THE PHOENIX

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JAPAN SPECIAL ISSUE

PHOENIX IN JAPAN

Phoenix involvement in Japan has grown by leaps and bounds since the first MTsurvey was carried out in 1981 with an MT-16 system. The MT careers of Gerry Graham, George Balint, Bill Pelton, Dave Wight and Mark Halliday were just beginning.

In the early 1980's, Phoenix activities in Japan were mainly MT survey contracts for geothermal exploration. Several MT (and CSAMT) surveys, carried out in more than 15 areas, were performed for KEPCO (Kyushu Electric Power Co.), NEDO (New Energy Development Organization), NEF (New Energy Foundation) and Idemitsu Geothermal. Phoenix MT surveys contributed to the development of Hatchobaru Geothermal Power Station, at 110 Megawatts the largest in Japan.

Since Mits Yamashita joined Phoenix in 1984 (see profile, p.3), many V5 and Turbo V4 systems have been delivered to Japan and MT/AMT and CSAMT survey contracts have operated almost non-stop. Currently there are fourteen V5 systems and two Turbo V4 systems in use in Japan for geothermal surveys, mineralization studies, MT for non-seismic oil exploration, deep crustal study, hot spring surveys and engineering applications. Many of the MT surveys are now being carried out by V5 owners in Japan.

Although it's not possible to mention all the surveys done with Phoenix equipment, the 1994 list of surveys by V5 owners in Japan iS illustrative: two geothermal surveys for KEPCO by West Japan Engineering Consultants (WestJEC) and Phoenix; a geothermal survey for NEDO by Nitettsu Mining Consultants (NMC); an oil survey for Japan National Oil Company (JNOC) by NMC; a geological survey for the Geological Survey of Japan (GSJ) by Sumiko Consultants (SUMICON); a survey in the Hishikari Gold Mine area for Metal Mining Agency of Japan (MMAJ) by SUMICON; a research survey for earthquake study by 18 universities, institutes and the GSJ; CSAMT/AMT surveys by OYO Corporation; CSAMThot spring survey by Dowa Engineering and an AMT hot spring survey by NMC.

Chief Geophysicist G. Leandro of Costa Rica's Instituto Costaricense de Electricidad (ICE) checks out some real ice (and his first snowfall) while participating in the MT Lithoprobe" survey for the Geological Survey of Canada (GSC). Phoenix conducted the survey for GSC last fall in northern Saskatchewan and Manitoba.

DAVID HUTCHISON PHOTO

Multi-Institute Survey

More then 45 geophysicists from 18 universities and institutes and the Geological Survey of Japan from the Conductive Anomaly Research Group used six V5 clock-synchronized systems for the earthquake study mentioned above. The survey took place in Kakuto Caldera, Miyazaki in November 1994. Mits Yamashita and Gerry Graham provided technical backup and Leo Fox participated as an observer.

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MESSAGE FROM THE PRESIDENT

This special Japan issue of "The Phoenix" is dedicated to our valued clients in Japan.

In November, 1994, I was fortunate to return to Japan after seven years to participate as an observer (and layout helper) in the group MTsurvey at Kakuto Caldera (Kyushu) organized by 18 universities and institutes.

As before, the contrasts of Japan impressed me — the peaceful, uninhabited forests near Ebino with great, urbanized areas like Tokyo. Also impressive was the supreme organization of the 45 members of the group survey (six crews in all) and the effective evening discussions in which every member of the group participated. This annual exercise should serve as a model for inter-university co-operation in Canada.

Perhaps no group of users has taught us more than our clients in Japan. Their very high standards, as well as the technical difficulties of geophysical field work in Japan, compelled us to learn and grow. We prize our success in this market, the most demanding in the world.

