# THE PHOENIX

## 20th Anniversary

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## TURBO USERS TRIUMPH WORLDWIDE

Phoenix is justifiably proud of its Turbo V-4 IPReceiver and so are its successful owners. The eight-channel receiver is easily one of the most popular for mining exploration around the world. Rugged and operable to -40° C, the Turbo is a hit with Canadian geophysical contractors who operate through the winter.

With the big down-turn in mining exploration in Canada in the late 1980s, many of Canada's largest mining companies shifted their exploration efforts out of the country, notably to South and Central America. Phoenix's receiver, as reliable in the heat and humidity of southern climates as in the Canadian cold, has helped our clients remain competitive during the tough recession years.

"Our production rate is three times greater with the Turbo V-4", says Rémy Bélanger, owner of Rémy Bélanger Geophysics from Evain, Quebec (near Rouyn-Noranda). "We can acquire up to six line-kilometres a day with 50-metre dipole spacing, using the Turbo. In the hands of an experienced crew like mine, productivity goes way up with this receiver."

Bélanger is a former McPhar employee and a loyal Phoenix customer. From 1968-1975 he worked as an IP operator for McPhar. "I was planning to quit geophysics, but then I got an offer to start my own IP crew. In 1975 I bought a McPhar-developed P660 Transmitter and that was the beginning."

Falconbridge, Noranda and Placer Dome are just some of the Canadian mining companies that have hired Bélanger and his Phoenix equipment to conduct geophysical surveying contracts.

Alex Walcer of Walcer Geophysics owns two V-4's. "Phoenix still builds the best equipment that I know of in geophysical circles," he says, crediting the high-quality equipment for his ability to not only stay in business during the downturn but to move into overseas markets.

"We've worked in Yemen, Panama, Bolivia and Peru in the past year," Walcer says, explaining that he works in cooperation with Robert Turcotte of Val D'Or Geophysics. "We complement each other's expertise in the application of geophysical methods," he adds.

Athird Canadian owner of the Turbo V-4 is Ron Mertens of Tandem Geophysics Inc. (formerly Mertens and MacNeil Geophysical Ground Surveys Ltd.). "Our clients are extremely pleased with the repeatability and the quality of the data from the Turbo," says Mertens. "Even in very poor signal conditions the data quality is great. We own one Turbo and rent a second and we're using them in the United States, Mexico, Canada and Australia."

Although the V-4 receiver is a multi-purpose unit incorporating several geophysical functions, the big winner for these contractors is Phase IP – a reconnaissance induced polarization technique developed by Phoenix from 1980 to 1983. Phase IP measures phase shift between transmitter and receiver at a single frequency. It is the fastest IP technique available today.

Rémy Bélanger

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## MESSAGE FROM THE PRESIDENT

Since I joined Phoenix in March, 1982 we have experienced dramatic ups and downs in geophysical exploration, metal prices and oil prices.

We have survived through it all, never ceasing to invest heavily in R&D and new products. The strength, breadth, depth and teamwork of the Phoenix group has continuously increased. Like the company itself, every staff member at Phoenix has overcome significant challenges. (See Mr. Reddering's profile opposite, for a dramatic example.) But each hurdle we successfully cleared made Phoenix and its staff stronger.

Our success is owned to many things – most importantly, our people. Their brains, strength, dedication, perseverance and long hours made the company what it is today. Special thanks to all of them and to their families who were steadfast during the tough years, never complaining when the father was "missing in the field" for weeks at a time.

I'm pleased to tell you that as Phoenix's success grew, we shared a little of it with our community. For the second year, this past Christmas the company made a substantial donation to two charities that help underprivilegd children in Toronto. Just recently we also contributed to the Kobe Fund in aid of the victims of the Kobe, Japan earthquake. Thank you to all our clients who helped to make this possible.

— Leo Fox

## FROM THE EDITOR

Happy Birthday to ourselves. Phoenix is leaving its teen years behind and turning 20 in just a few weeks – and we fully expect to be even more successful in our mature 20's. Thanks to everyone who helped us reach this new stage in our development.

Thanks too to all of you who sent in stories, pictures and ideas for future issues – we couldn't do it without you. Keep up the good work and keep in mind our deadline for the next issue (printed in time for the EAEG in Glasgow) is the end of April.

