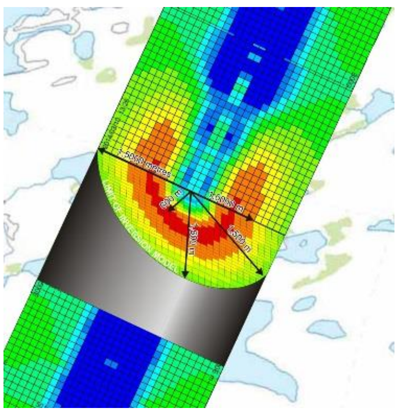
Selected examples of research and applied professional experience
Greg A. Shore, P.Geo.
Premier Geophysics Inc., Premier Geophysics (US) Inc.
1966-2015
Shore is a Registered Professional Geoscientist (P.Geo) in Ontario and British Columbia
Member of Society of Exploration Geophysicists (SEG) and Society of Mining Engineers (SME) of AIME.

HIGHLIGHT: 2015 - First true 3D IP and resistivity mapping in the historic Comstock Trend, Nevada. Fs3D IP and resistivity coverage of historic underground silica-gold workings and a blind test of characterization of a new low-grade gold deposit hosted in an oxidized porphyry intrusive. Classic high resistivity mapping of the former, and successful characterization of the latter with a recognizable 3D IP signature. For Crone Geophysics & Exploration Ltd., Mississauga, Ontario, and Comstock Mining Inc., Virginia City, Nevada.

2013: Re-investigation of the core principles behind DC resistivity results in the proposal of two results-driven definitions: ***fs3D*** (full spectrum 3D) and its subcategory ***con3D*** are reserved for specific standards of 3D data set characteristics, and by extension, for the 3D inversion-generated earth models derived from such data sets. The new definitions challenge conventional thinking and practice at every level of DC resistivity from single line traverses to 3D distributed acquisition data sets and 3D inversion processing, suggesting both historic and ongoing deficiencies.

2012: LINEAR E-SCAN survey procedures and results are formalized and named as the "cross-line strategy" for the cost-effective ***con3D*** detection and definition of large scale conductive bodies, embodying real-time control of survey line placements per accumulating data.



HIGHLIGHT: 2011 - LINEAR E-SCAN reconnaissance with integrated en-route 3D anomaly resolution for large- scale conductive targets (geothermal, uranium, IOCG, SEDEX) gets major control and progress-tracking software upgrade to increase efficiency of implementing in-field transitions from single line acquisition to ***con3D*** to ***fs3D*** survey completions. Example field data sets from British Columbia and Nevada geothermal projects.

2010: Twenty square mile (51 km²) E-SCAN ***fs3D*** resistivity geothermal system mapping in Dixie Valley, NV. 3D imagery of hydrothermal plume and conduit, to 2,500 metres below surface, using >4,000 m (Ze) field data. Crew of 3 deployed; estimate that an equivalent 3D distributed acquisition survey would require >12 field crew. Terra-Gen Power.

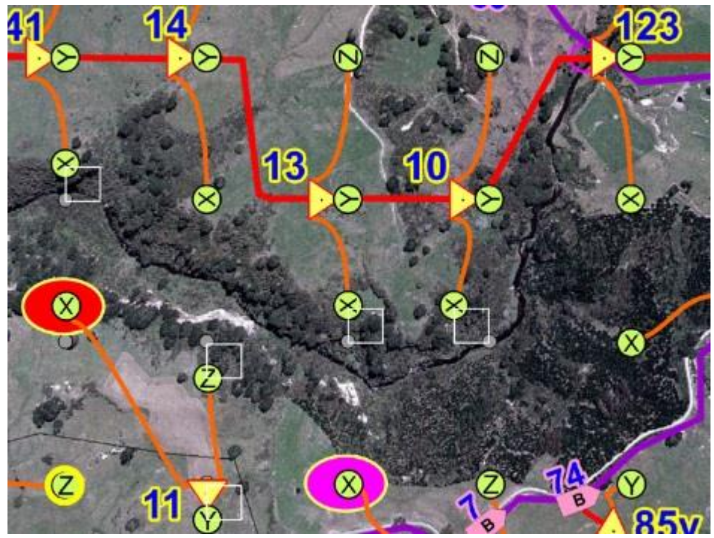
HIGHLIGHT: 2009: High efficiency cost breakthrough: 15 square mile E-SCAN ***fs3D*** resistivity geothermal system mapping in Buena Vista Valley, Nevada. Demonstrated new small-crew procedures and hardware developments requiring just 2 field workers for the entire 37 km² field geophysical program. Estimate that an equivalent 3D distributed acquisition survey would require >10 field crew. Terra-Gen Power.

Left, automation for desert operations allows high-speed deployment and the equally-fast gas-powered recovery of 3D survey wire by a single worker.

2009: 3-point Schlumberger (***3pS***) mapping of part of the Black Warrior geothermal complex. Nevada Geothermal Power Company Inc.

2008: Large scale E-SCAN ***fs3D*** resistivity mapping in Central Volcanic Region, NZ, two more properties totaling over 40 km². We see the continuing efficiencies of crew members making local electrode siting decisions in these intensively-farmed survey areas. Glass Earth Gold Ltd.

HIGHLIGHT: 2007: New operational flexibility has crew making decisions. Large scale E-SCAN ***fs3D*** resistivity mapping in Central and Mamaku Volcanic Regions, North Island, New Zealand, for epithermal gold. Steep topography, intensive farming and development, livestock issues and infrastructure characterize a lot of New Zealand survey areas, requiring innovative operating practices in order to maintain cost-efficiency. Locally sourced and trained field crew. Four exploration projects totaling over 65 km². Glass Earth Gold Ltd.



The corners of the white squares identify electrode positioning offsets that are available for selection by the on-site wire-installation crew. When the nominal site (grey dot) proves inaccessible or compromised, a nearby site can be selected on the GPS screen as the *go-to* replacement. No time is lost. Data acquisition will proceed with optimally-placed stations that always correspond with the planned 3D inversion mesh element nodes.

This may seem like a small detail, but it is the mastery of literally dozens of "small" details that positions an E-SCAN crew for success in delivering a cost-effective survey completion. This allows E-SCAN to guarantee up-front the cost of any proposed 3D survey, eliminating the client's exposure to over-run costs when unexpected issues challenge survey progress.

HIGHLIGHT: 2006 - Large scale *fs3D* E-SCAN geothermal mapping survey in Salt Wells area, near Fallon, Nevada. Successful deep 3D imagery in conditions of <2 ohm-metres with extensive electrical noise originating at the nearby Naval Air Station. Vulcan Power Company, Bend, Oregon.

2006: 3-point Schlumberger (***3pS***) geothermal mapping of the Salt Wells valley area and Bunejug Mountains covers many geothermal features manifestations, working in background conditions as low as <1 ohm-metre.

A number of enhanced target sub-areas were identified for follow-up investigation.

Environmental concerns seem to increase annually, requiring constant updating of field procedures, while attempting to keep costs low.

Vulcan Power Company, Bend, Oregon.

This 5-wheel flotation-tire (2 psi) transporter leaves no long-term marks even in the most delicate desert conditions. All areas that were heavily traveled by 5-wheelers in a 1989 E-SCAN survey near Gabbs, NV are today identifiable only by a slightly-increased lushness of the sage vegetation, while same-period tire tracks left by the client's pickup truck remain as unmistakable 3 inch deep depressions.