Leo Fox, President

FROM THE EDITOR

Best Wishes for 1995

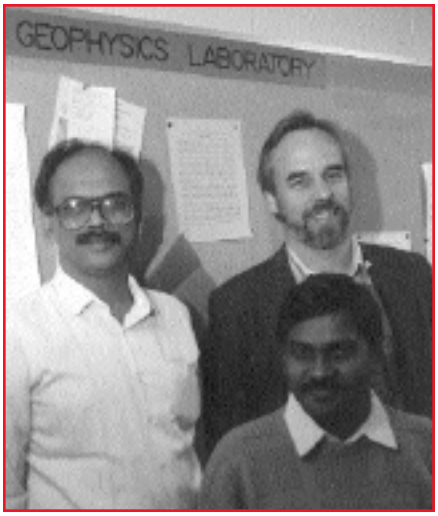
It was a pleasure to meet so many of you at the SEG in Los Angeles and we look forward to seeing many of you at future shows. Your response to the first issue of The Phoenix was gratifying. Don't forget that to stay interesting and relevant, we need your help — if you have any pictures, comments or story ideas, send them along and tell us what you're doing with Phoenix equipment.

By the time you receive this issue, the holiday seasons will be behind us. We hope your celebration (whether it was Christmas, Diwali, Hanukkah or New Year) was wonderful and we wish everyone a happy and prosperous 1995.

Audrey Hutchison
Editor

VISITORS

Left to right, Phoenix engineer Herman Reddering and Ari Poikonen and Kalevi Sulkanen of The Geological Survey of Finland discuss the GSF's V5 spectral IP system. The GSF uses their system for mining and pollution studies.



Dr. Sanjay Gokarn and C.K. Rao of the Indian Institute of Geomagnetism, Bombay, toured the Geophysics and Geology Departments of the University of Toronto with Dr. Richard Bailey during their month-long training visit to Canada. IIG acquired a V5 MT system for earthquake predition research.

PHOENIX IN JAPAN (Continued from front page)

The six V5 systems were supplied by the Earthquake Research Institute of Tokyo University (1 system), the Research Center for Earthquake Prediction, Disaster Prevention Research Institute, Kyoto University (2 systems), Aso Volcanological Laboratory, Kyoto University (1 system) and the Geological Survey of Japan (two).

"Cultural noise" in Japan is extremely strong, probably the worst in the world" according to Mr. Yamashita. "It is caused by highly-developed industry, a dense electric-train network, 50Hz and 60Hz power lines (intermixed in some areas) and radio and VLF stations."

"In the Kakuto project, the survey area was just in front of a powerful VLF station and the signal level was often up to 3V/100m for example. Therefore, in Japan all MT surveys are conducted with time-series data acquisition, with the far-remote reference sites from 10 to 300 km from the survey area," said Yamashita. "As well, the terrain in the area is extremely rugged and therefore the system must be robust and portable."

In this issue we're pleased to tell you a little more about two employees who , although they have travelled the world, have spent a good part of the last few years working with clients in Japan.

MITSURU YAMASHITA
(P. Eng.,M.A.Sc., Geophysicist)

Mitsuru Yamashita immigrated to Canada in 1968, the same year he graduated from Tokyo University with a Master's of Applied Science degree, with a major in Geophysical Prospecting. He was, he says, looking for a challenge in the field of geophysical prospecting. He found it when, within months of arriving in Canada, he began work with McPhar Geophysics.

At McPhar, Mits gained experience in airborne surveying, data processing and interpretation, computer software development and research and development in EM and IP(electro-magnetics and induced polarization).

In 1975 McPhar was sold to outside interests and several employees founded Phoenix Geophysics. Mits looked for yet another challenge and formed his own company, MITSCO Geophysics. He devoted his efforts to developing a new EM system which he called GEM — a multi-frequency portable electromagnetic system which measures the ellipse of polarization.

Five years later Mits returned to McPhar with GEM, worked as a chief geophysicist and added micro-processor control to the new GEM5 and GEM8 systems. He travelled frequently to many countries and once spent three months in Moscow installing a computer and software for an airborne system.

Phoenix was fortunate to have Mits join the company in 1984 to develop CSAMT. In 1988 he became Vice-President. During the past decade he has travelled extensively to all five continents for surveys, sales, acceptance tests, training and conferences. His work load involves data processing and interpretation , software development and various R & D projects. Most recently he has been involved in V5-TDEM (FasTEM, MulTEM and LowTEM development).

