high Volcan Uturuncu in southwest Bolivia. Most volcanos in the Central Andes of Bolivia are inactive, but Volcan Uturuncu has been growing by one centimetre a year for at least the last fifty years. This is very fast in volcanological terms and indicates that the magma chamber beneath the volcano is growing rapidly.

This build-up might be a sign of an impending “supervolcano” eruption, which can eject up to a thousand times more material than a normal eruption, temporarily affecting the climate of the entire planet. An example is the eruption of Toba in Indonesia about 74,000 years ago. Scientists estimate it ejected 2800 cubic kilometres of material, causing a little ice age and subsequent massive die-offs of several species.



Photo: Martyn Unsworth

The glowing tents of the field camp on Volcan Uturuncu were photographed beneath the light of a full moon.

The region of the Andes in southern Bolivia, northern Chile and Argentina has experienced a number of supervolcano eruptions in the last 10 million years. Thus one goal of the PLUTONS project (*see page 2*) is to investigate whether Uturuncu might be the next supervolcano.

The field crew was based in the small village of Quetena. But travel on local roads was very slow, so the field crew also made camp at higher elevations. The highest MT station was deployed just below the summit at 5800 metres. Although the Phoenix instruments worked well at this altitude, the field-crew members often suffered shortness of breath while digging.

Initial results suggest that there is a magma body between ten and fifteen kilometres below the volcano. Future MT fieldwork will be needed to better define the shape and location of the magma body and to gain a better understanding of potential future eruptions.

Field-crew members were Djamil Al Halbouni, Enrique Calvo, Matthew Comeau, Matthew Drew, Dauth Porcil, Faustino Ticona, Eusebio Ticona and Martyn Unsworth.

*Thank you to Dr. Martyn Unsworth for submitting the information and photographs for this article.*

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**Above:** Matthew Comeau, a University of Alberta graduate student, operates a Phoenix MTU-5 on Volcan Uturuncu, in Southern Bolivia.

**Right:** The field crew at the highest MT station (5800m) on Volcan Uturuncu.

### About the PLUTONS Project

The Andes were built by countless volcanic eruptions that also formed many of the region's mineral deposits. Scientists from Argentina, Bolivia, Canada, Chile, the UK and the USA are investigating Volcan Uturuncu through the PLUTONS project. The acronym is derived from the initials of the two main volcanoes under study (Lazufre and Uturuncu) and of the various organizations involved in the project. Pluton is a geological term meaning a body of intrusive rock which forms from slowly cooling magma, the molten rock below the surface of Earth. Learn more at: <http://plutons.science.oregonstate.edu/about>



## PRESIDENT'S MESSAGE

On January 12 a group of friends and colleagues of the late Dr. Phil Hallof, founder of Phoenix, gathered at a cozy bar at the Royal York Hotel with his widow Lois, a long-time member of the Women's Association of the Mining Industry of Canada (WAMIC) to honour Phil prior to his induction into the Canadian Mining Hall of Fame (CMHF). Coincidentally, it was in this same bar 30 years earlier (March 1982) that Phil Hallof, Bill Pelton and Paul Cartwright hired me to work for Phoenix. When I asked Phil about a job title, he responded, "Call it whatever you want, but do it."

Just months after I started, Phil was asked to exhibit at a Shanghai trade show. He backed my suggestion to go for it in a big way and we shipped a 40-foot ocean freight container filled with \$1Million of Phoenix equipment. As the container left our office, Phil commented, "You realize if this doesn't work, we'll have to fire you!" But it did work. In March 1983, Phoenix sold all the equipment at the Shanghai show, and ever since then has done well in the China market. I have never forgotten Phil's willingness to take a chance on a new employee with a big idea.

~ **Leo Fox**

*The following is from the Canadian Mining Hall of Fame citation:*

Phillip Hallof (1931–1992) earned his status as one of the "fathers of modern geophysics" for his pioneering and innovative work in the field of frequency domain induced polarization (IP), which grew from an obscure research effort into an essential mineral exploration tool. Born in St. Louis, Missouri, Hallof earned a BSc degree in geology and a PhD from the Massachusetts Institute of Technology. While still a graduate student, he demonstrated the effectiveness of the then-novel variable frequency IP method, which evolved into a valuable new tool to help identify buried non-conductive mineral deposits that conventional electromagnetic (EM) surveys could not detect.

