

# SPANISH RIVER CARBONATITE COMPLEX

2003 EXPLORATION PROGRAM – ZONE No. 4  
MINING CLAIM 3002843  
TOFFLEMIRE TOWNSHIP, SUDBURY DISTRICT

by

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December 4<sup>th</sup> 2003

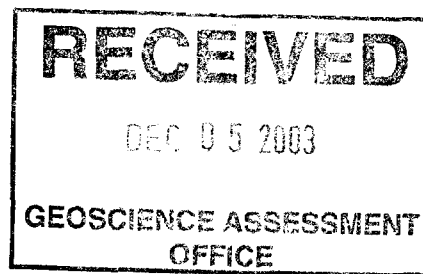


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## SUMMARY

Agricultural Mineral Prospectors Inc. ("AMP") is a private company of mineral industry professionals that explores for, tests, develops and produces organic approved agromineral fertilizer and soil amendment products. After farming and gardening organically for many years the AMP founders began in 1990 prospecting for the minerals approved for organic use by the various North American and European certifying agencies. These essential minerals approved and required by organic farmers are high calcium limestone, hard or soft rock phosphate (apatite), various potassium rich minerals (langbeinite, glauberite, orthoclase feldspar or biotite) and an ever-increasing number of trace elements.

We were aware of the inevitability of ever more stringent control of the toxic metals and pathogens contained in fertilizers and soil amendment products. Many of the available rock phosphate and compost products wouldn't pass waste management guidelines employed in other industries. Radioactive minerals and cadmium content alone may exceed current standards. Such stringent agricultural environmental legislation is already in force in various jurisdictions and will certainly be the future requirement for Ontario agriculture. Anticipating the demand for extremely clean and safe products we incorporated these standards into our exploration search parameters.

Further to our exploration search parameters we targeted the most reactive minerals as superior for organic operations. The more reactive a mineral is the quicker it will break down, weather or decompose giving up its nutrients to the soil solutions and thus making them plant available. We were aware that minerals with identical chemical composition could vary widely in their reactivity as well as other characteristics. In particular limestone and dolomite the universally recommended agricultural liming materials can have widely varying reactivity. Agronomists focus on fine grind and potential neutralizing capacity and pay no attention to the inherent reactivity of the individual mineral. Dolomites can vary from being slightly reactive to almost totally inert. They are recommended because they contain both magnesium and calcium, but often provide neither when required. All Ontario liming materials are sourced from sedimentary or metamorphic limestone which if high calcium limestone can be quite reactive, however, more than 70% of aglime is dolomite and substantially less reactive. On many impacted soils, with depleted calcium carbonate levels neither high calcium limestone nor dolomite are sufficiently reactive to buffer heavy acid rainfall and prevent aluminum and manganese toxicity.

The sovite found in Carbonatite Complexes maybe more reactive than virtually all, sedimentary and metamorphic limestone. Fortuitously they also may contain sufficient reactive primary biotite and apatite for potassium and phosphorous requirements. We researched Canadian Carbonatite deposits and in 1993 acquired the Spanish River Carbonatite deposit and carried out exploration of the deposit through 1996. We then mined a small bulk sample and transported it to our farms and gardens for testing. The exceptional results led to securing a 1000 tonne bulk sample in 2000 for application on as wide a range of Ontario farms as possible. This large scale field-testing confirmed the exceptional results of our small scale testing and we proceeded to complete the permitting process and began production in late winter 2001. By the end of November 2003 AMP will have produced 11,500 metric tonnes of Spanish River Carbonatite and have applied it over 24,000 acres in southern, eastern and northern Ontario, Quebec, PEI, Michigan, Ohio, Vermont, Pennsylvania. The average application rate was 380 kilograms per acre. Our intent was to supply bulk tonnage from quarry to farm as inexpensively as possible. The average mineral content of material shipped to date was:

68% CaCO<sub>3</sub>

15% Biotite-Vermiculite

12% Apatite  
5 % Trace Minerals (Pyroxene, Magnetite, Albite, Pyrite, etc.)

The material was approved for use on certified organic crops by Organic Crop Producers and Processors Ontario Inc. and listed with the Organic Material Review Institute ("OMRI"). Calcite (calcium carbonate) biotite, vermiculite and rock phosphate are all approved minerals and are used in every organic jurisdiction we have examined. On many of the fields that received this product we did mineralogical audits, soil sampling and analysis and a great number of comparative tests were carried out. The main findings from this work are summarized as follows and an extensive program of extended evaluation is planned to further confirm these exceptional results. The Spanish River Carbonatite deposit has undergone, exploration, development and product testing for a ten-year period.

Starting in 2002 AMP commenced exploration on sovite veins hosted in fenitized quartz monzonite. The main characteristic of the sovite seams found in what is referred to, as Zone 4 is the total lack of biotite, apatite, magnetite and vermiculite mineralization. The purpose of this exploration program was to locate sufficient tonnages to permit the extraction of chemical grade calcium carbonate.

The requirements for chemical grade limestone in Northern Ontario and Quebec mining industry is good. A second market AMP has been investigating is mineral supplement. Preliminary tests utilizing selectively quarried clean sovite as mineral supplement for poultry has been very encouraging. The purity and lack of contaminants of sovite located in Zone 4 justified extensive trenching and geological mapping.

A total of 9 trenches and one test pit have been excavated to define Zone 4. Though this work was able to cut and delineate numerous sovite veins and seams none of them were of any economic significance. The area exposed is predominantly fenitized host quartz monzonite with an abundance of fracture fillings comprised of sovite and pyroxene. The sovite veins, though of high purity are narrow and discontinuous in this vicinity.