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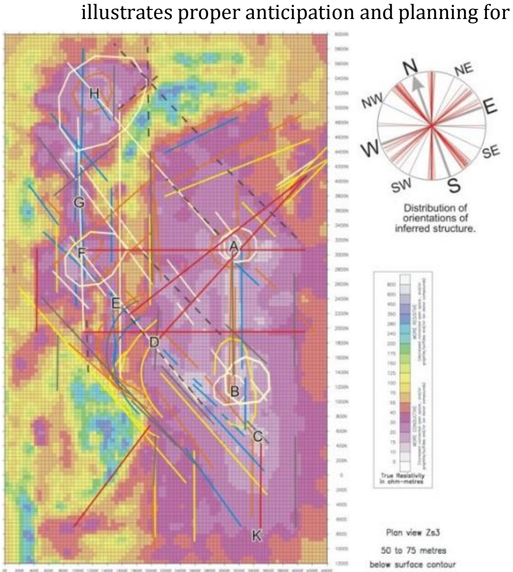
2006: 3-point Schlumberger (***3pS***) mapping of a geothermally-active Basin and Range valley, Crump Geyser, Warner Valley, OR. Follow-up full Schlumberger soundings provided vertical confirmation of a low-resistivity ***3pS*** anomaly associated with the geyser site. Lightweight boats were employed to complete the survey coverage across hazardous (often partially frozen) flood conditions. Nevada Geothermal Power Inc.

HIGHLIGHT: 2005 - E-SCAN *fs3D* geothermal mapping in Pumpernickel Valley, Nevada, covering 60% moderate-to-steep range areas and 40% flat valley. Dual grid spacings of 400m and 200m provided very deep large-scale characterization of a hydrothermal outflow plume extending along the valley, while retaining detailed resolution of linear and cross-breaking alteration patterns imaged in the exposed range rocks upslope from a range-front boiling hot spring. This survey illustrates proper anticipation and planning for an encounter with both very large scale plume signatures and comparatively small scale signatures of structurally-controlled thermal fluid conduits in a single survey pass. Nevada Geothermal Power Inc. with U.S. Dept. of Energy co-funding.

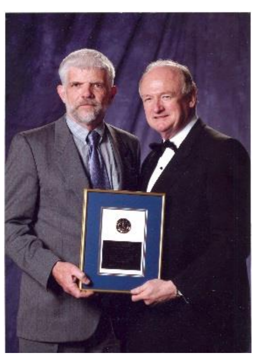


The main valley plume (15 km^2) is seen in plan view. To its left, some details of the higher-elevation fracture-controlled fluid anomalies are seen. This plot also summarizes the many geophysical linears interpreted from the full 3D inversion model, with three principal orientations being identified.

HIGHLIGHT: 2005 Shore awarded CIM's Barlow Memorial Medal for best applied geology paper published in CIM Bulletin, 2002.

This paper is a description of the evolution and application of the 3D E-SCAN geo-electric mapping system, illustrating conditions and concepts that are important for development of any 3D mapping system.

This is useful reading for persons facing difficult geophysical challenges, including mapping subtle targets, working in complex or industrialized site conditions, or in extreme terrain conditions.

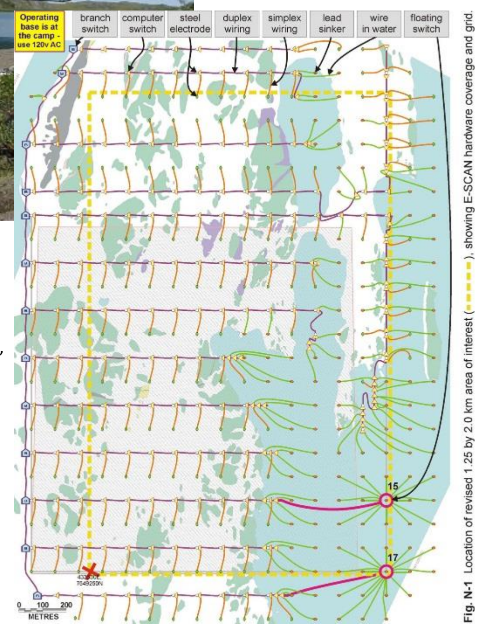


2004: Hollister area, Nevada - E-SCAN ***fs3D*** resistivity survey mapping epithermal silicification in weathered and covered volcanic terrain WSW of Hecla's Hollister-area Gwenivere mine development, for Geologix.

HIGHLIGHT: 2003 –surficial marine clays, with extensive lake cover.

Hope Bay project, Nunavut: ***fs3D*** geo-electric mapping of a broad area of resource-hosting Archean lithology and structure. Classic electrical-geophysics problems of masking and distortion by conductive surficial marine clays prove manageable with true 3D data acquisition and inversion processing. Large lake areas are included, requiring floating electronics to maintain a regular grid spacing through the water areas. Survey design, execution, 3D interpretation, and report to Miramar.

LEFT - Crew prepares for wiring the lake areas with floating electronics (yellow-pink) and GPS positioned lake-bottom electrodes.



Right - Uninterrupted resistivity mapping through lake areas is a challenge in many exploration settings. Water-filled depressions may result from preferential erosion of altered rocks or structure, either of which may be represent important exploration features.

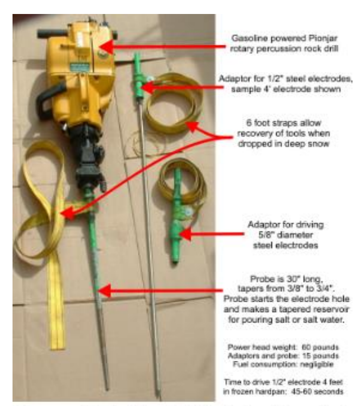
This survey setup was quick to install, quick to shoot, and easy to recover, - adding very little extra cost to fully incorporate the lake areas into the fs3D field data set.

2002: PAPER: Shore, G., "Multiple total field 3D DC resistivity mapping."
CIM Bulletin, v95, no 1058, Feb 2002.
"Multiple total field" is the then-current generic description for 3D E-SCAN.
In 2005, CIM's Barlow Memorial Medal was awarded to Shore for this invited paper.

HIGHLIGHT: 2002 - 3D resistivity mapping, Athabasca Basin, SK.

3D geo-electric images through Waterbury Lake east of the Cigar Lake deposit show alteration envelopes in association with underlying conductive anomalies near and below the unconformity elevation (500-600 metres below surface). This was a winter through-ice survey, which was itself no technical problem, and in fact represented the simplest part of the survey. The infamous contact issues relating to deeply-frozen dry-land sandstones proved to be as difficult as had been predicted, particularly in terms of keeping any transmitter from shutting off in an automatic response to a (falsely) perceived open circuit condition. Gas-powered electrode pounders (right) helped very little.

Field data acquisition, 3D inversion and report to Cogema Resources Inc.