Mits was, in past years, extremely active in the Toronto Japanese community and was a founding member of two Japanese cultural and language schools. He now spends more than half the year travelling on business and can no longer find time for Majong and Go games. When he's home, Mits enjoys time with his son, Takato, his daughter, Kana, her husband Allan and their infant son.

Gerald Graham
(M.S.E.E., P.Eng. Engineer)

Senior Engineer, Gerald (Gerry) Graham, graduated from the University of New Brunswick in 1980 with his Master's of Science in Engineering (Electrical). His major was Electromagnetic Fields, his minor Signal Theory Analysis and Computer Programming (Numerical Analysis). He participated in a research project at UNB for a year and then, he says" got my first real job". Luckily for Phoenix, it was with our company.

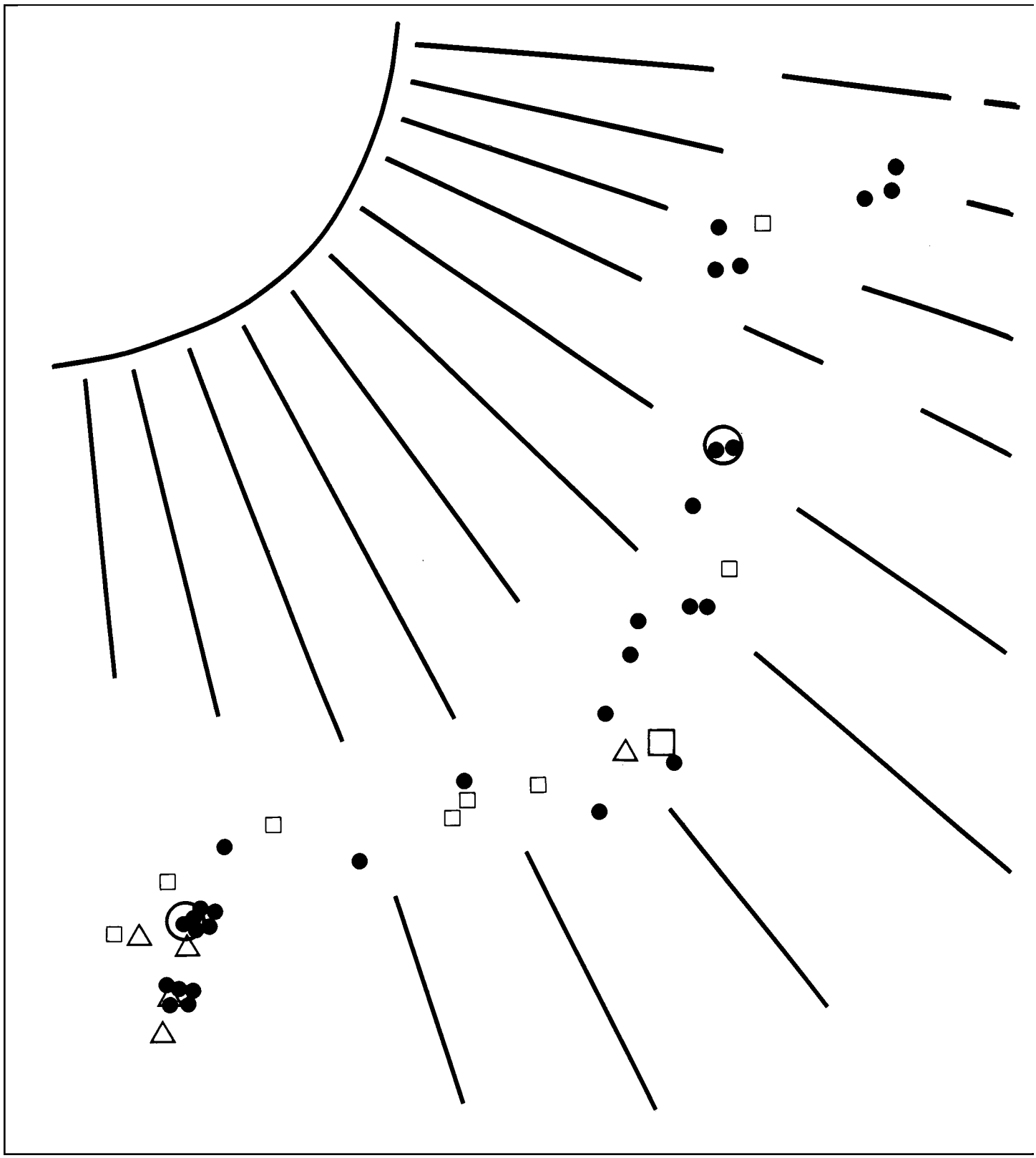
Hired in March, 1981, Gerry was immediately sent to Phoenix's Denver, Colorado subsidiary to undertake the engineering design, software development and technical aspects of the prototype MT system. He spent two years there before returning to the Toronto head office. In February, 1984 he got is Professional Engineer certificate.

