

MT sees through Antarctic Icecap

An international team has used Phoenix MT systems to see through the Antarctic icecap that is up to two kilometres thick in the survey area. This is the first time that such a survey, investigating the deep geological structure of the Trans-Antarctic Mountains (TAM) of the Antarctic interior, has been carried out.

In December 2010 and January of this year, the team of nine scientists and two mountaineers, led by Principal Investigator Prof. Phil Wannamaker (University of Utah, USA), acquired 33 MT sites along a 230km profile across the central TAM. The 45-million-year-old TAM is the uplifted shoulder of a very large rift system which is comparable to the well-known rifts of the southwest USA and of East Africa.

The team worked in a spectacular setting out of a sizable but temporary camp that also supported research in paleontology, glacier dynamics, and bedrock geology. Helicopters deployed the research crews to most of the profile sites 25 kilometres or more from the central TAM camp. More distant sites on the polar plateau, up to 140 kilometres from camp, were reached by Twin Otter fixed-wing aircraft.

The danger of crevasses (deep snow-covered fissures) required very careful site selection: satellite images were examined; then Twin Otters flew reconnaissance over the area; and finally, locations were pinpointed by observation from low-flying helicopters. The team's mountaineers probed the area immediately upon



landing. And as a final safety precaution, the researchers walked in pairs, roped together, to install electrodes.

The study was funded by the U.S. National Science Foundation with participation and support by New Zealand Geological and Nuclear Sciences (NZ GNS), Tokyo Institute of Technology (TITECH) and University of Adelaide, Australia. TITECH and GNS provided ten Phoenix MT systems for the project. The Phoenix technology, long proven in far northern latitudes, was well suited for the Antarctic conditions.

The high contact impedance (up to two megaohms) was mitigated by using buffer pre-amplifiers developed for the University of Utah by John Stodt. Recording times were up to one week

John Stodt and Virginia Maris install a site near the TAM-Ross Sea transition. Mountaineer Danny Uhlmann works near the helicopter.

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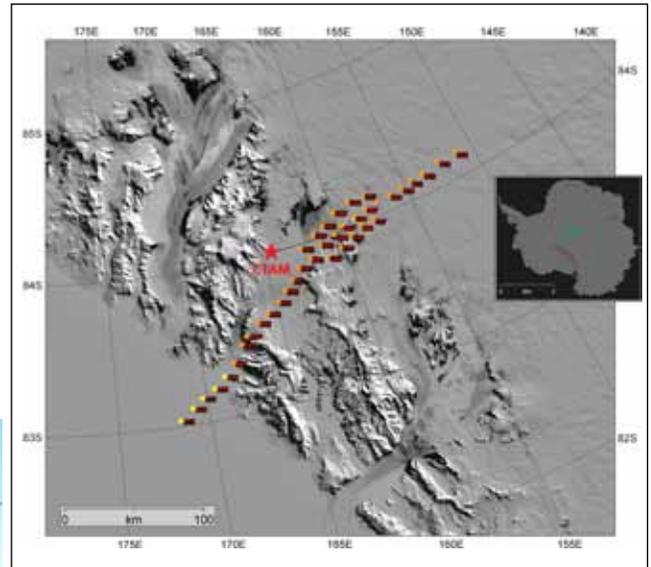
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to ensure data down to at least 3000 s period. System battery power was backed up by solar panels. Signal was steady and environmental noise (e.g., electrically charged blowing snow) was low. Data quality generally was excellent.

The recent CTAM MT project builds upon successful smaller MT surveys in central West Antarctica (1994–95) and at South Pole (1997–98). MT can now be considered a standard tool for geophysical investigation of the Antarctic interior.



CTAM MT Transect Science Team, L to R: Danny Uhlmann (mountaineer, Raytheon Polar Services, Inc.), Ted Bertrand (NZ GNS), Jamie Pierce (lead mountaineer, Pike’s Peak Alpine School, Inc.), John Stodt (Numeric Resources, Inc.), student Marie Green (U Utah), Graham Hill (NZ GNS), student Danny Feucht (U CA Berkeley), post-doc Virginia Maris (U Utah) and P.I. Phil Wannamaker (U Utah). Inset: Post-doc Kate Selway (U Adelaide) and Co-Investigator Yasuo Ogawa (TITech.) left camp before the photo shoot.