Gas-powered breaker drives steel electrodes through permafrost

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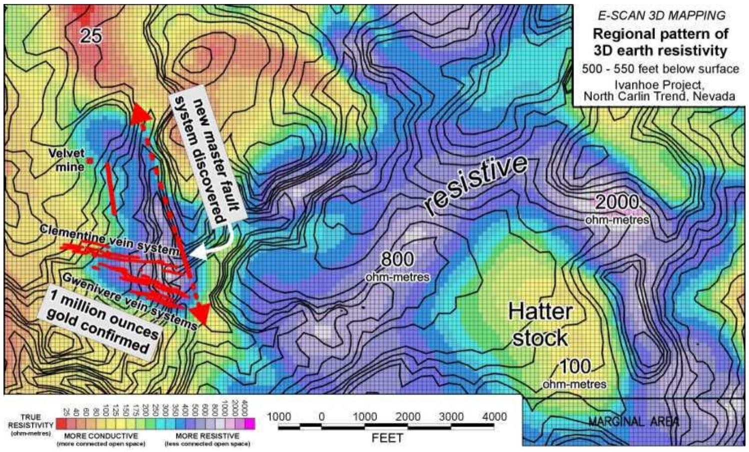
2000: PRESENTATION: Shore, G., "Multiple total field 3D DC resistivity mapping." CIM PDA Joint Annual Meeting, Toronto. Abbreviated slide presentation of the history and development of 3D E-SCAN.
This well-received presentation resulted in an invitation by the editor of the CIM Bulletin to create a summary paper for the monthly bulletin.

2000: Hollister area, Nevada. Close-spacing (400') E-SCAN ***fs3D*** resistivity mapping extends prior survey coverage and confirms imagery of silica alteration patterns overlying high-grade gold vein feeder structures. The 3D imagery is said to be evocative of Hishikari style mineralization, and provides indirect guidance for drill-targeting the otherwise geophysically-invisible high-grade deep feeder conduits in the underlying Ordovician. Great Basin Gold.



HIGHLIGHT: 1999 - "Electrically hostile" Archean surface environment proves no difficulty for 3D mapping. Archean environment 3D surveys, northern Quebec, Canada. Three large-scale programs in typical Archean conditions demonstrate that the near-surface regime which alternates conductive swamps and lakebed clays with resistive eskers or outcrop is no impediment to detailed 3D mapping in the district. Lake and townsite are enclosed within one survey area. 3 clients, confidential.

1999: Poster Session presentation, Shore, G.A., "Description and case results: Multiple total field 3D DC resistivity mapping."
2nd International Symposium, Three-Dimensional Electromagnetics (3D-EM2), Univ. of Utah, Salt Lake City, 1999. E-SCAN.

HIGHLIGHT: 1998 - Indirect mapping of ore setting in Carlin-type sediments. Western Utah: E-SCAN ***fs3D*** resistivity mapping in a Carlin-type sed-hosted environment tracks known gold mineralization that is spatially associated with dolomite anticlines, by accurately mapping anticline dips and offsets under pervasive cover. Location, client confidential. This square-mile survey ranks as the fastest E-SCAN ***fs3D*** resistivity survey ever undertaken, taking a crew of two just 4 days (arrival to departure) to acquire the complete field data set and clean up.

1998: Extreme terrain in the eastern Sierras of California.
fs3D E-SCAN resistivity survey is used to map the extent of intrusive-based mineralization in a historic mining district. The entire survey setup is hand-laid and shot, using supplies from a couple of wire and electrode caches set out on drill roads.

HIGHLIGHT: 1998 - Dry desert sand operation In an area of Nevada known as "unsurveyable" due to contact problems with pervasive deep, dry sand cover, E-SCAN ***fs3D*** resistivity mapping proceeds without problems to reveal the deep underlying structure and anomalous linear resistive zoning. For E-SCAN, *no contact or signal problems whatsoever*. Sandman (ex-BP) property, Nevada, client confidential.

1997: Helicopter-access rough-terrain E-SCAN **3D IP and *fs3D*** resistivity mapping in the Yukon Territory. Base metals target. Survey design, execution, 3D interpretation, report to Atna Resources Ltd.

1996: Barkerville area, British Columbia. E-SCAN **3D IP** and ***fs3D*** resistivity survey of an unknown steep area marked by prospective geochemistry, float and limited outcrop. Detailed resolution of intersecting narrow diagonal, multi-directional linears and deep-seated conductive prisms. Survey design, execution, 3D interpretation, and report, Barker Minerals.

HIGHLIGHT: 1996 - 3D resistivity images the K2 ore setting, Republic district, Washington State. E-SCAN ***fs3D*** resistivity survey over the silicic, volcanic-hosted K2 orebody to determine a 3D signature and test its viability as a regional deep-cover target model. Prior electrical geophysical surveys were unsuccessful; the reason was clearly identified by the E-SCAN imagery. Survey design, execution, 3D interpretation, forward model testing and report to Echo Bay Minerals Company.

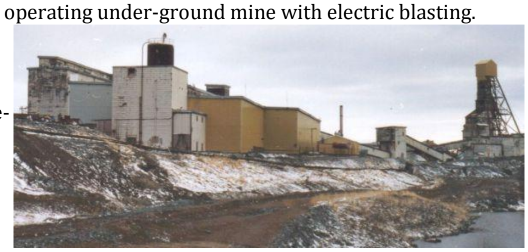
1996: Enhancements to the suite of 3D E-SCAN data acquisition instrumentation and control software, providing superior system diagnostics and additional lightning-strike tolerance. Improved Induced Polarization **3D IP** data acquisition characteristics.

1995: Paradise Peak area, Nevada. E-SCAN ***fs3D*** resistivity survey west of Paradise Peak and County Line deposits, mapping covered ground. Target was a Paradise Peak or County Line analog under cover. Design, execution, 3D interpretation and reporting, Royal Eagle Exploration Inc.

HIGHLIGHT: 1995 – 3D E-SCAN sets new standards in speed and cost/effectiveness, regional mapping in desert cover.
Sleeper area, Nevada. Medium-wide spacing (600'x750') E-SCAN ***fs3D*** resistivity mapping of a large area on strike southwest of the Sleeper deposit, targeting similar structurally-controlled settings. Proof-of-concept for high-speed, wide area, low cost 3D mapping to a mile depth. 21 sq. miles surveyed, 3D processed, interpreted, drilled, all within 90 days, completing exploration decision making *before* the first Federal BLM claim payment of US$180,000 came due. Legal title to claims maintained throughout. Royal Eagle Exploration Inc.

Innovations like this gas-powered wire recovery system speed up key field operations, while reducing manpower. The same system also dispenses wire at high speed, using a disc braked automatic damping mechanism to prevent wire backlash.

HIGHLIGHT: 1993 - 3D E-SCAN images economic shear zones under heavily industrialized minesite. Northwest Territories, Canada.
E-SCAN ***fs3D*** resistivity survey of Giant Yellowknife mine site, including buildings, tailings ponds, dumps. Successfully mapped all known mineralized zones to >1000 feet below surface, in hostile geo-electric conditions, over an operating under-ground mine with electric blasting. For safety, the survey work was scheduled *between* mine shifts,in twice-daily 4-hour 3D survey sessions. Royal Oak Mines.



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1993: Yukon Territory, Canada. E-SCAN ***fs3D*** resistivity survey on placer gold property, Hunker Creek, Klondike, to map resistive anomalies in the basement rock. The concept is to locate remaining *in situ* bedrock mineralization, the so-called motherlode, from which downstream placer deposits originate. Design and execution, 3D inversion interpretation, report to Kennecott Canada.