His expertise in magnetotellurics has led Mr. Yamashita to dubb Gerry "Dr. MT". Gerry's first overseas job was in Japan in 1981 but since then he has trained many MT crews around the world, from China and Japan to Hungary and the United States.

Most recently Gerry has installed V5 systems in Japan and consulted on several survey projects. Gerry calls himself a Phoenix "insurance policy" because his unique combination of skills allows him to use the equipment, maintain it and continue its software development.

Although Gerry now spends more than half the year outside Canada, when he has holiday time he usually returns to his eastern Canada home. He is the fifth generation born and raised in Canada's tiny island province, Prince Edward Island. (See page 7 for the story of "Ann of Green Gables" or "Akage No Anne" as she is known in Japan.)

PHOENIX PERSONNEL INVOLVEMENTS IN JAPAN



The map indicates some of the geophysical surveys in Japan where Phoenix personnel have been involved. (For our non-Japanese readers, the upper left character means "sun", the lower-right one means "source" or "origin" – together they are pronounced "Nihon" which means "Land of the Rising Sun.")

ILLUSTRATION BYROBERT NORRIS

GEOTHERMAL EXPLORATION IN JAPAN

Situated in one of the most active volcanic zones in the world, Japan is blessed with abundant geothermal resources. Development of alternative energy sources is a high priority for the Japanese government because Japan imports more than 99% of the oil it consumes.

Although the first successful geothermal power station (12 MW) was built in the Oita area as early as 1925, serious efforts to utilize geothermal as a source to generate power began in the 1960s. The Matsukawa power station (20 MW) was begun in Iwate in 1966. The Kyushu Electric Power Co. developed Hatchobaru geothermal power station which is currently putting out 110MW. The total output in Japan is approximately 300 MW and significant expansion is planned.

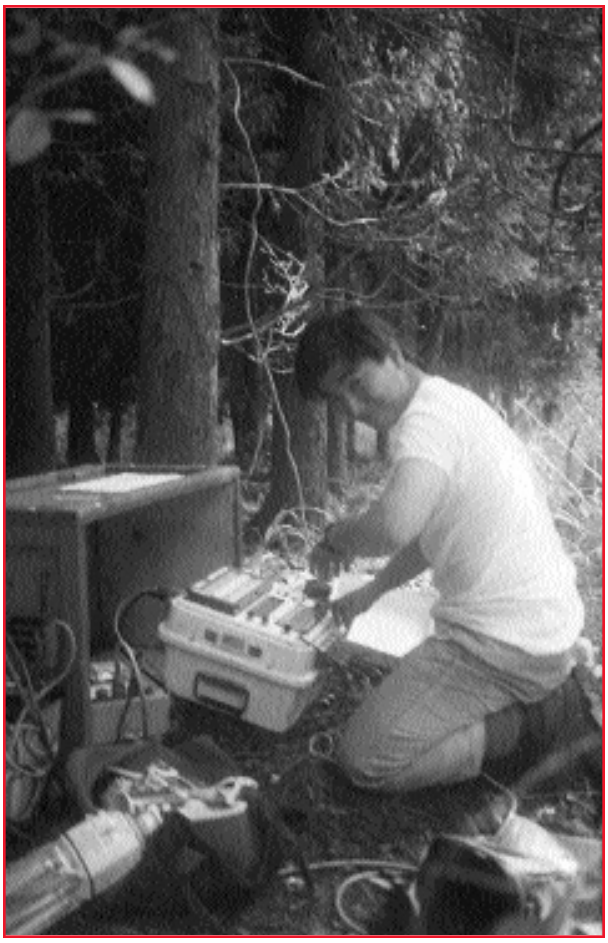
NEDO (New Energy and Industrial Technology Development Organization) has systematically researched and explored geothermal energy as one of several energy sources to be developed. (Others are solar, wind and hydrogen, for example).