Hallof joined Toronto-based McPhar Geophysics Inc. becoming its president, (and a Canadian citizen) in 1961. His leadership of McPhar, and later Phoenix, contributed to advances in IP science, complex resistivity (Spectral IP) and magnetotellurics and innovations in electrical and EM geophysical techniques, aiding in the discovery of mineral wealth worldwide.

Dr. Hallof is also honoured through the KEGS Hallof Scholarship and the KEGS Pioneers Scholarship. Learn more and donate at [www.kegsfoundation.org](http://www.kegsfoundation.org)



Lois Hallof with members of the geophysical and mining community, prior to the CMHF Induction Dinner; left to right, Glenys Prince (WAMIC president), Frank Jagodits (Savaria Geophysics), Micki Allen (MARAC), Audrey Hutchison and Leo Fox (both Phoenix Geophysics), Jerry Roth (Stratagex and KEGS Foundation), Chris Dayton (Hallof family friend), Lois Hallof, Jon Baird (CAMESE), Stephen Reford (PGW and KEGS Foundation), Carol Ann Devine (WAMIC) and Paul Cartwright (Pacific Geophysical)

Photo: Keith Houghton

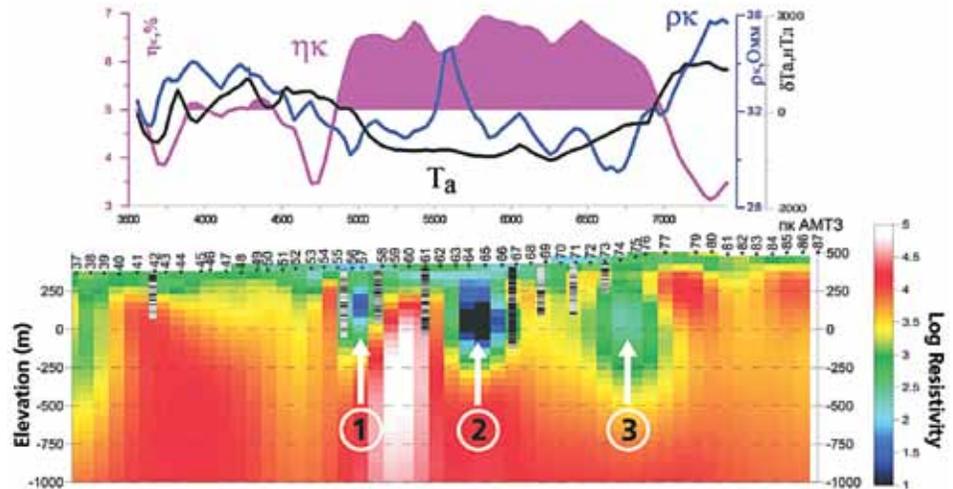
# AMT Survey at Rich Gold and Copper Deposit

An AMT survey with Phoenix equipment has helped target drilling at one of the world's richest gold and copper deposits.

Moscow-based Nord-West, owner of Phoenix equipment, carried out AMT surveys at the very large Peschanka gold-copper-molybdenum porphyry deposit in the Chukotka region of Russia, across the Bering Strait from Alaska.

Peschanka is a rich deposit, reportedly containing 1600 tonnes of gold and 27 Million tonnes of copper. The Governor of Chukotka, Roman Kopin, said in 2010 that these figures indicate that Peschanka is among the five richest ore bodies in the world.

As shown in the upper part of the diagram, earlier IP (pink) and magnetic (black) surveys showed a single broad anomaly approximately two kilometres wide. DC resistivity surveys (blue) showed a similar broad low with one local high near the center. While useful, these surveys lacked sufficient detail for targeted drilling.



The initial drillholes shown here were mainly targeted on shallow IP maxima and thus did not test any of the deeper conductive anomalies (marked 1, 2 and 3 above) identified in the later AMT survey. Within the drillhole symbols the white horizontal bars indicate <1% sulfides; grey bars, 1% – 3%; and black, >3%. The vertical white (high resistivity) zone in the center of the plot is a gold-bearing quartz vein.