If you picked up this issue of The Phoenix at a trade show or maybe from an agent, but would like to be on our direct mailing list, please contact us. Quarterly issues are scheduled for June, September and December of 1995.

Audrey Hutchison
Editor

## EMPLOYEE NEWS

Eve Foster

Eve Foster spent a year or so with McPhar before joining Phoenix in the summer of 1975. At Phoenix, Eve was the proverbial "Jill of all trades", cheerfully filling in wherever needed. Her various jobs included sales assistant, shipper, secretary, receptionist and accounts payable.

In 1989 Eve retired early to learn about and do things she never had time for while working and raising her children. She enjoys sports (everything from badminton to cross-country skiing and sailing), nature trips, travel (especially camping in Florida) and learning French.

Eve has three daughters. The two oldest are married and between them have five children. Luckily they live in the Toronto area so Eve sees them often. Her youngest daughter, Carol, works on an oil rig in Fort St. John in northern British Columbia.

## $50,000 FOR JOINT RESEARCH

Phoenix has signed a joint research agreement with the Geological Survey of Canada to develop new processing strategies for AMT (Audio Magnetotelluric) data in mineral exploration. The objective is to gain a better understanding of the high frequency fields between 1 KHz and 10 KHz.

The agreement was signed under IPP (the Industrial Partners Program) in which industry and government match each other's funds to research subjects of mutual interest. Phoenix and the GSC will each contribute $25,000 to the program before March 31, 1995.

Phoenix has modified the V-5 Receiver's existing AMT program to permit collection of time series data. The resulting large amount of data fills even the V-5's 40 Mb of internal RAM in only a few minutes. GSC will process the data and, together with Phoenix, develop new algorithms for AMT data acquisition and processing.

Chief engineer Herman Reddering was born in Amsterdam of Dutch parents while his civil servant father and his family were home on leave from Indonesia. Herman was brought up in Indonesia. It was a charmed colonial-style of life until 1941 when occupying Japanese troops threw young Herman and his family into two separate concentration camps.

It is difficult to find anything good to say about Herman's next four years, but there was one bright spot — he received excellent one-on-one tutoring from educated internees who were determined the children in camp would continue with their schooling.

When the emaciated 17-year-old left Indonesia in 1945 he went straight into a five-year Electronic Engineering program (equivalent to a Master's of Science degree ) in Delft, Holland. It was there he met his wife, Joan.

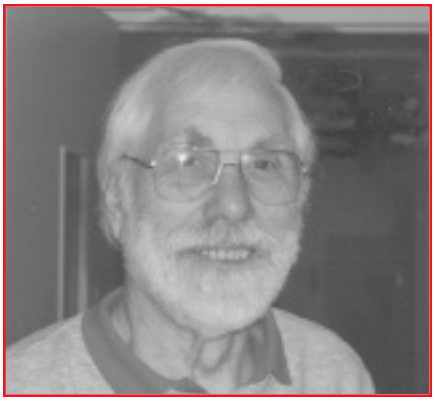
The couple emigrated to Canada in 1952 and Herman found work with Ferranty Packard Electric, a computer-oriented company — during the days when computers filled whole rooms. In 1969 he moved to Huntec, a geophysical firm,and then to McPhar in '73.

Herman was one of the founders of Phoenix, begun in early 1975 after the sale of McPhar. As Chief Engineer and Production Manager of the new enterprise, from its inception until the present, Herman was responsible for the successful development of many new instruments. The most notable and successful is the V5 Multi-purpose Receiver. This IRAP-sponsored program, started in November of 1985, set out to develop a Real-Time AMT System. Nearly a decade later Phoenix personnel are still expanding the applications and capabilities of the highly successful V5.

If anyone deserves to rest, at least a little, on their laurels, Herman does. Earlier this year he began to gradually cut back his work load and turn his duties over to James Kok.

Herman Reddering

Joan and Herman have two daughters and a son; Karen has three children, Debbie has four and Tom, at this point, only one. They all live in Ontario and often descend upon Joan and Herman's cottage in Haliburton, north of Toronto, for family get togethers.