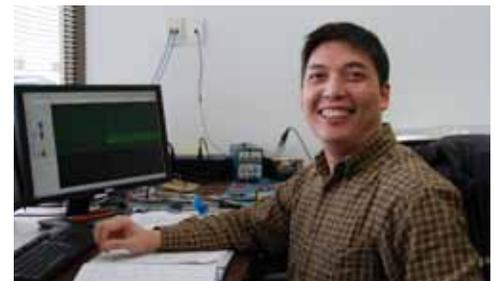


MODIS (multispectral) image / map of central Transantarctic Mountains. The grey scale intensity provides information about the surface material (snow, ice, gravel, rock, etc.) Orange dots denote 33 acquired MT sites; yellow dots, part of a planned future survey. The red star marks the CTAM camp. “SP” in the inset is the South Pole. See <http://modis.gsfc.nasa.gov/>

Thank you to Prof. Phil Wannamaker of the University of Utah for his assistance with this article and for the accompanying photographs.

WELCOME

Roger Dong graduated from Jiangnan Petroleum Institute (now known as Yangtze University), China, where he majored in Geophysical Exploration Instrumentation. After graduation, he worked as an Electronics Engineer with CNOOC. In 2000, Roger moved to Canada. He worked with a seismic equipment manufacturer as a hardware and firmware designer before joining Phoenix in May of 2010. He enjoys socializing with his family and friends, reading, listening to music, and travelling. He is married to Hong Yu; their son Richard is a university student.



Robert Bazinet joined Phoenix last September as a research scientist with an emphasis on sensor development. Robert holds a PhD in geophysical engineering from Ecole Polytechnique Montreal and specialized early in instrument development. After a short stint as a professor of geophysics, Robert turned to industry and, over a varied career, has designed instruments and software packages for several geophysical instrument manufacturers. Out of the office, Robert is an avid reader who also enjoys cooking and good wines.



Peru

In December 2010, Phoenix completed a geothermal MT survey in the Andes mountains of Peru, for West Japan Engineering Consultants (WestJEC). The survey area was between 4000m and 5000m elevation.

The abandoned puppy (third from right in the back row), was adopted by a crew member and taught to deliver small tools to other survey members. Mako now lives the good life on Rapa Nui (Easter Island).



Canada

Phoenix recently completed a survey on the west coast of James Bay, northern Ontario, for De Beers, the world's leading diamond company. Diamonds are found in volcanic pipes (kimberlites). Although airborne geophysics helps locate the kimberlites, ground geophysics, like that performed by Phoenix, maps kimberlites at depth, providing volumetric information.

After Phoenix completed a very successful 2008 pilot project, De Beers geophysicist and project manager, Charles Murphy, asked for a follow-up survey on the same kimberlite. Data is currently under analysis and, according to a De Beers geophysicist, "it looks very good".



Braden Fox snapped this red fox in April while on the De Beers survey. The red fox is a small mammal with a light body build that allows it to be quick on its feet and a tail that makes up one-third of its total length. Red foxes are not always red; foxes from the same litter can be red, brown, black or silver.

Djibouti

At left, Phoenix's Tes Haile stands with Dr. Knútur Árnason of ÍSOR (Iceland GeoSurvey) at the edge of Lake Asal. ÍSOR conducted a geothermal MT survey in the Lake Asal region using Phoenix systems. Lake Asal is a crater lake in central Djibouti, lying 155 metres below sea level. Its shores comprise the lowest point on land in Africa and the third lowest land depression on Earth after the Dead Sea and the Sea of Galilee. The lake is also the most saline body of water on earth outside Antarctica.

Algeria

The first MT survey in Algeria with Phoenix equipment was in the early 1990s. This survey studied the upper mantle anomaly beneath the oil- and gas-producing sedimentary basins of the Sahara. The project was supervised by Prof. Marianne Mareschal of Ecole Polytechnique Montreal (EPM) using EPM's V5 MT system, in cooperation with the Université des Sciences et de la Technologie Houari Boumediene (USTHB) in Algiers and the Algerian state petroleum company, Sonatrach.

A second survey with EPM studied the deep structure of the Hoggar Massif in the Tuareg Shield of southern Algeria, in cooperation with USTHB and the Algerian Research Center in Astronomy, Astrophysics and Geophysics (CRAAG). Shield areas elsewhere in the world host many metallic mineral deposits and diamonds.