AMT provided deeper penetration and better horizontal and vertical resolution, thus providing more reliable data for choosing where to drill.

After the AMT survey, more holes were drilled (not shown here). The new holes confirmed that the AMT anomalies are sulphide orebodies.

## PHOENIX AROUND THE WORLD

### Croatia

The Iceland GeoSurvey (ÍSOR) carried out an MT survey in Slatina, Croatia last year. Using Phoenix equipment and processing software, ÍSOR took 65 MT soundings between mid-May and mid-June of 2011.

ÍSOR completed the work as a subcontractor for EFLA Consulting Engineers of Iceland. Since 2010, EFLA has been working on a geothermal project in the eastern part of Croatia where Earth's crust is relatively thin, the temperature gradient is rather high and there are great prospects for exploitation of geothermal energy. The survey took place over an area of 70 square kilometres. The goal was to use information from the subsurface resistivity structure to locate possible up-flow of geothermal fluid to help site drill holes and to reduce the risk of drilling. Temperatures in the wells (which are up to five kilometres deep) ranged from 70 to 180°C. Although the survey results are confidential, the plan is to produce electricity from the geothermal energy.



The field crew in Croatia, left to right: Zlatko Pintari and Franjo Božuri (Croatian assistants); Gylfi Páll Hersir and Arnar Már Vilhjálmsson (ÍSOR geophysicists) and Matija Perkovac of Geoslatina in Croatia

## ON THE ROAD

**Latin America:** Carlos Guerrero, Phoenix Sales Manager for Latin America, participated in EXPOSIBRAM 2011 (the Brazilian International Mining Congress & Exhibition) held in Belo Horizonte, Brazil, last September. Carlos gave presentations at the Vale S.A. office in Belo Horizonte.

Carlos also took part in the VIII Congreso de Exploración y Desarrollo de Hidrocarburos, held in Mar del Plata, Argentina, in November. **Right**, left to right: Francisco Vilanova (Haliburton-Landmark Manager, Argentina), Dr. Jorge Rossano (Phoenix sales representative for Argentina) and Carlos Guerrero



**Kenya:** Tes Haile, sales manager for Africa, the Middle East and South Asia, attended the Kenya Geothermal Conference held in Nairobi last November. **Above**, left to right: Carolyne Kipsang and Anna Mwangi, both with Kenya Electricity Generating Company (KenGen), Tes Haile and Risper Kandie of KenGen



**Indonesia:** Our agent, Phoenix Geosystem Indonesia (PGI), exhibited within the Canadian Pavilion at the World Renewable Energy Congress in Jakarta last fall. Centre are PGI President Hery Wibowo and PGI geophysicist Andy Fuadi.

## COMING UP

- **February 26–29:** Phoenix President Leo Fox and Tes Haile will attend the ASEG in Brisbane, Australia.
- **March 4–7:** Please visit our booth during our home town convention, the PDAC, in Toronto.
- **May 14–16:** Carlos Guerrero will attend the International Gold Symposium in Lima, Peru.
- **June 4–7:** Phoenix will exhibit at the EAGE, Copenhagen, Denmark.
- **July 26–31:** Phoenix will participate in the EM Induction Meeting in Darwin, Australia.
- **October:** In mid-month, Phoenix and the St. Petersburg State Mining Institute will hold a seminar on research and applied geophysics. Contact Phoenix for dates and details.
- **November 4–9:** Visit our booth at the SEG, Las Vegas, USA.



**Leap Year, Leap Second: GPS Alert!** Not only will 2012 see an extra day at the end of February, it will also see an extra second at the end of June. The clock will tick from 23:59:59 to 23:59:60 before July arrives at 00:00:00. Customers using Phoenix GPS-synchronized equipment are advised to avoid transmitting or recording over the midnight transition from June 30 to July 1, and for about 15 minutes afterward. Otherwise, they may find time-stamp errors or phase discrepancies in their data. Read more about leap seconds (introduced in 1971) at

<http://www.cl.cam.ac.uk/~mgk25/time/leap/>

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