

**QUALITY MANAGEMENT MANUAL**  
**FOR**  
**PATHFINDER EXPLORATION PTY LTD**  
**(EXCELLENCE IN GEOCHEMISTRY)**



**PATHFINDER EXPLORATION PTY LTD**

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## **PATHFINDER EXPLORATION PTY LTD**

### **Company Profile**

The Pathfinder Exploration Pty Ltd consultancy commenced in 1986 and specialises in geochemical exploration ranging from orientation and sampling surveys through to the interpretation of the geochemical data. Regolith mapping is also carried out where required. The principal of the consultancy - Dr. Craig Rugless has over thirty years' experience in both geochemical sampling and interpretation in Australia and Oceania.

*Particular emphasis is placed on researching methodologies that are capable of gaining maximum geochemical results in the difficult terrain* of the East Yilgarn. An example of this is provided by a geochemical survey conducted in the Yamarna - Minnie Hill area, east of Laverton where sampling and analytical methods proposed by Pathfinder Exploration located hitherto unknown gold mineralisation beneath transported aeolian sands (~2m) and Permian glacial sediments (~30m) overlying the Archaean basement. An additional sampling method involves sampling the magnetic LAG or MAGLAG fraction using the *Pathfinder Exploration MAGSAM 2000 magnetic sampler* coupled with various partial digests, followed by ICP/MS-OES analyses. This method offers the advantage of providing an Fe – rich concentrate, even in aeolian sands, and enhancing the target elements including Au, Ag, As, Ba, W, Sb, Te and the chalcophile elements Cu, Pb, Zn, Ni and Co. More recent work has involved using the *MAGSAM 2000* sampler for PGM exploration where the full suite of PGEs (Pt, Pd, Ru, Rh, Os, Ir) are analysed using a very cost effective mini Aqua Regia digest developed in conjunction with Ultra Trace Laboratories, Canning Vale, WA.

*Salt lake sampling* can be efficiently undertaken using the Predator salt lake auger and sited using DGPS surveying equipment. The auger is also capable of shallow core drilling in the salt lake environment. The auger/core method of sampling is quick and free of contamination. The resulting sample can be analysed by various partial techniques including Enzyme Leach that has outlined mineralisation at Lake Lefroy, Kambalda, WA based on classical peripheral “rabbit ears” anomalies developed by the rare earth elements. The water sample in the auger hole can also be analysed for Au at ppt levels using the ICP – graphite furnace (ETV) technique.

*Pathfinder can provide field assistants* that are familiar with the necessary strict procedures and quality controls required for a good geochemical sampling programme. Ongoing guidance is provided by the principal geochemist to ensure that the sampling programme is efficient and is of high quality. The field teams are provided with a vehicle, communications and DGPS equipment capable of sub-metre positioning. The sample teams are geological/regolith experienced and provided with field data loggers to provide a regolith record for each sample point.

*Pathfinder has a field team based in Perth and equipped with a Toyota Landcruiser King Cab, DGPS surveying equipment, laptop computers, satellite & CDMA telephones, UHF radio and full camp gear.*

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### **Field Duties and Quality Control**

- The field teams can provide pegged survey lines based on a *differential real - time DGPS* positioning system using either the Trimble AG132 or Omnistar Omnilite DGPS units linked to either Psion or PDA data loggers. The Hewlett Packard CE (PDA) unit can be linked to the DGPS to provide accurate ( $\pm 10$  to 20 cm) positioning for geological mapping and/or GIS applications. The equipment offers the opportunity to provide accurate surveys both throughout Australia as well as Africa, SE Asia, the Americas and Europe.
- DGPS readings are taken at every sample station and the *Pathfinder Exploration* geochemical/regolith data ledger or logger is used and subsequently downloaded or reproduced in a digital form.
- Auger geochemical samples are also accurately positioned by DGPS surveys.
- In - field sample duplicates can be taken and standards inserted at regular intervals to ensure quality control of the geochemical analyses and sampling methodologies.
- *Pathfinder Exploration* head office is kept informed of the sampling teams progress via daily communications and email downloads where possible.
- The samples and digital data will be sent regularly to *Pathfinder Exploration* head office. A summary report will also be provided, as required.
- Field communications are currently successfully provided by analogue mobile telephones. Vehicles are also equipped with high frequency SSB radios for use in more remote areas.
- Topofil/compass and hand held GPS traverses can be conducted, if required.
- The sampling will be done according to *Pathfinder Exploration's* requirements with the field team *dedicated* to the contracted job.
- Field work periods will be tailored to ensure completion of individual geochemical sampling programmes.
- Advice can be sought from the principal geochemist - Dr Craig Rugless at *Pathfinder Exploration Pty Ltd* at all times. Total confidentiality is guaranteed.
- All Pathfinder Exploration field personnel used are MARCSTA certified and have First Aid training.
- All field personnel will conform with the Mining Act while on site.
- **SAFETY IS PARAMOUNT** – Regular in – house meetings are held to investigate potential hazards on the job and to suggest ways of avoiding accidents.