Joe Sevenhuysen

A circuitous route brought Joe Sevenhuysen from his birthplace of Heemstede, Holland to a senior engineering position at Phoenix.

At the outbreak of World War II, at age 14, Joe left school to work as a clerk in a shipbuilding yard. That lack of formal schooling never slowed down Joe —in fact,his natural abilities and hard work took him further than many others with doctorates.

In 1945, at 18, Joe joined the Dutch army. He was sent to Scotland for training and then posted to Indonesia where he worked as a radio mechanic. Back in Holland he studied electronics in his spare time — his last job in Holland was fixing air planes at a government training school for KLM pilots.

Arriving in Canada in 1953, Joe found work on a radio communications production line at Rogers Majestic,Toronto. By the end of his year there he was trouble-shooting for the entire plant.

In 1953 Joe joined McPhar Geophysics under chief engineer George McLaughlin, "the man I consider my best tutor in electronic geophysics", says Joe. "Some of the products I worked on were ground and airborne EM and E-mag systems, IP with Dr. Phil Hallof, the first phase IP system and phase IPcase histories with Bob Smith who is now chief geophysicist at CRA (Conestoga-Rovers & Associates Limited) Australia.

Joe decided to build a more modern IP system in his garage after McPhar was sold. (Many key employees went on their own at this point.) Joe's former colleagues heard what he was up to and they got together, first calling themselves ENACO and then, in May, '75, forming Phoenix Geophysics.

Joe has fond memories of Frank Wakida, Tony Anselmo, Dave Morgan and the many others instrumental to the success of Phoenix's many projects over the years — including Phase IP, Spectral IP with Dr. Bill Pelton, "Dumbo"110KwTx, IPT6 100 KwTx, MT components and the AC 3006/3007 50/60 Hz power modules and IPT-l transmitter.

Although Joe tried to retire from Phoenix he was cajoled into part-time consulting until a couple of years ago when he officially left for an active retirement which includes sailing, skiing and camping.

Joe has two sons. Peter and his wife live nearby but John and his wife and three children live in Iqaluit, Frobisher Bay in Canada's Arctic. Joe has no wish to visit his grandchildren in the frozen north (he prefers Florida), but treasures their summer visits to Toronto.

## FINNISH SURVEY AND PHOENIX WORK TOGETHER

Phoenix and the Geological Survey of Finland GTK (its Finnish initials) have signed a technical cooperation agreement which draws upon the complementary strengths of both parties.

During 1995, Phoenix/GTK will develop several new products including the SAMPO frequency domain EM function for the Phoenix V-5 Receiver; and new, low-noise, wideband AMT and MT coils.

The extremely successful "SAMPO" Frequency Domain EM System was produced in limited numbers in an earlier cooperation between GTK and the well-known Finnish mining company, Outukumpu Oy. The SAMPO system was instrumental in discovery of the large, high-grade "Keivitsa" lead-zinc deposit in Lapland (see EAEG Abstracts,1994); and a large copper deposit in Chile. SAMPO has also been used successfully for through-the-ice soundings in Antarctica.

SAMPO is a loop-loop EM system operating at 81 frequencies between l Hz and 20,000Hz. It uses a battery-powered transmitter and receiver; transmits into a loop and measures three components of the magnetic field with a uniquely designed three-axis magnetic sensor.

### New Low-Noise Magnetic Sensors for AMT/MT

GTK and Phoenix have adapted the older ACM-21 magnetic sensor and will soon introduce a new,wideband AMT sensor with frequency range 1Hz to 20,000Hz. Noise at the important 2KHz frequency (where natural signals are weakest) is less than $10^{-6}$ nT/SQRT(Hz). Phoenix will market the coil worldwide and GTK in Scandinavia.

Wideband (1 - 20,000 Hz), lightweight (3 kg), extremely low-noise AMT magnetic field sensor developed by GTK/ Phoenix.

Another sensor will be used for lower-frequency MTmeasurements. We'll provide more details in the next issue.

## NEW PHOENIX MT SYSTEM IN TIBET

Phoenix has signed a Technology Licence Agreement with the Geological Survey of Canada (GSC) through which Phoenix will build and sell its own version of GSC's "LIMS" (Long Period Intelligent Magnetotellurics System). The Phoenix version is called LRMT.