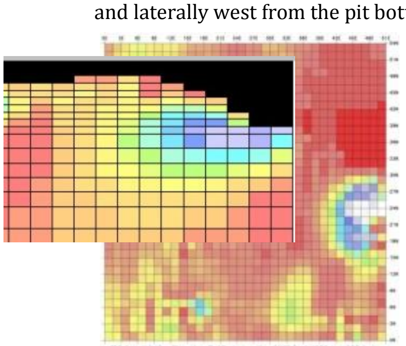
HIGHLIGHT: 1993 - 3D E-SCAN sub-bottom exploration through 6 feet of ice at -40 C. Northwest Territories, Canada. E-SCAN **3D IP** and ***fs3D*** resistivity surveys on Great Slave Lake, off Yellowknife. Surveys through 6-8 feet of ice using bottom-placed electrodes. Mapped sub-bottom structures and sulfide zones corresponding with airmag, bathymetry and prior drilling results. Survey and ice technique design, field surveys and report to Royal Oak Mines Ltd.

1993 PAPER: "Concepts toward more precise location of underground nuclear explosions using static and time-variant 3D electrical resistivity signatures." Workshop on seismic and non-seismic verification of a Comprehensive Test Ban (CTB), Ottawa, 4 Feb 1993, Ministry of External Affairs and International Trade, Non-proliferation, Arms Control and Disarmament Division. This paper was subsequently presented at General Round meeting, Geneva. Concept: Having employed 3D E-SCAN to identify the candidate blast site as an unexplained resistive anomaly (moisture is removed by underground blast effects) *within the wider general area identified by the international seismic array*, E-SCAN then observes (in 4D) the re-establishment of the more-conductive ground-water moisture regime over a period of weeks. This provides a unique, non-natural process signature that is detectable long after the initial seismic event is registered and gone. Drill confirmation of the presence of appropriate isotopes within the so-identified anomaly would provide the scientific evidence for an indictment.

1992: PAPER: Shore, G.A. and Clearwater, R.P., "Hidden anomalies: Small near-surface variations can completely mask large, deeper anomalies." Geothermal Resources Council TRANSACTIONS, v.16, Oct. 1992. Exposure of a significant weakness in conventional DC resistivity as used in geothermal geophysics, worldwide, over the prior 25 years. Many surveyed areas that were considered fully explored (with data of this type) may actually remain effectively untested.

1992: PAPER: Shore, G.A. and Clearwater, R.P., "LINEAR E-SCAN: A reconnaissance resistivity mapping system that evaluates its own anomalies en route." Geothermal Resources Council TRANSACTIONS, v.16, Oct. 1992. The answer to the limitations of single-traverse dipole-dipole reconnaissance (above paper), by expansion of wider-area single-line capture into a full 3D evaluation of any anomaly setting, in real time. Precursor example of today's "cross-line strategy".

HIGHLIGHT: 1992 - The classic Borealis epithermal branching signature is defined in 3D at Freedom Flats, Borealis Area, Nevada. E-SCAN **3D IP** and ***fs3D*** resistivity survey over the Freedom Flats area. 3D inversion generates a map of deep sulphide-gold extension area extending below and laterally west from the pit bottom. The Borealis Trend was largely developed by geological mapping and step-out drilling, as the available conventional IP and resistivity survey results offered no useful guidance. E-SCAN ***fs3D*** resistivity survey was immediately successful, establishing an orebody model signature and a mapping tool for seeking out look-alike deposits under the extensive covered areas that lie on both sides of the trend. Survey design, execution and report to Santa Fe Pacific Gold Corp.



HIGHLIGHT: 1991 - Previously undetectable narrow high-grade epithermal gold structures are mapped with regional scale 3D E-SCAN survey, at regional scale costs. Toodoggone Area, BC. The Toodoggone district is notorious for its absolute refusal to cooperate with any applied electrical geophysics, EM or DC, ever. This largest-ever 3D E-SCAN resistivity survey over the Lawyers mine area, and including the AGB, Duke's Ridge, Cliff Creek and Silver Pond areas, marks a local breakthrough that confirms the unique power of ***fs3D*** DC resistivity data. The survey first documented the typical 3D geo-electric signature for all known gold deposits in the area. Using these signatures, numerous look-alike 3D E-SCAN anomalies were determined to be potentially significant. Many of these remain untested today, despite some interesting results:

One such 3D anomaly was drilled to reveal the Phoenix deposit, a very high grade (>75 oz/ton Au) siliceous shear structure which was immediately profitably mined. This survey success illustrates:

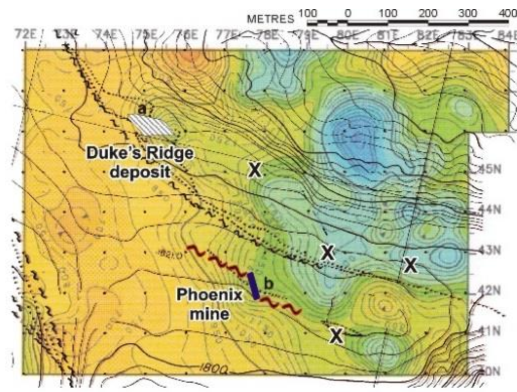
1) the concept of calibrating expectations for an area-wide exploration signature using the signatures of already known local deposits, and

2) a regionally-specific case of very narrow (2 metres) epithermal structures being marked by larger scale silicic alteration envelopes, which are amenable to detection and drill-targeting using 3D E-SCAN mapping.

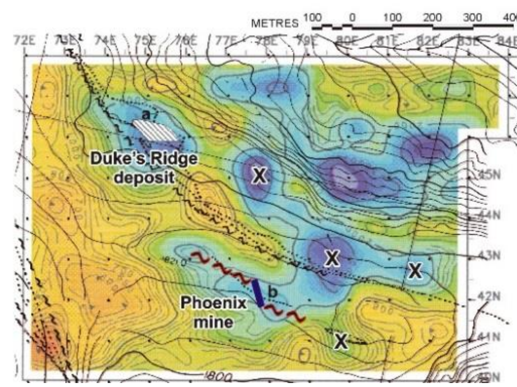
Cheni Gold Mines Inc., Vancouver, BC.

Toodoggone volcanic hosted epithermal gold: 3D E-SCAN.

Upper: – unprocessed field data (contoured pseudo-plan plot).



Lower: 3D inversion of the E-SCAN ***fs3D*** field data set correctly positions the resistive patterns in True 3D, revealing the resistive (silicic) envelope that surrounds the linear structure hosting the 2 m wide Phoenix shear (up to 75 oz/ton Au).



Below: Press release noting the discovery of the Phoenix deposit upon drilling the 3D E-SCAN anomaly pattern.

CHENI GOLD MINES INC.
SUITE 200, 580 HORNBY ST.
VANCOUVER, B.C. V6C 3B6
TEL: (604) 688-2321
FAX: (604) 684-0642

September 9, 1992

PRESS RELEASE

A small surface exploration campaign is being conducted on the Lawyers property in the near vicinity of the milling facility to test targets identified by the E-Scan campaign conducted during 1991 and to locate the source of high grade float identified in earlier work. Trenching and diamond drilling on one of the targets has identified a new mineralized quartz-chalcedony vein carrying ore grade values over narrow widths. A total of 950 meters in 20 holes has been drilled in a grid of east-west tiers dipping -50 degrees per tier at 15 meter intervals with 5 holes per tier. Results have varied from non-economic intercepts to hole 92-47 which returned 78.5 oz/ton of gold and 1,330 oz/ton of silver over 1.75 meters. The strike length of the vein is about 60 meters and extends to a depth of at least 60 meters. The structure sits within a megacrystic tuff. Mineralization within the vein is dominated by argentite with lesser amounts of electrum and leaf and wire silver. The Company plans to test the continuity of the zone to the west and carry out additional exploration on some of the other E-Scan targets in the general area.