CRAAG acquired Phoenix System 2000 MT equipment in 2004 and, since then, has carried out various projects. These include extension of the Hoggar Massif studies by acquiring MT data on several long profiles and conducting smaller detailed studies. Dr. Abderrezak Bouzid of CRAAG expressed his satisfaction with the reliability of the Phoenix equipment, as field work in this area is very challenging due to the remoteness, high daytime temperatures, lack of water, and dusty, sandy conditions. Dr. Bouzid manages the MT field operations, including planning and data acquisition, and leads the interpretation and modelling work.

The Hoggar work is well summarized in Dr. Bouzid's 2010 doctoral thesis: *"Apport des données magnéto-telluriques à l'étude géodynamique du Hoggar"*.

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South Africa



Current Exploration Solutions (Pty) Ltd, Botswana, purchased 5 MT Systems in 2010; training and acceptance took place last May and June in KwaZulu-Natal, South Africa. Above: Phoenix's Tes Haile (foreground) with Bill Doerner (in red Phoenix hat) and field crew.



Above: survey work at Abalessa, near Tamanrasset, about 2000 km south of Algiers, November 2010. Left to right: Mr Moulay (driver), Abdelhamid Bendekken (Head of the Tamanrasset Observatory), Dr Abdeslam Abtout, Mohamed Hanni (master's student) and Dr Abderrezak Bouzid.

Japan



In November 2010, Phoenix's V-P and senior geophysicist Mitsuru Yamashita, senior engineer Gerald Graham and application developer Jean-Sebastien Hogue demonstrated the new EMpower software. Thank you to Gerald for the above photo of Mits and Jean-Sebastien with Munemaru Kishimoto, a geophysicist with Nittetsu Mining Consultants Company (NMCC) and Takeharu Takahashi, a geophysicist with Nittetsu Mining Company (NMC). Mits and Jean-Sebastien returned to Japan in May to demonstrate the updated EMpower software and new equipment to geophysicists of NMC and NMCC in the office of NMCC, Tokyo.

Phoenix Shortlisted for Award

Also Featured in Canada's National Newspaper

Phoenix is proud to announce we were on the short list of the 2011 Immigrant Success Awards given by the Toronto Region Immigrant Employment Council (TRIEC). Damien Fox submitted the award application, enthusiastically supported by our 51 employees who come from 20 countries and speak 15 different first languages.

The awards recognize leadership and innovation in recruiting and retaining skilled immigrants in the Toronto Region. Our name on the shortlist puts us in very good company that includes the law faculty of the University of Toronto and the Business Development Bank of Canada.

To read more about TRIEC, the awards and our submission, go to www.triec.ca/programs/is/Shortlist#Phoenix

The Globe & Mail, Canada's national newspaper, in a May 11 front-page Report on Business article, featured Phoenix Geophysics and one of our employees, Tesfakiros Haile. Tes, sales manager for Africa and the Middle East, had written a moving statement to

accompany Damien's submission (as did other employees). Read the full article here:

<http://www.phoenix-geophysics.com/news/>

WELCOME

Software developers Jean-Sebastien Hogue and Jean-Philippe Proulx joined Phoenix last spring. Both work with Software Development Manager Jorge Torres writing new software for controlled source and natural source data processing and data management. In the photos below, Hogue and Proulx familiarize themselves with field operations of Phoenix equipment, leading to superior post-processing software.

Jean-Sebastien Hogue graduated in Computer Science from Université de Sherbrooke, Quebec. While studying, he acquired real world experience in software development during co-op internships in Montreal, in Vancouver and at the Panasonic San Jose Laboratory in California. Jean-Sebastien also lived in Japan for five months as an exchange student at the engineering faculty of Kyoto University. He got engaged to Mayuko Yoshioka in Hawaii last September, and the couple married in Fukuoka, Japan, on May 4. Cooking, as well as indulging in espresso and Japanese tea, are his favorite ways of getting away from computers.



Jean-Philippe Proulx completed his college diploma in Sciences from CÉGEP de Rimouski, Quebec after which he moved to Montreal where he graduated in Software Engineering from McGill University. When he is not running or skijoring* with his German shorthaired pointer, Mika, you will find him reading the latest novels or enjoying the outdoors. Some of his other passions include scuba diving, yoga and photography.