LIMS was developed in the GSC's labs between 1988 and 1993. Sixteen systems are in use for deep, very long-period crustal studies. LIMS measures MT signals in the frequency range lHz to 0.000005 Hz — the latter figure corresponds to a period of 200,000 seconds, or 2.5 days! LIMS and LRMT both use a specially-designed, compact three-component magnetic sensor.

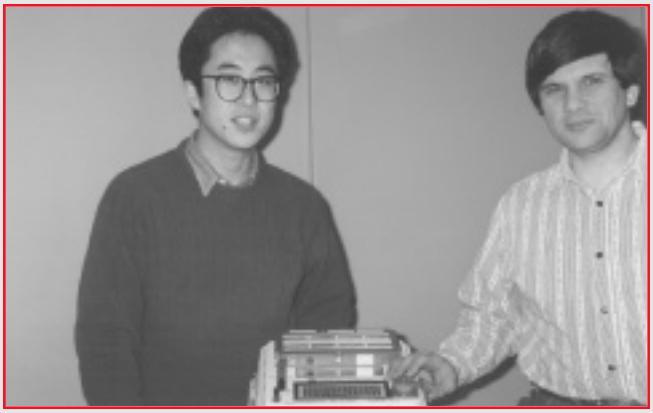
The first five LRMT systems will be delivered to the University of Washington (Seattle) in March, 1995. Professor John Booker will take the five LRMT units to Tibet where he will join Dr. Alan Jones of the GSC. The GSC's 16 LIMS and the University's five LRMT's will be used in a three-month experiment to probe the deep crust just north of the Himalaya Mountains, to learn more about the collision of the Indian Plate with the Asian Plate 60 million years ago. It is this geologically spectacular event which pushed seafloor sediments to the top of Mt. Everest. Dr. Jones and Dr. Booker want to find out if the Tibetan Plateau was formed by the edge of the Indian Plate being pushed down ("subducted") far beneath the Himalayas or by concertina-like crumpling of the rocks. They'll cooperate with the Ministry of Geology and Mineral Resources in China.

Phoenix technician Mike Reh assembles one of five Phoenix LRMT (Long Period Recording MT) systems purchased by the University of Washington (Seattle, USA) which will be used to study the deep crust in Tibet.

## VISITORS

Phoenix president Leo Fox (center) and Phoenix technician Yi Lu (far right) in front of a Christmas tree after our December holiday lunch. With them are three visitors from Da Qing Geophysical Prospecting Company (Da Qing Oilfield Administration), People's Republic of China. They are, from left, Tan Hui Lin, crew chief of MTSurvey teams; Chen Feng Nien, Manager of the Non-Seismic Survey Division of several survey teams and Yao Wan Min, junior manager in the supply/purchasing department.

Dr. Ping Zhang of INCO's Exploration and Technical Services Inc. of Coppercliff, Ontario, shares a laugh with Leo Fox at Phoenix's Christmas lunch. Dr. Zhang visited our Scarborough offices to discuss MT survey results in the Sudbury area with Phoenix field manager George Elliott.



Mr. Koichiro Fukuoka from OYO Corp., Tokyo Division, poses with Oyo's V-5 and Phoenix senior engineer Gerald Graham. Mr. Fukuoka visited Phoenix to pick up and learn about a software package for recording AMT-DFT coefficients that was developed by Mr. Graham.

## WALCERÕS PRIVATE ARCHIVES

Thanks to Alex Walcer of Walcer Geophysics for saving the May 29,1975 issue of The Northern Miner and bringing it to our attention. To the right is a reprint of the announcement of Phoenix's formation.

Other news of note in that issue: Gold was US$175 per ounce and Alan Greenspan, then Economics Advisor to the president of the USA was predicting an imminent end to the 1974 recession.

*ANNOUNCEMENT*

**PHOENIX Geophysics Limited**

PHOENIX Geophysics is pleased to announce that many of the geophysical personnel previously associated with McPhar Geophysics Ltd. have formed a new geophysical service company, PHOENIX Geophysics Ltd. As McPhar Geophysics has done over the past 25 years, the new group will offer a wide range of geophysical services with continuous improvement and innovation. With offices in Toronto, North Vancouver and Tucson we will be able to offer these services in a region extending from Central America and Mexico to Alaska and the Yukon Territory.