1991: Presentation: A long-term early warning system for future geologic threats to Yucca Mountain Nuclear Waste Repository

Responding to a request for proposal from the US Nuclear Regulatory Agency, Premier Geophysics proposes a 100-year fixed-array deep (>25,000 feet) automated 3D earth resistivity monitoring installation.

The system is based on E-SCAN DC resistivity and co-existent Magnetotelluric (MT) arrays* for joint 3D data inversion, sharing a digital control and data download network that is monitored from a remote office site. The system would provide seasonally-corrected early warning of changes in groundwater levels, and changes in deep structure and temperature that would signal potentially renewed volcanic activity, a threat to the repository. This proposal remains with others in the current state of administrative limbo, as decisions on the future of Nevada's Yucca Mountain Repository site continue to be deferred.

* 20 years later, ORION 3D "invents" the same thing: **IP/resistivity + MT**. *This 1991 3D E-SCAN system would measure 4-5 times deeper than ORION does today, over a 100 year monitoring period designed to outlast the 100 year fast-removal storage period.*

HIGHLIGHT: 1990 - 3D E-SCAN surveys are permitted in a restricted-access BLM Desert Tortoise Preserve. Imperial Valley, California. Zero environmental disruption, and major reduction of drilling requirements are key to achieving special permitting for this area.

E-SCAN **3D IP** and ***fs3D*** resistivity survey over seven square miles of the Mojave Desert. Demonstration of the environmental acceptability (BLM approval) of E-SCAN in this highly-restricted Class 3 Desert Tortoise habitat shows that government agencies can respond to technical advances that reduce impact on sensitive lands. Survey design, execution, report to Bema Gold Corp., Vancouver.

HIGHLIGHT: 1990 - Silicic mushroom images in the Hollister area; a deep feeder structure is imaged. North Carlin Trend, Nevada.
E-SCAN **3D IP** and ***fs3D*** resistivity surveys map deep structure and hydrothermal sulfide distribution in a historical cover-play. In 1995 3D inversion reprocessing located a deep feeder conduit oriented WNW beneath the Clementine silica-gold zone, and another oriented NNW through Butte. These distinct patterns predate and now mark the mineralized system being developed for mining by Hecla.
Original survey design, execution, interpretation, report to Ivanhoe Gold Company, Battle Mountain, NV.

HIGHLIGHT: 1988-89 - The Paradise Peak siliceous tuff orebody, the Ketchup Flat orebody and buried copper sulfide mineralization are all imaged for the first time, in a single definitive 3D survey sweep.
Gabbs, NV. Regional scale E-SCAN **3D IP** and ***fs3D*** surveys are applied here as a test where all other geophysical methods have consistently failed. The accuracy of E-SCAN's 3D ore zone imaging is remarkable.

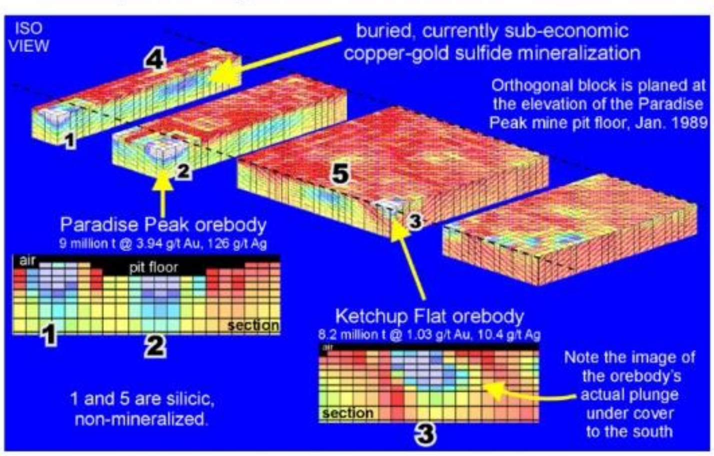
The first functional UBC 3D inversion algorithm was applied to 3D field data from the Ketchup Flat area.

This was also the first deployment of full 3D E-SCAN survey through an operating open pit mine, without interruption to mining.

The Paradise Peak ore signature is repeated in the 3D mapping of the Ketchup Flat deposit a mile away, where even the SW dip of the ore zone is apparent in the 3D imagery.

All economic ores in the area have a strong, blocky resistive signature. Of 5 resistive anomalies, three are ore or prospective ore. Two are barren silicification. This is a case example, drill-supported, of the strategy of identifying the true 3D geo-electric signature of known ore, then proceeding to search for similar signatures in the surrounding area, effectively providing comprehensive wide area condemnation at the same time. Survey design, execution, reports to FMC Gold Company.

3D E-SCAN *post-discovery* test: resistive bodies in conductive host volcanics.



3D E-SCAN imagery of the main three mineralized bodies at Paradise Peak

These bodies remained invisible to all applied geophysical techniques while exploration proceeded by prospecting and pattern drilling.

HIGHLIGHT: 1987 - Conglomerate-hosted epithermal hot spring deposit yields a 3D signature identifying the conduit breccia and secondary mineralized zones. Graham Island, BC. E-SCAN ***fs3D*** survey of the Cinola Deposit, including mapping of the deep breccia pipe feeder system. This is a calibration on the known orebody for purposes of designing a regional reconnaissance survey specification.

Of note: intensely clay-altered rock is counter-intuitively far more resistive than the unaltered water-saturated open-space conglomerate. This singular observation shatters a handful of well-used concepts regarding what should be conductive and what should be resistive. Some clay (contributing to ionic conduction) may increase conductivity, but too much appears to gum up ion mobility and elevate resistivity – with an expectation of a high IP effect reasonably anticipated. A high IP effect has in fact been seen to accompany similar conditions nearby. Survey design, execution, interpretation and technical report to City Resources (Canada) Ltd., Vancouver, BC.

HIGHLIGHT: 1987-1989: 3D inversion R&D. Premier Geophysics participates in a program of research into 3D inversion modeling of E-SCAN 3D data sets, conducted by Department of Geophysics and Astronomy, University of British Columbia, Dr. Doug Oldenburg, principal investigator. Program co-sponsored by Premier Geophysics Inc. and the Natural Sciences and Engineering Research Council (NSERC), Ottawa. This program evolved and became the more widely supported Geophysical Inversion Facility at UBC.

The UBC-Geophysical Inversion Facility was started in 1989 with funds from the B.C. Science and Technology Fund. The goal was to establish a local centre of excellence with a mandate to develop new computer technologies for mineral exploration and to interact with industry on research projects of mutual interest. This has spawned a number of close interactions with industry and NSERC.

The first collaboration was with E-SCAN Technologies. Modelling and inversion of 3D pole-pole DC resistivity were the first technical problems to be addressed.