NEDO's initial targets were geothermal reservoirs at a depth of one to two kilometres. In addition to geological, geochemistry and borehole surveys, several geophysical methods were employed. Remote sensing, micro-seismic, seismic, gravity, magnetic, conventional EM, SP, heat flow methods and MT (magnetotelluric technique) all played important roles.

The first three phases of this long-term research focused on reconnaissance surveys throughout Japan to collect data and select areas with high potential. The fourth and present phase includes detailed surveys and development of geothermal power generation.

Deep-seated geothermal resources (those more than 2km deep) are now being studied because research shows that the higher temperatures and steam ratios of the deep reservoirs supply more energy per well than a "shallow geothermal reservoir". (It is estimated that the total capacity is 20,000 MW from "shallow geothermal" and 40,000 MW from "deep geothermal", according to NEDO.)

As a deep exploration technique, MT is important in this research. During reconnaissance surveys with randomly distributed sounding sites a few kilometres apart, MT is used to map resistivity structure. Although a geothermal reservoir is not always found in a low resistivity zone, a low resistivity zone is always found at a geothermal site.



Mitsuru Honda of WestJEC operates a V5 system at Hatchobaru.
ROSS GORDON PHOTO

In an area such as Hatchobaru, a high-density (200m x 200m) MT survey grid was used to study in detail fracture zones or faults to determine drilling locations. During NEDO's Phase 4, high-density MT surveys are being used on high-priority areas chosen from initial survey results.

All MT surveys in Japan are performed with a far-remote reference technique because of the interference of extremely high cultural noise. (This is caused by highly developed industry, a dense railway network and many power lines and radio transmitters.) With the far-remote reference method, one system is placed in a relatively low-noise area far from the survey area, usually more than 20 kilometres in NEDO survey specification. The data acquisition system(s) in the survey area and the far-remote system are synchronized by precision clocks to record synchronized time-series data.

In reprocessing of the time-series data, non-coherent signals between the survey area and the remote site are considered noise. During reprocessing, the natural signal is enhanced and the noise suppressed. This technique is essential in Japan to obtain high-quality data for useful interpretation.

Phoenix is proud to have conducted or actively participated in many MT surveys for geothermal exploration and to have supplied many V5-MT systems to Japan for geophysical exploration.

Conductive Anomaly Research Group survey at Ebino, Japan, November 1994. TOSHIHIRO UCHIDAPHOTO

V5 OWNERS

The following is a list of current V5 System owners in Japan, their main activities and the applications of their systems.

Geological Survey of Japan (GSJ)
Two of the first V5 systems built were delivered to the GSJ in March, 1988 (the third went to the Geological Survey of Canada). Since then Mr. Y. Ogawa, Mr. T. Uchida and Mr. S. Takakura have conducted many MTsurveys for earth crustal study, including the transection of the islands of Japan, one of the most active earthquake zones in the world.

Nittetsu Mining Consultants Co. (NMC)
Their first V5 system was acquired in 1989 and currently NMC owns three V5 systems, one Turbo V4, a T30-MG30 high-powered transmitter and two light-weight IPT-1 transmitters. In the early days, NMC carried out many joint geothermal MT, AMT and CSAMT surveys with Phoenix; more recently, NMC has conducted research MT surveys with JNOC (Japan National Oil Company). Some of the surveys made five simultaneous soundings (EMAP-like, but TENSOR measurements) with one V5 receiver using four SPV2 two-channel telluric sensor processors. (A second V5 system was placed at a remote site more than 200 km. from the survey area.) NMC recently completed the first phase of EM tomography development (surface-to-borehole and surface-to-tunnel) using the V5 system.