The professional staff of PHOENIX Geophysics has many years of experience in the application of geophysical methods in all of these geographic areas.

*Geophysicists & Geologists*

Philip G. Hallof, Ph.D. — President
Robert A. Bell, Ph.D. — Vice-President
Paul A. Cartwright, B.Sc. — Senior Geophysicist
Alex Walcer — Manager, Field Operations
Ashton W. Mullan, M.Sc. — Manager, Western Canada
Bruce S. Bell, B.Sc. — Manager, U.S.A.

*Geophysical Surveys*

- Induced Polarization
- Vertical Loop E M
- Horizontal Loop E M
- Magnetometer
- Scintillometer

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# SPECTRAL IP OVERVIEW

(The full text of this paper and further details of the cited references are available from Phoenix. Limited space permits only a summary to be given below.)

Spectral IP (Induced Polarization) refers to IP measurements of amplitude and phase of the received signal made in the frequency band approximately 0.00l Hz to l,000 Hz.

Spectral IP arose from the need to solve two problems: (l) the contamination of IP data by "electromagnetic coupling" in areas with conductive surface conditions and (2) the desire to discriminate between economic and non-economic mineralisation, based on different grain sizes.

Dr. W. H. Pelton's classic paper (ref. #6) perfectly explains the problems and the theory of Spectral IP. He defines a simple 4-parameter, frequency-dependent model for the measured wideband IPresponse of the earth. The model chosen (Cole-Cole) is especially attractive because it is symmetric in the log frequency domain (not all models are). (ref. #7)

During the 1950s and '60s, EM coupling was a serious (although unrecognized) problem in the conductive terrains of the Southwestern USA. For this reason many drill holes were sited on false anomalies arising from inductive coupling (and not from the earth's IP response).

Pelton (ref. #6) demonstrates a simple technique for identifying and removing EM coupling effects from frequency-domain Spectral IP data. In essence, all that is required is to extend the IPmeasurements to high enough frequencies (ca. 100 Hz and above) so that the dominant contribution to data comes from EM coupling and not from the intrinsic IP response of the earth. The Cole-Cole model can also be used to describe the EM coupling effect, so coupling removal from the phase spectrum is then a simple subtractive procedure.

Pelton's paper also refers to mineral discrimination in porphyry copper deposits, based on typical grain size differences (mineral habit) between pyrite and chalcopyrite. Pelton's paper sparked considerable interest in the application of spectral IP to exploration problems, but due to the post-1978 decline in copper prices, copper exploration in North America practically ceased and with it interest in Spectral IP.

Interest then shifted to China, where there is a pressing economic justification for increased domestic copper production, as there is in present-day Iran, Chile, India and so on.

Government-sponsored Spectral IP research carried out in the early 1980s (Ref. #'s 2 & 3) clearly demonstrates that EM coupling can contaminate IP data even when very short dipoles (l metre) are used and even at low frequencies (less than 1 Hz). As explained by Klein (ref. #1) EM coupling depends on several factors as well as resistivity. It becomes more severe as a)the distance between transmitter and receiver increases b) dipole length increases c)frequency increases and d) resistivity decreases.

Normally the Time Domain IP technique hopes and expects to avoid the problem of EM coupling by use of the "delay time" (waiting a suitable length of time, about 450 milliseconds) after the transmitter is switched off before starting to acquire useful data. During this delay it is expected the EM coupling will die away to negligible levels. However, in highly conductive environments it is not possible to avoid the problem this way.

By definition, the measurements of amplitude and phase are made in the frequency domain; that is, amplitude and phase are measured directly by the measuring apparatus at each individual frequency of interest. The receiving apparatus controls a companion transmitting apparatus which generates the signal at each individual frequency of interest.