Founding members of the UBC-GIF at the first UBC-GIF Open House in 1989. Left to right: Yaoguo Li, Robert G. Ellis, Misac Nabighian, Doug Oldenburg, Rob Ellis and Greg Shore. (from UBC-GIF website: www.eos.ubc.ca/ubcgif/)

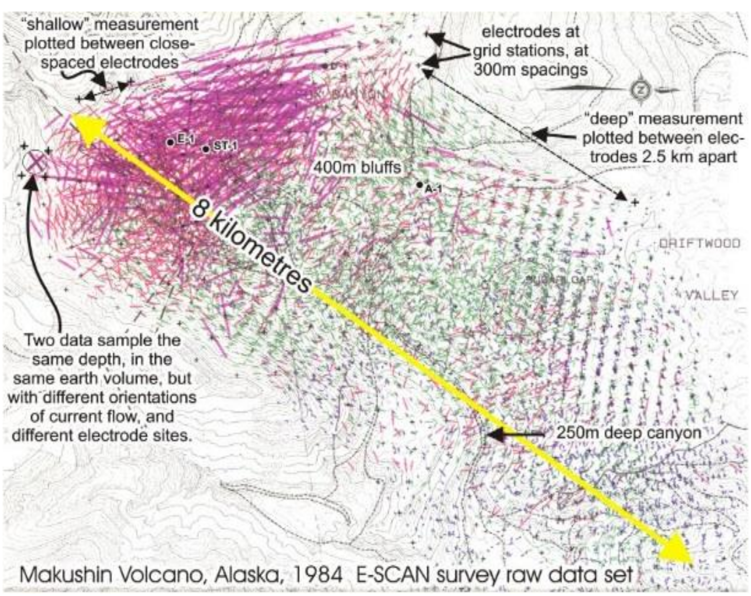
HIGHLIGHT: 1987 - 3D E-SCAN IP and resistivity raw data image a 3-mile wide intrusive centre with classic hydrothermal concentric zoning. Sulfides are mapped under >700 ft of oxide, including fault-offsets. Crescent Valley, 2 miles north of Pipeline Deposit, Nevada. Three overlapping E-SCAN **3D IP** and ***fs3D*** resistivity surveys mapping deep intrusive structure and hydrothermal sulphide (gold-bearing) distribution in a historical cover-play. Coral Gold Corp., Vancouver, BC.

1986: Banks Island, BC Application of high density (50' grid spacing) E-SCAN **3D IP** and ***fs3D*** resistivity survey on six separate programs for gold and sulphide mineralization in complex folded and faulted geology. Documentation of significant anisotropy in some resistivity results indicates another possible mapping indicator being available, and inviting questions as to how this condition might influence or be preserved within 3D data inversion processing.
One of these six survey programs also hosted the first field application of the **E-SCAN Rotary Gradient** survey technique, and the one-hour **E-SCAN mise-a-la-masse** survey.
Trader Resources Ltd.

1986: PAPER: Shore, G.A. and Ryder, A.J.D., "Mapping the Makushin reservoir with 3D E-SCAN resistivity." Geothermal Resources Council TRANSACTIONS, v.10, 1986.

HIGHLIGHT: 1986 - E-SCAN Rotary Gradient and 1-hour Mise-a-la-masse surveys prove powerful tools in extremely disturbed surface conditions. Development of the **Rotary Gradient** and high-speed **Mise-a- la-masse** E-SCAN survey concepts, hardware adaptations, and processing software, representing fast, low-cost acquisition of fundamentally different geo-electric data using an E-SCAN system setup prior to shooting the 3D E-SCAN survey. This research has led to useful field tools that have been successfully applied in conditions where deep resolution is compromised by large-scale extreme resistivity variation.

HIGHLIGHT: 1984 – An all-directional 3D resistivity field data set that will inspire accelerated 3D inversion research. Makushin Volcano, Unalaska Island, Alaska. Large scale, multi-directional E-SCAN survey is laid out with no GPS, LORAN or any other navigational assistance, in extreme terrain conditions. This set of 10,570 all-directional pole-pole array field data was introduced two years later at a meeting at the University of British Columbia (UBC). The data set confirmed to UBC inversion researchers a level of available data acquisition technology that might advantageously support automated inversion processing to deliver 3D earth resistivity models, if, as, and when such inversion developments could be conceived, proven and delivered.
See **HIGHLIGHT: 1987-1989: 3D inversion R&D.**



Makushin Volcano, Alaska, 1984 E-SCAN survey raw data set

HIGHLIGHT: 1984 - 3D geothermal resistivity in terrain too rough for any other technique. Makushin Volcano, Unalaska Island, Alaska, - 3D E-SCAN survey to map boundaries of a known geothermal field, test adjacent areas for resource possibilities. Predates GPS, assisted by helicopter in terrain conditions impossible for any other method. Real-time summary results presentation in field. Survey area 10 sq. miles; electrode spacing 1000'; slopes to >60 degrees. Republic Geothermal Inc., Los Angeles, CA., Alaska Power Authority, Department of Geology and Geophysics, and State of Alaska.

1983: PAPER: Shore, G.A., "Application and interpretation of multiple pole-pole resistivity survey, Mt. Cayley, British Columbia." Geothermal Resources Council TRANSACTIONS, v.7, pp 545-550. The first published report on 3D field results from the new E-SCAN geophysical system.

HIGHLIGHT: 1983 - Successful proving of the new LINEAR E-SCAN extreme-depth reconnaissance traversing hardware. New Aiyansh, BC, - reconnaissance geothermal resistivity survey through recent (<200 years) volcanic flow area: first trial of the LINEAR E-SCAN survey mode. Geological Survey of Canada, Open File Report.

1983: Patricia Bay, BC. Design, execution, and interpretation of downhole pole-pole resistivity survey, -, Dept. of Energy, Mines and Resources.

1983: Lakelse Lake, BC. Design, execution, and interpretation of E-SCAN multiple electrode geothermal resistivity survey to analyze fluid distribution and flow dynamics in and around a hot spring system in marine clay sediments. Demonstrated the E-SCAN data set's immunity to power line effects: swampy property is bisected by major power transmission corridor supplying the Kitimat aluminum smelter. Technical report to Geological Survey of Canada, published as an Open File Report.

1983: Analysis and reassessment of helicopter EM-33 survey results from the Meager Creek valley, conducted for purposes of characterizing the response to hot spring outflow in valley sediments. Re-interpretation reverses negative conclusions, characterizes a highly successful reconnaissance method which replicated years of ground survey conclusions in a two-day flight program. Premier internal research.

1983: Theoretical research into potential for application of E-SCAN technology to the full range of geothermal exploration, from preliminary reconnaissance through detailed discovery mapping, to resource exploitation management (4D). Development of LINEAR E-SCAN mode of operation, with cross-line real-time anomaly position evaluation. Premier internal R & D program.

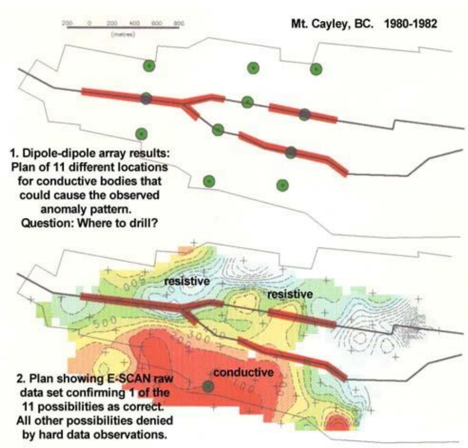
1983: Analysis of transient response characteristics of the E-SCAN hardware/wiring/electrode system in various configurations, preparatory to application of E-SCAN field hardware for induced polarization mineral exploration in rough terrain, complex geology. Premier internal R & D program.