West Japan Engineering Consultants Co. (WestJEC)
WestJEC is one of the world's leading consulting companies in geothermal surveys, interpretation and development. Its parent company is Kyushu Electric Power Co. (KEPCO).

In 1981,WestJEC and Phoenix jointly conducted one of the first successful MT surveys in Japan in the Hatchobaru geothermal area. The client was KEPCO. Hatchobaru Geothermal Power Station is currently generating 110 Megawatts.

WestJEC owns one V5 system and one Turbo V4 system with two IPT-1 transmitters. Phoenix also carried out a successful geothermal CSAMTsurvey for WestJEC in Guatemala.

Sumiko Consultants Co. (SUMICON)
Sumicon's parent company is Sumitomo Metal Mining Co. which mines Hishikari Gold Mine, one of the the richest mines in the world (average ore grade of more than 88g/t). Sumicon bought two V5 systems with MT, AMT, CSAMT, TDEM and TDIP functions in 1991.

In addition to geothermal surveys, Sumicon conducted an oil-MT survey for JNOC, an MT survey for GSJ and MT surveys in the gold mine area to study deep structure in relation to gold ore mineralization mechanism.

OYO Corporation
OYO purchased a V5 system with AMT, CSAMT, TDEM, SIP and Resistivity in 1991. An EM group at the OYO Geotechnical Institute uses the V5 system to assist the development of geophysical instruments and software.

Dowa Engineering Co.
Dowa and Phoenix jointly conducted MT surveys for NEDO and NEF in the Tohoku geothermal area in 1988 and 1989. Dowa purchased a V5 system with CSAMT, TDEM, SIP and TDIP in 1991.

Earthquake Research Institute, Tokyo University
One V5 system was delivered in March, 1994.

Disaster Prevention Research Institute, Kyoto University
The Earthquake Prediction Center purchased two V5 systems and they were delivered in March, 1994.

ASO Volcanological Laboratory, Kyoto University
One V5 system was delivered in March, 1994.

The last four systems mentioned above (at the two universities), as well as the GSJ's two systems, were used for the Kakuto Project MT survey in November, 1994. These systems will be used not only by the above institutes but by many other universities and institutes for various types of research. Although it is too early to report their activities and research results yet, Phoenix sincerely wishes for fruitful results using the V5 systems.

WELCOME, YI LU

Yi Lu, new employee

We welcome Yi Lu as a part-time technician in our engineering department. Yi graduated from Wuhan University in China in 1984 with a bachelor's degree in Electrical Engineering. He came to Canada seven years ago and has worked in the electronics field for different companies while upgrading his English and Computer Programming skills at the University of Toronto.

PHOENIX AT J.S. SUMNER WORKSHOP

Phoenix Geophysics was pleased to be one of the co-sponsors of the John S. Sumner Memorial Workshop on Induced Polarization (IP) in Mining and the Environment, held in Tucson, Arizona, Oct. 17-20.

D. J. (Jack) Dodds, a consultant who does software design work for Phoenix's IP receivers, was pressed into service to represent Phoenix in Tucson. (All our other candidates to attend were already out of Canada attending trade shows or working on surveys.) Jack has many years of experience in IP and presented two papers at the conference in 1981.

The objective of the meeting was to bring together users and practitioners of linear and non-linear IP for a four-day workshop dedicated to recommending geological, geochemical and geophysical research for IP applied to mining and environmental problems.