As is well known, time domain and frequency domain representations of phenomena are related by the Fourier Transform, so that (in principle) wideband measurements made in either domain can be (and are) transformed into the other domain. Pelton (ref. #8) provides the mathematical and theoretical description of the transform, as well as a critique of the practical strengths and weaknesses of the two approaches. For example, the narrow-band frequency-domain measurement provides better signal-to-noise ratio than the wideband time domain measurement. Also, it is easy to calibrate (i.e.remove instrument response from the data) in the frequency domain, difficult in the time domain. In the frequency domain, the desired amplitude and phase values are measured directly; time domain measurements must be converted to the frequency domain by the Fourier Transform.

For these and other reasons the frequency domain approach has proved more workable. (Ref.#6), although the ultra wideband Time Domain approach used by Anaconda Mining Corp. (with telluric noise cancellation) was successful. (Refs.#4,#5).

It is essential to make very wideband measurements (perhaps to frequencies as low as 0.000l Hz) in order to achieve satisfactory grain size discrimination (Ref. #9, #10). This implies long times (several thousand seconds) for data acquisition. Therefore, Spectral IPis an anomaly follow-up technique, not a reconnaissance technique. In addition, multi-channel equipment is essential to maximize productivity. If the measurements are made in the Time Domain, telluric noise cancellation is essential.


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## DR. WARD LINKED TO PHOENIXÕS PAST

Dr. Stanley H. Ward, Electrical Methods Geophysicist, has had a long and illustrious career that has touched the lives of many in the mining industry around the world.

A Canadian from Vancouver, British Columbia, Dr. Ward received all of his academic degrees from the University of Toronto. His links with Phoenix go back to the days of McPhar Engineering which became McPhar Geophysics which, of course,preceded Phoenix.

"I joined McPhar Engineering in 1949 after graduating with my BSc," recalls Ward from his winter home in Tucson, Arizona. "I was developing scale models for EM interpretation because in those early days there were no catalogues for interpretation."

When McPhar Geophysics was formed, Ward was one of the principals,along with president C. Stanley Davidson. (Arthur Brant, the "dean" of mining geophysics then teaching at the University of Toronto, introduced Davidson to the McPhar engineers when they were working from a residential garage.) "It was Davidson's idea to do EM on the frozen lakes of Manitoba, pulling a transmitter on a sled and about 200 feet behind, hauling a receiver," says Ward.

"McPhar Geophysics was doing contract EM surveys at the outset and I helped Stan with the interpretation. The next year we began field surveys and we were very successful in finding ore deposits.

"The most dramatic discovery was the New Brunswick Camp, of copper, lead and zinc. I, along with many others, have been recognized by the N.B. provincial government as a pioneer of the N.B. Mining Camp.

"Within the next couple of years, everyone wanted to buy us out. Some of the senior members, including myself, formed NUCOM and developed helicopter EM systems. We made the first airborne EM discovery in the world — the Heath Steele Ore Deposit in New Brunswick."

Ward continued with NUCOM until leaving in 1959 to teach Applied Geophysics in the College of Engineering at the University of California, Berkeley. He remained there until 1970 when he moved to the University of Utah and taught there until 1988. Ward is now Professor Emeritus at the University of Utah. He then became adjunct professor and then research professor at the University of Arizona.

Dr. Ward and his wife, Shirley (who holds degrees from the Universities of Toronto and Utah) golf during the Arizona winter and boat during the summer at their second home in Anacortes, Washington.

The Wards are looking forward to a two-month long trip to the People's Republic of China later this year, where they will be honoured guests. Dr. Ward is an Honorary Professor at Guilin College of Geology, at the Institute of Geophysical and Geochemical Exploration, Ministry of Geology and Mineral Resources, P.R.C.

Phoenix salutes Dr. Ward and his distinguished career.

## CROSSROADS A FIRST RATE AGENCY

For nearly 30 years, since the days they worked at Donway Travel and planned trips for McPhar personnel, Walter Verzuu and Gene Hartmann have booked airline tickets, found hotels and arranged visas for the frequent fliers of Phoenix. (McPhar was, of course, Phoenix's predecessor and several of our staff date back to those days.)

Ten years ago this past January, Walter opened his own agency, Crossroads Travel; Gene went with him. Along with Walter's wife, Rosemary, Margaret Nye and Nancio deSousa make up the small, but efficient and knowledgeable, staff.