### **Personnel**

Dr Craig Rugless - Principal

Mrs Carolyn Rugless – Secretary

Mr Andrew Mitchell - Senior Field Officer

Mr Louis Bell – Senior Geologist (available if required)

Mr Rod Williams – Senior Resource Geologist/geochemist (available if required)



## **Equipment**

- Toyota Landcruiser 75 Series King Cab ute fully equipped with scrub bars, long range fuel tanks, twin batteries and extra spare tyres, capable of carrying either the light weight auger or the quad bike. Registration No. 8KR817.
- Toyota Landcruiser 80 Series Wagon fully equipped with scrub bars, long range fuel tanks, twin batteries, extra spare tyres and water tank. Registration No. 8DD593.
- Predator light weight (390 kg) multi - purpose auger rig capable of being towed behind a quad bike on salt lakes and difficult sand hill country.
- Suzuki LT – F300F King Quad 4WD Quad Bike.
- DGPS capability with Trimble AG132 and Omnistar Omnilite DGPS units linked to Psion and PDA data loggers. Garmin 12XL (2) and Garmin Plus II 12 channel GPS units equipped with external aerials and power packs are also available for stream sediment sampling programmes.
- Topofil chain/suunto compass (if required).
- UHF radios and CDMA telephone links.
- Iridium satellite phones for communication anywhere in the world.
- Field computers - 2 X PC Computers including Pentium laptop computers and HP palmtop computers for use on site. Head office in Perth is equipped with networked Pentium computers, HP 750C plotter, GIS/geochemical software and full internet/email services.

## **Insurances**

Field assistants are employed by Pathfinder Exploration Pty Ltd and are covered by the following insurances.

Workers Compensation:

Workers Compensation Industrial Diseases:

Public Liability (if required): Limit \$10,000,000

Motor Vehicle: Comprehensive Insurance of Toyota Landcruiser with Third Party Personal

## **Environmental Policy**

The company exercises care of the environment at all times and uses established tracks wherever possible. It may be necessary, from time to time, to drive along grid lines and all care will be taken to preserve the flora along the traverses. In the unlikely event of a major mechanical breakdown that may require an oil change - all waste oils (and contaminated soil) will be collected in plastic bags and disposed away from the field site, according to the act.

## GEOCHEMICAL TECHNIQUES

Pathfinder can conduct a variety of geochemical sampling and orientation surveys (refer Appendices 1 & 2) , as follows:

- -6 mm + 2 mm & 2 mm LAG sampling.
- **MAGLAG** sampling using *Pathfinder Exploration's MAGSAM 2000* rare earth magnetic sampler (refer Appendix 2). MAG samples provide a proven method of trace element concentration and can be analysed by various partial analytical techniques and proprietary micro-cyanide leach (MCL) techniques.
- Very fine fraction. -75µm Ao soil samples.
- Experience in and case histories of a variety of partial analytical digests including Conc & Dilute HCl, Enzyme Leach & MMI techniques.
- -2mm BCL 2 kg (BLEG) soil and stream sediment samples.
- Fine fraction (-75µm) overbank stream sediment samples.
- Active channel magnetic fraction - **MAGSTREAM** stream sediment samples using Pathfinder Exploration's **MAGSAM 2000** rare earth magnetic sampler.
- **Auger** calcrete & ferricrete sampling using the multi - purpose Predator 10 light weight auger drill and acid testing for base of calcrete horizon.
- **Auger** salt lake sampling using the multi-purpose Predator 10 light weight auger drill towed behind a quad bike that can be used for reduced mud horizon sampling and water sampling at ppt levels.
- Multivariate statistical analysis and image processing of geochemical raw data and statistical indices coupled with full interpretation, plotting and GIS services.