* *Skijoring with a dog is a sport in which a dog (or dogs), assist a cross-country skier. The skier provides power with skis and poles, and the dog adds additional power by running and pulling. Watch Jean-Philippe and Mika skijoring:*

www.youtube.com/watch?v=Sf6ohINL2n0

IN MEMORIAM

COLLETT, Leonard Stanier: September 19, 1922 – March 9, 2011

Len spent his pre-university years on a farm near Burford, Ontario, graduated from McMaster University with a degree in Physics and Chemistry, then completed his master's in Geophysics at the University of Toronto. After four years with Newmont Mining in Arizona, he joined the Geological Survey of Canada for a full and valued career in Ottawa, retiring in 1990. Len was active in community affairs, supported the arts and cultural life of Ottawa, and was a strong advocate of scholarships for students of geo-sciences.

CRONE, James Duncan: August 7, 1929 – March 4, 2011

After graduating from the University of Toronto in 1951 with a BSc in Mathematics and Physics, Duncan joined the remarkable group of innovative geophysicists (including Harry Seigel and Len Collett) who worked for Newmont in Jerome, Arizona under the legendary Dr. Arthur Brant. Here, the practical application of Induced Polarization to mineral exploration was born. Later, with co-operation from Newmont, Duncan would use what he learned in Jerome to build practical IP and EM instruments which were simple to operate and extremely reliable.

In 2009, Duncan was recognized as a geophysical Pioneer by the Canadian Exploration Geophysical Society and is included in the roster of notable Canadian geophysicists honoured and commemorated by the KEGS Pioneers Scholarship Fund for education in geophysics.

Go to www.cronegeophysics.com for more.

ON THE ROAD

Brazil: Phoenix's Carlos Guerrero attended the non-seismic forum presented by the Brazilian Geophysical Society in Rio de Janeiro, in September 2010. Afterwards he visited the offices of our Brazilian representative, Strataimage. In the photo at right are: Paula Romero (Strataimage geophysicist), Professor Abel Carrasquilla (UENF), Patricia de Lugaõ (geophysicist and Strataimage owner) and Carlos Guerrero.



Japan: Mits Yamashita attended the SEGJ conference May 10 – 12 at Waseda University in Tokyo. Special topics included the Tohoku earthquake and tsunami of March 11.

We extend our best wishes to Jean-Sebastien Hogue and Mayuko Yoshioka, married in Fukuoka on May 4. (See p. 5, *Welcome*)



South Africa: Tes Haile attended the Mining Indaba Conference and Exhibition held in Cape Town, Feb. 6 – 10, 2011. Below: Tes with Temba Hawadi, Director of the Geological Survey of Zimbabwe, at the conference.



PRESIDENT'S MESSAGE

On August 13, Phoenix employees, friends and family members will participate for the second year in the ORBIS plane pull. ORBIS is a nonprofit organization dedicated to saving sight worldwide. One of their fundraising efforts is to encourage teams to pull an airplane, a feat that is more difficult than it sounds. In 2010, the Phoenix team scored the fastest time and raised the most money. Phoenix will again match the funds raised by employees, to a maximum of \$10,000.

Last year, teams of 20 pulled a Boeing 727. This year we will pull a larger and heavier aircraft – a Boeing 757 – so need 25 people on each team. We appreciate your support for this good cause. Go to <http://www.orbiscanada.ca> for more details.

On a sad note, two well-known Canadian geophysicists died recently. Duncan Crone was founder of Crone Geophysics; its equipment was known for its reliability and ruggedness. Len Collett, of the Geological Survey of Canada (GSC), was the "father" of many innovations by Toronto geophysical companies. He supervised grants of small but critical amounts of seed money for the development of many instruments. (See p. 5, *In Memoriam*)

In memory of Duncan, Phoenix donated to the The KEGS Pioneers Scholarship Fund, established in 2003 to honour notable exploration geophysicists associated with KEGS; to honour Len, Phoenix donated to the GSC Pioneers Scholarship Fund that honours the many advances and accomplishments of GSC geophysicists. We urge others to follow suit: www.kegsfoundation.org/donations.html

~Leo Fox

COMING UP

- **August 13, 2011:** ORBIS plane pull at Pearson airport in Toronto
- **September 18 – 23:** The SEG exposition and the 81st annual meeting in San Antonio, Texas



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