"Phoenix provided us with a few challenges over the years," Walter laughs. "Usumbura, Goma and Almaty weren't exactly tourist hot spots, but we sent people to those exotic locations years ago. We currently book about 50 trips a year for Phoenix personnel."

Do you need help with your staff's travel plans? Call Crossroads in Toronto: (416) 920-4800

Crossroads' Walter Verzuu and Gene Hartmann can solve all your travel problems.

Bob Norris, Phoenix office manager, appears drawfed by towering frijonias in Ecuador. Last fall Bob took part in an MT survey in the 4,000 metre high Andes on the Ecuador/ Colombia border.

Ross Gordon Photo

## FOUNDING OF CANADAÕS SURVEY

To acquire, interpret and make available knowledge of the geoscience of Canada's land mass and its offshore is the formidable job of the Geological Survey of Canada(GSC).

This knowledge is necessary for Canada's economic development, public safety, environmental protection and national sovereignty— and for more than 150 years the GSC has been providing it from the far reaches of the second largest land mass and the longest coastline of any country in the world.

In September, 1841, the government of the Province of Canada (now the southern part of the provinces of Ontario and Quebec), passed a resolution granting money for a geological survey of the province. The following year the GSC was born, Canada's first scientific agency and one of its oldest government organizations.

Although that survey was probably proposed to quickly enrich the provincial treasury of that small area, the Province of Canada became the Dominion of Canada and finally stretched 5,514 kilometres from coast to coast and 4,634 kilometres from north to south. Needless to say, this increased the work load of the Survey!

The Survey's first director was William Logan. Born in Montreal and educated in Scotland, Logan's keen interest in geology was aroused when his uncle sent him to manage a copper-smelting company in Wales. He not only learned the business but became an enthusiastic amateur geologist. While visiting Montreal, he heard about the newly-created survey and bid for the director's job. He was appointed April 14, 1842.

By the end of 1844, the original grant money, as well as some of Logan's own, was gone. But Logan and his assistants had made many important discoveries and their results showed the benefits of a systematic geological survey. The mandate of the GSC was renewed.

Logan then made an important career decision — rather than accept an attractive appointment in India, he chose instead to stay with the GSC. He was a well-liked man with a knack for hiring dedicated and competent people and he went on to inspire his employees for another quarter century. (Adapted from "No Stone Unturned, The First 150 Years of the Geological Survey of Canada", by Christy Vodden, 1992)

## PHOENIX RECEIVER WELL-RECEIVED

Durability and reliability are two features built into all Phoenix equipment — features that are, of course, of utmost importance when instruments are dragged up mountains, through valleys and tossed about on bumpy roads.

"Some of our equipment is 12 to 13 years old and it is still working well," says Bruce Bell, partner with John Reynolds in BAR Geophysics of Denver, Colorado. Bell and Reynolds own nine Phoenix IPT-1 transmitters (seven AC3000s and two AC3003s) as well as several different Phoenix IP receivers.

BAR was formed in early 1989 when the two partners, both well-known in mining circles for more than 20 years, decided to go on their own. Several large mining companies keep the company busy exploring for gold, silver and copper in the northern provinces of Mexico.

Bell, a former Torontonian, worked for McPhar conducting EM and MAG surveys in Labrador until moving to Tucson, Arizona in 1972 to run McPhar's American office.

In 1975 he became vice-president of the American branch of the newly-formed Phoenix.

"In those days, Phoenix hadn't yet built any of its own equipment so we used the eight pieces of McPhar equipment that I had in Tucson," Bell recalls. John Reynolds is also a former McPhar and Phoenix employe as is BAR's long-time field operator, John Busby.

"The V-2 Phase IP receiver is the best IP receiver ever made," says Reynolds. "The V-2 gives us productivity, reliability and repeatability of data."

## HOPING TO SEE YOU... Exhibition/Meeting Schedule

* Phoenix will have a display at SAGEEP'95 (the Symposium on the Application of Geophysics to Engineering and Environmental Problems), Orlando, Florida, April 23-27.

* Leo Fox will represent Phoenix at the World Geothermal Conference in Florence, Italy, May 21-26.

* Our booth number is 4074J for the 57th EAEG, Glasgow, Scotland, May 29-June 2. See you there.

PHOENIX GEOPHYSICS

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