Surveying a soil geochemical grid using a Trimble AG132 DGPS unit coupled with a psion data logger in the East Yilgarn, WA.



## SALT LAKE AUGER GEOCHEMICAL RIG

The *Salt Lake Auger* can effectively go where a 4WD quad bike can go on the salt lakes. The salt lake samples can provide meaningful geochemical results based on initial surveys done at Lake Lefroy, Kambalda by WMC (pers. comm. Michelle Carey – Phone Kambalda 90 27 6211). The salt lake auger can also be used for bedrock sampling down to 12+ m along the western shores of the salt lakes in the Eastern Goldfields. The advent of DGPS surveying techniques also provides accurate positioning of the drill hole programme on the lake.

Various geochemical digests methods have been successfully applied to the salt lake sediments (pers. comm. M. Carey – WMC, Kambalda) including the Enzyme Leach method offered by ACTLABS. Water samples from the auger holes can also be analysed at ppt levels using the activated carbon “tea bag” method developed by the CSIRO. Water samples can also be directly analysed by the new Electro Thermal Vapourisation (ETV) system as a sample introduction system for the ICP – MS unit with a detection limit of 0.5 ppt Au in water by Ultra Trace Laboratories.

### Auger Details

**Depth potential:** 10 to 12+ m in salt lakes, 5 to 10 m as a standard auger depending on the regolith types. The auger rig is capable of penetrating to 12+m in relatively soft saprolite or unconsolidated material.

**Bits & rods:** 3.75 to 4 inch blade and screw bits coupled to 1.5 m & 1.8 m rods. We currently have 2 x 1.5 m rods & 2 x 1.8 m rods although additional rods can be acquired for particular jobs. The trailer mounted Salt Lake auger hold a 1.8 m rod in the mast, with up to 3 m of rods capable of being held in the mast while the rig is on the back of the Toyota ute. This greatly increase the

efficiency of the rig when undertaking systematic auger programmes. ***Both 1 m & 1.8 m core barrels (80 cm) are also available for salt lake/tailings/clay cores.***

**Motor:** Very light weight 18 hp Honda petrol engine with a 2:1 reduction box to provide 12 hp @ 2200 rpm.

**Hydraulic:** Priority feed hydraulic motor direct coupled to the Honda engine will provide 14 GPM for max flow to all functions. The hydraulics can develop 1800 psi of pressure with the capability of lifting up to 1.5 tonnes. The rig has rotation & feed levers in a console in the front of the auger to provide maximum safety.

**Rotation:** Motor direct coupled to auger drive head can provide 600 nm torque @ 70 rpm with a maximum speed of 120 rpm.

**Mast:** The mast is capable of taking both 1.5 & 1.8 m auger rods. It is counter balanced manual lift/lower and not hydraulic to reduce weight. The hydraulic motor is mounted on top of the mast and provides 0.5 tonnes pull up & pull down via a direct couple chain drive for complete drilling control. The top drive hydraulic motor is connected to the rods via break plates and hex chuck with rods attached by snap pins.

**Auger chassis:** The auger is mounted with a strong box chassis that has been treated with anti-rust paints etc. Two sets of wheels and tyres have been supplied with the rig including the standard 6 inch rims and the extra wide *10 inch rims* that distribute the weight of the rig evenly to produce less pressure than a human footprint on the salt lake surface.

**Weight:** The rig currently weighs 370 kg, with the weight increasing to about 400 kg when fuel, water and rods are added for drilling on the lake. The weight of the rig and ancillaries is equivalent to the standard 4 WD quad bike.

**Method of propulsion:** The auger rig can be towed easily by a standard 4 WD quad bike. The rig has a direct tow coupling to ensure that no extra weight is put onto the back of the quad bike. The rig can also be quickly mounted onto the back of the Toyota Landcruiser ute to act as a standard auger.

**Towing Trailer:** A trailer has been designed for the rig. Modifications will be made to the trailer to facilitate the wider wheels & tyres now supplied with the rig.



**Predator 10 light weight auger on the thin salt crust at Lake Barlee, near Mt Elvire homestead, north of Southern Cross.**