Greg Shore, P.Geo. Premier Geophysics Inc. 53 Duncton Wood Crescent, Aurora, ON, Canada L4G 7T4
Tel: 1 905 713 2704 e-mail: gashore@premiergeophysics.com web: www.premiergeophysics.com

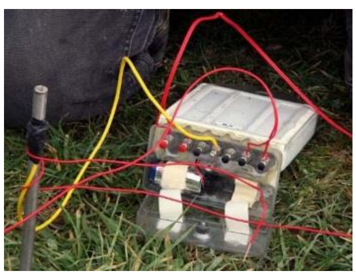
1982: Anahim Volcanic Belt, BC. Design, execution, and interpretation of follow-up Schlumberger resistivity soundings in areas of 1981 large dipole anomalies. Program of Schlumberger soundings in district valleys to determine the background resistivity conditions for geo-electric exploration for hot spring discharge accumulation. Technical report to Geological Survey of Canada, Open File Report.

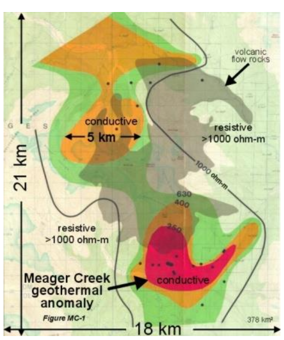
1982 - 1983: Mt. Baker, Washington. Design, execution, and interpretation of 3-point Schlumberger (***3pS***) geothermal resistivity surveys, S and SW flanks of Mt. Baker, geothermal energy program of Seattle City Light.

HIGHLIGHT: 1982 - Successful first field survey with the new 3D E-SCAN hardware clarifies prior data. Mt. Cayley, BC. Design, execution, and interpretation of 3D E-SCAN multiple electrode resistivity survey covering and extending the 1980 dipole resistivity area. Resolution of previously uninterpretable area resistivity anomalies (11 possible solutions) to a single non-ambiguous target result. Technical report to Geological Survey of Canada, published as an Open File Report. Summary paper published in Geothermal Resources Council, Transactions, Vol 7, 1983.



1981-1982: With Mike Marchant, P.Eng., final instrumentation development and construction of a field-ready 256 (later 384) electrode E-SCAN system for multi-directional resistivity surveys in rough terrain and complex geology. Funding assistance was provided by the Geological Survey of Canada.





1981 - 1982: Meager Creek Geothermal Project First North American use of grid-regular 3-point Schlumberger (***3pS***) reconnaissance mapping, throughout >100 km^2 of the alpine Meager Mountain complex. This is an extreme-terrain adaptation of the standard *along-roads* method for mapping geothermal reservoirs in New Zealand.

In co-operation with KRTA, Auckland, N.Z., and Peter MacDonald, DSIR, Wellington, N.Z. Technical reports to the BC Hydro and Power Authority.

1981: Anahim Volcanic Belt, BC. Design, execution, and interpretation of a large spacing (1000 and 2000 foot dipoles) geothermal dipole-dipole traverse across 26 miles of the Volcanic Belt. GSC Open File Report.

1981: Elaho Valley, BC. Design, execution, interpretation and reporting of remote area dipole-dipole geothermal resistivity survey in four metres of snow. Tech report to NSBG/ BC Hydro and Power Authority.

1981: "Report on coordination and review of resistivity survey results from the Meager Creek Geothermal Area, 1974 to 1981",
for BC Hydro and Power Authority. Principal author of correlation, integration and analysis of all electrical resistivity results from the Meager Creek Geothermal Project; application of 2-D forward modeling of south reservoir structure and resistivity distributions using dipole data; correlation of resistivity results with drill results.

1981: Mt. Cayley, BC. Design, execution, and interpretation of dipole-dipole geothermal resistivity survey; application of 2D forward modeling of results. Nevin, Sadlier-Brown Goodbrand Ltd., BC Hydro and Power.

1980: Mt. Cayley, BC. Design, execution, and interpretation and reporting of dipole-dipole geothermal resistivity surveys at high elevation through Mt. Cayley volcanic complex, central Garibaldi volcanic belt. Notable for unrecognized "side-look" discovery of the main Mt. Cayley resistivity anomaly, resolved in 1982 3D E-SCAN follow-up. GSC Open File Report.

1980: With Mike Marchant, P.Eng., completion of prototype design of E-SCAN multiple pole-pole computer-operated survey hardware. .

1980: Evaluation of multiple pole-pole experience; commencement of design and prototyping of a computer operated single-wire 256 channel distributed scanning system for multiple pole-pole surveys.

1979: Coast Mountain Range, British Columbia. Design, execution, and interpretation, deep snow (>15') dipole-dipole resistivity traversing between Meager Creek valley and Elaho River valley to the south. Nevin, Sadlier-Brown Goodbrand Ltd., BC Hydro and Power Authority and Dept. of Energy, Mines and Resources, joint project.

1978: PAPER: Shore, G.A., "Meager Creek geothermal system, British Columbia, Part III: Resistivity methods and results." Geothermal Resources Council TRANSACTIONS, v.2, pp 592-596. Examining some results from early all-directional resistivity studies, part of the field research that led to the development of E-SCAN 3D survey technology.

1978: Meager Creek Geothermal Project, BC. Design, execution, and interpretation of wide-spacing valley-bottom dipole-dipole resistivity surveys. Technical report to Nevin, Sadlier-Brown Goodbrand Ltd., BC Hydro and Power, and Canada Dept. of Energy, Mines and Resources.

1978: Meager Creek Geothermal Project, BC, research project to verify convertibility of multiple pole-pole measurement elements into more complex (derivative) array forms, - internal research project within 1978 field program.

1978: Meager Creek Geothermal Project, BC. Design, execution, and interpretation of multiple pole-pole array resistivity surveys over 35 km^2 of extreme mountain terrain. Tech report to Nevin, Sadlier-Brown Goodbrand Ltd., BC Hydro and Power, and Canada Dept. of Energy, Mines and Resources, joint project.

1977: Meager Creek Geothermal Project, BC. Design, execution, and interpretation of rough-terrain multiple pole-pole resistivity survey, using helicopter-dispensed wiring and no-landing airborne emplacement of key remote electrodes. Technical report to Nevin, Sadlier-Brown Goodbrand Ltd., project engineers for BC Hydro and Power Authority and Government of Canada, Dept. of Energy, Mines and Resources.

LEFT: A Jet Ranger lays survey wire across some extreme terrain from a TurAir dispenser, in part of the 1977 research program *that would not likely be permitted today*..

1977: Design, development and construction of a 24 wire relay-multiplexed, scanning multiple pole-pole IP/resistivity system, utilizing 1200 Volts DC high amperage transmitted power, and multiple wire, computer-operated data acquisition, measurement, storage. Real-time color display of vector results. This system was successfully deployed in 1978 on the Meager Creek Geothermal Project, then abandoned as the limitations of centrally-connected individual wire setups were realized.

1977: St. Lawrence area, Burin Peninsula, Newfoundland. Conventional IP/resistivity surveys for copper/gold in a granitic environment covered by peat bog. Client confidential.