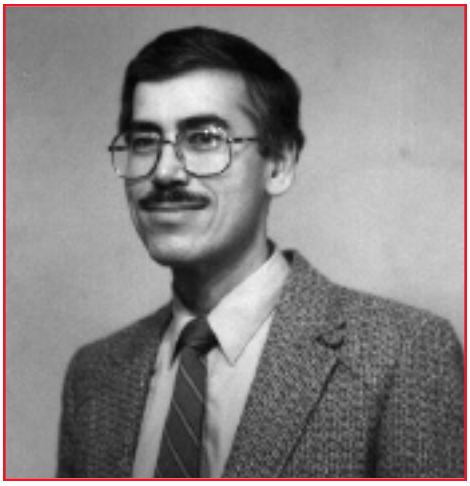
Papers and posters, based on a global perspective, were presented; break-out sessions and round-table discussions led to recommendations for future research areas for IP in both mining and environmental applications.

The workshop, held only every decade or so, has been named in memory of Dr. John S. Sumner. He and his wife, Nancy, died in June, 1993, in their Cessna 180 during takeoff from a Mexican airstrip near where they had been vacationing. The tragic accident was a severe loss to their family and the applied geophysical community.

A superb pilot who served in World War II and the Korean War, John also held degrees in geology and physics and a doctorate in geophysics. He taught at the University of Arizona (Tucson) campus.

The geophysical community will best remember John for two major accomplishments, the 1976 book Principles of Induced Polarization for Geophysical Exploration which became an international reference for practical application and for the large number of students that John nurtured personally and professionally. They are now employed around the world as geophysicists, consultants, professors and business owners.

Two separate scholarships have been established in the names of John and Nancy Sumner at the University of Arizona: the Applied Electrical Methods Geophysics Scholarship in the Department of Mining and Geological Engineering, and the Geophysics Scholarship in the Department of Geosciences. Donations may be sent to the University of Arizona Foundation, University of Arizona, Tucson, AZ, USA, 85721, directed to the appropriate scholarship.



Jack Dodds

CREATOR OF ÒAKAGE NO ANNEÓ

Lucy Maud Montgomery, author of Anne of Green Gables, was born in 1874 and brought up near Cavendish Prince Edward Island. (Engineer Gerry Graham is also from Canada's tiny island province – see page 3.)

When Maud was 21 months old, her mother died and she was sent to live with her mother's parents on an island farm. Although she had many relatives on the island, Maud didn't see them very often because travel by horse and buggy was slow and people had a lot of farm work to do.

The imaginative little girl was lonely without children her own age to play with — she compensated by learning to read before she began school and by making up many imaginary friends.

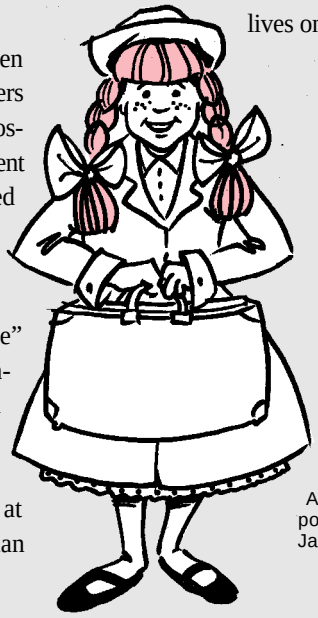
Maud began writing as a child and although her early efforts were rejected, she never gave up writing.

By 1903 Maud was earning a comfortable living writing for magazines — one of the first women in Canada to make a living from writing.

In the spring of 1904, Anne of Green Gables was begun but after five publishers rejected the book she hid it away in a closet. Three years later Maud found it and sent it off to a sixth publisher. It was accepted and on June 20, 1908 Maud received her own printed copy. Almost overnight she became a celebrity.

Eventually there were eight "Anne" books, translated into more than 15 languages. Anne starred in plays, movies, a ballet and television shows. Tourists from around the world, including many from Japan, visit the national park at Cavendish developed by the Canadian government in 1936.

During her last years, Maud was unwell and depressed. She died at 67 in 1942 and was buried in her beloved Cavendish. Immortal Anne lives on.



"Akage No Anne" ("Ann of Green Gables") "Akage No Anne" is an extremely popular book with Japanese girls.

HOW SWEET IT IS!