1976: Meager Creek Geothermal Project, BC. Design, execution, and interpretation of regional self-potential (SP) reconnaissance survey and vertical electrical sounding resistivity mapping surveys. Technical report to Nevin, Sadlier-Brown Goodbrand Ltd., BC Hydro and Power.

1975: Meager Creek Geothermal Project, BC. Design, execution, interpretation of large spacing dipole-dipole resistivity survey to extend and detail 1974 reconnaissance findings, using a 36 Kw transmitter system. Report to Nevin, Sadlier-Brown Goodbrand Ltd., BC Hydro and Power.

1973-1974: Pine Point, Northwest Territories. High power (36 Kw system) IP/resistivity survey using small dipoles to map sulfide bodies that were previously undetected by wider-spacing reconnaissance IP surveys. Ruth Mining Company, Toronto.

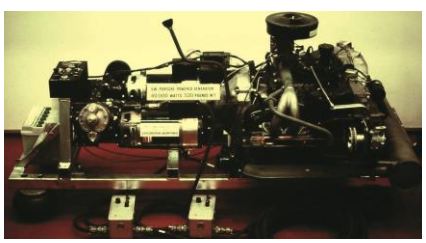
1973: Design, development and testing of solid state IP/resistivity transmitter control/switching modules for up to 500 Kw of coded pattern pulse delivery across a 200 mile gradient resistivity array, proposed for a semi-permanent earthquake prediction observatory experiment spanning part of the Rocky Mountains.

HIGHLIGHT: 1973 - Integrated methods succeed in mapping ore where previous surveys missed. Kamloops, BC. Integrated use of high power IP/resistivity in various array configurations, with seismic follow-up.

A gradient array IP survey mapped the lateral boundaries of a previously IP-indicated buried porphyry copper ore body. Specifically-sized dipole-dipole IP coverage then determined the depth-to-top across the entire chargeable ore zone, followed by hammer seismics to determine the thickness of overburden (how much drill casing needed).

With its predictably superior depth performance, the gradient array's data also mapped out a previously-undetected, adjacent, down-faulted lobe of the main ore body, lying below the depth range of all of the dipole-dipole array coverage that had been used over the main body. Expanded dipole-dipole arrays then confirmed the down-faulted ore extension and determined the new depth-to-top, adding significantly to the total prospective ore tonnage at this early stage of exploration. Survey design, technical report to Sovereign Metals.

HIGHLIGHT: 1972 – Helicopter-portable very high power transmitter.
Design, development and construction of world's first modular, lightweight 36 kilowatt induced polarization and resistivity transmitter with break-apart 40 kilowatt generator system, 2-man loadable anywhere. The system was used in SW USA (Arizona porphyry copper), Pine Point area (lead-zinc), central BC porphyry copper belt, and in definitive discovery work in the geothermal program at Meager Creek Geothermal Project, BC. The system was easily moved about the Meager Volcanic Complex by helicopters as light as a non-turbocharged Hiller 12E.



LEFT: A de-stressed 90 HP Porsche military - industrial engine powers the 400 Hz, 40,000 watt ultra-lightweight (520 pounds) IP system generator that can break down into 3 parts to move, even hand-loaded into a 4x4 pickup truck. At this time, the 40 kilowatt generator used in the high power IP systems of Asarco and Anaconda required a 5-ton truck.

RIGHT: Once important for mapping geothermal and porphyry copper, this *3600 volt, 100 ampere,* 36 Kw Premier IP transmitter is no longer required, outdated by modern tech.

In 2015, 3D E-SCAN delivers equivalent or greater depths of exploration, with better signal return, *using less than 5 kilowatts.*

Seldom requiring more than 2 amps of current into the ground, the newer 3D E-SCAN technology also eliminates the physical ground disturbances (digging pits) previously required for installation of high current electrodes.

HIGHLIGHT: 1972 – 600 Ampere marine resistivity system.
Design, development, construction of 600 ampere SCR-switched DC transmitter and generator, with buoyant 14 mile streamer array and high-current self-cleaning seawater interfaces, for marine resistivity profiling. Intended for offshore oil exploration in seismic-attenuating bottom conditions (e.g. Trinidad), and for sub-bottom permafrost mapping (Beaufort Sea). Project terminated before deployment due to Federal budget cutbacks. Energy, Mines and Resources Canada R&D project, Mackenzie Delta, Beaufort Sea.

1972: Johnson Camp, Arizona. High power (Premier's new 36 Kw) IP/resistivity survey to map extension of a known sulphide orebody into area of deep valley cover. Technical report to Superior Oil Company.

1971: Kalahari Desert, Namibia. Test, demonstration, and training of client crew, new Huntec Mark III induced polarization and resistivity receiver. Huntec (70) Ltd, Toronto.

1970: Hoyle Township, Ontario. 200 line mile VLF electromagnetics and magnetic survey program, all in swamps, for Paterson, Grant and Watson, Limited, Toronto.

1969: Great Bear Lake, Northwest Territories. Design and execution of VLF electromagnetics and magnetic surveys, for Norm Ursel, consulting geophysicist, Toronto.

1968: In-field engineering (hand carved fuel-valve cams) and adaptation of a constant-flow fuel injection system for a Huntec 7.5 Kw IP motor-generator. Eliminated frequent spark plug failures (carbon fouling) caused by delayed airflow acceleration (= rich mixture) during pulsed loading of the previously *carburetor-equipped* two-stroke JLO engine. The adaptation effectively doubled the available pulse-load power for the Portugal survey, with sparkplug life expectancy extended from half a day to several months. Barringer Research.

HIGHLIGHT: 1967-68 - 120 km by 20 km IP survey.
Wide spacing time domain induced polarization and resistivity survey for pyrite over 2400 km^2 of a Tertiary cover play, central Alentejo province, Portugal (pyrite belt). This conventional 7.5 kw pole-dipole survey delivered an average of five measurements per day due to low signal and difficult large-array logistics. The survey was designed to explore to 1000 metres depth, searching for pyrite (for its sulfur content) for the Portuguese match industry.

Barringer Research, for Companie Uniao Fabril, Lisbon.

In 2015, 3D E-SCAN can employ a similar size crew to map similar depths, delivering over 2,000 IP measurements per day in true 3D.

1967-1968: Development, documentation, and implementation of field calibration techniques for the Huntec Mark I and Mark II IP/resistivity receivers, report to Barringer Research Inc.

1966-1967: Time domain induced polarization and resistivity ground follow-up to airborne INPUT EM surveys flown over 25% of the Republic of Ireland. Survey operations in 16 of the 26 counties. Also magnetics and vertical loop electromagnetic surveys. With Barringer Research, for Tara Exploration and Dev. Co., Dublin.

1966: Halliburton area, Ontario. IP and resistivity survey at extreme small (3 m) spacings for detection of near-surface molybdenite veins under thin organic cover. Barringer Research, for unnamed client.

1966: Field evaluation and recommendations for technical and operating improvements to the new Barringer GM102a Proton Precession Magnetometer, internal report by G. A. Shore to Barringer Research Ltd.

1966: Big Onion Mountain, Smithers, BC. Helicopter-supported conventional 7.5 Kw time-domain induced polarization and resistivity survey on steep mountainside for copper sulphide mineralization. Barringer Research, for Canadian Superior Oil.

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