In recent months, many of you have been the recipients of a tin of genuine Canadian maple syrup. (The lucky winners were drawn at several different trade shows. At the SEG held in Los Angeles, for example, we drew for three tins each day — the winners were from as far away as Lagos and Venezuela and as near to L.A. as Sunnyvale, California.)

Phoenix president Leo Fox presents a can of maple syrup to outgoing SEG President Michael Schoenberger at the SEG in Los Angeles, October, 1994.

Although all the winners were pleased with their prize, some of you were unsure about just what the prize was and what to do with it. So this month we'll tell you a little about maple syrup and where it comes from. Let's assume you have a maple tree on your front lawn and wish to make a tin of syrup from it.

For starters, you must be able to tell the different types of maple trees apart — the best syrup comes from the sugar maple, not the similar-looking Norway, black, silver or red maple trees. Although maples grow all over the world, only Canada and the north-eastern United States produce the syrup. A maple must be 40-80 years old before it is large enough to "tap".

Tapping involves drilling from one to five holes in the tree then inserting a special spout (a "spile") into each hole. Next you must attach large containers (in the old days, wooden buckets with lids) to each spout to catch the sap that will run from the tree when the days are sunny and above 40 F° and the nights are freezing. (This occurs sometime from late February to late March.) The sap is clear and colourless like water but with a slightly sweet taste.

Once you've gathered the sap, it must be boiled ... and boiled and boiled ... until 97.5% of the sap has evaporated. (It takes 40 litres of sap to make just one litre of delicious maple syrup to pour over your pancakes or ice cream.) The average tree yields 68 to 90 litres of sap in a two to three week period so, after all that hard work, you now have one to two litres of pure syrup from your tree.

To make enough maple syrup and sugar to supply a family all year was very hard work. At least once a day the sap buckets were emptied into huge wooden vats on the back of horse-drawn sleds. These vats were taken to the "sugar-shack", emptied into big cast-iron kettles hung above roaring maple log fires and the sap was boiled for hours to condense it.

Modern methods, such as running plastic tubing from tree to tree and directly to electric evaporators in the sugarshack, have eased the workload.

Assuming you don't have access to your personal sugar maple — plan to stop by the Phoenix booth at our next trade show, drop off your business card and you might take home a can of pure maple syrup from a sugar bush in the province of Quebec.

Maple Trivia:

- The Toronto Maple Leafs hockey team wears sweaters with a blue maple leaf on a white background. The team was formed in 1917 and their home ice is Toronto's Maple Leaf Gardens.
- The maple leaf on Canada's flag is red set again a white square with a band of red on each side of the white. Although the maple leaf has been a symbol of Canada since 1805, the maple leaf flag became Canada's official flag in 1965. (The leaf is green, naturally, in the spring and summer but changes to red and yellow in the autumn.)
- There are 100 million maple trees in Canada, but only a few of them are tapped for syrup-making.

HOPING TO SEE YOU... Exhibition/Meeting Schedule

Phoenix personnel will attend the following shows in coming months. Please look for us.

- We're back in our regular spot for the Annual Prospectors and Developers Association of Canada convention and trade show, March 5-8, 1995. Now more than 60 years old, the P&D last year attracted more than 3,200 delegates from over 40 countries. Plan to drop by for an ice-cream: Booth #26, The Canadian Room, Royal York Hotel, Toronto.
- The Symposium on the Application of Geophysics to Engineering and Environmental Problems (SAGEEP '95) is in Orlando, Florida at the Twin Towers Hotel, April 23-27.
- The 57th European Association of Exploration Geophysicists (EAEG) Meeting and Technical Exhibition and the 7th European Association of Petroleum Geoscientists and Engineers (EAPG) Conference and Technical Exhibition is May 29-June 2 at the Scottish Exhibition and Conference Centre, Glasgow, Scotland.
- We will attend the First Latin American Geophysical Conference and Exposition and the Fourth International Congress of the Brazilian Geophysical Society in Rio de Janeiro, August 20-24, 1995. This international event, the first of its kind in Latin America, is to bring together the Societies and promote technology exchange and fellowship.

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