No further work is recommended with the exception of seismic and geophysics surveys to establish the contact between the fenite and outer core of the Spanish River Carbonatite complex. At this time it appears the main deposit coincides and is covered with deep deposits of fine glacial located immediately to the south and southeast.

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## PROPERTY DESCRIPTION AND HISTORY

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### PREVIOUS WORK

In 1955 Johns-Mansville Company performed a ground magnetometer survey over what is now referred to as the Spanish River Carbonatite Complex. The purpose for this survey was to find vermiculite. The Ontario Department of Mines in 1962 reinterpreted this data, which outlined an oval shaped magnetic high, which they believed to be a carbonatite.

In 1968 Union Carbide Exploration made a rough surface geological map and drilled a 1746-foot drill hole in search of niobium, copper and rare earths. Outcrop of the Carbonatite is scarce and the main oval shape and size of the deposit was primarily the result of magnetometer work and the one drill hole.

Jenmac Company Ltd. in 1960 completed a trenching program. This work was the basis of the 1962 ODM work and geological mapping by Union Carbide. It was also the point of reference for the Junior Mine Services Ltd. (JMS) 1996 trenching program ultimately leading to the Burns Mine.

In 1975 International Minerals and Chemical Corp. completed a seismic survey over the complex in an effort to determine overburden thicknesses. This was followed up with four reverse-circulation drill holes in an attempt to locate residual apatite. This work has been reinterpreted and included in JMS's 1996 trenching and stripping work. Of particular significance is the depth of what is referred to in the seismic data as the dense layer. Trenching has revealed that this dense layer represents a residuum capping the bedrock. This work has been used to establish ore reserves for the residuum covering the 1962 bulldozer trenches and 1996 follow-up trenching program. At the present time the residuum, whether carbonatite or biotite-pyroxenite represents the mined product.

Ron Sage from Ministry of Northern Mines and Development completed a geological report on the complex in 1987. Dr Sage has subsequently visited the site on several occasions to review work conducted by AMP.

From 1955 through to 1975 no niobium, uranium and residual apatite mineralization was located. Ironically, this feature of the Spanish River Carbonatite coupled with unusually high sovite content makes it ideal for organic agricultural use.

The original Spanish River property consisted of six mining leases and 5 unpatented claims in Venturi and Tofflemire Townships. All claims originally were 100% owned by Junior Mine Services Ltd. ("JMS"). In 1999 Agricultural Mineral Prospectors Inc. (AMP) was incorporated and optioned the property from JMS. The new company was formed to run all activities associated with the Spanish River Property and is controlled and run by the principles of JMS. Chris Caron and John M. Slack hold the unpatented claims in trust. Subsequent staking has added an additional 6 claims, which are held by either John M. Slack or Chris Caron in trust on behalf of AMP. The list of leases and mining claims that comprise the Spanish River Property are listed in table: 1.

The property was optioned because of the likelihood of locating sufficient reserves of the minerals calcite, apatite, biotite and vermiculite for the purpose of selling to organic farmers, market and backyard gardeners. From 1994 through to 1996, JMS conducted several site visits collecting samples, preliminary geological mapping and assaying. The purpose of the sampling was to determine consistency of material and potential toxic elements. This was critical to ensure Spanish River Carbonatite would be approved under the organic guidelines. The samples collected were crushed, screened and used in garden test plots and fed as mineral supplement to small flocks of layer hens. Coinciding with these activities JMS began extensive market studies and research into organic agricultural practices and accepted soil mineral amendments.

In 1996 JMS conducted a trenching and bulk sample program to delineate potential zones of afore mentioned minerals, either alone or combined. The program was successful in locating three areas that could be used as a source of nutrients and soil amendments for organic agriculture. As a result a 100 tonne bulk sample was taken and shipped to our farms in Southern Ontario. This material was used in test gardens on the farm, turf applications, layer hen mineral supplement and finally field trials in the Chatham-Kent area.

Following these initial trials we began a comprehensive research and investigation of soil mineral deficiencies, organic and conventional farming practices, weathering characteristics of Spanish River Carbonatite including soil geochemistry and biogeochemistry. From January 1998 until to May 2000 this was the total focus and only business activity carried out by AMP, employing three people full time. In the spring of 2000 AMP commenced an advanced exploration program comprising of

stripping, trenching, sampling and a second 1000 metric tonne bulk sample. That same year AMP obtained a quarry permit covering the original six patented claims. To date approximately 10,000 tonnes has been quarried and distributed in Ontario, Quebec, Vermont, New York, Michigan, Pennsylvania and Virginia.

**CURRENT EXPLORATION PROGRAM**

In 1996 the original a small test pit on claim 3002843 located an area of massive sovite hosted in fenitized quartz monzonite. The sovite located in this area was of high purity and lacked biotite, apatite and magnetite mineralization. Trenching and prospecting activities in this area started in the fall of 2002. Final trenching, geological mapping and sampling commenced on November 16<sup>th</sup> 2003 and decommissioning was being completed at the time of this report.

The following report is a geological compilation of stripping and trenching conducted on Zone 4.

**LOCATION AND ACCESS**

The Spanish River Carbonatite Complex straddles the common boundary of Venturi and Tofflemire Townships just south of a sharp bend in the Spanish River known as the “Elbow”. The property is cut by numerous, very well maintained, logging roads.

Access to the property is via the Fox Lake Lodge road, which turns off highway 144 at Cartier. From Cartier it is 25 km to the property. At present AMP and Fox Lake Lodge maintains the main road. All river and creek crossing have had culverts and bridges put in place to handle heavy logging trucks. Road infrastructure is excellent and required very little upgrade.

Cartier is the closest town, a village with approximately 500 inhabitants. Within the town limits is a rail spur owned by C.P.R. Sudbury is approximately 50 kilometres south of Cartier on highway 144. Total driving time from Sudbury to the property is 1½ hours.

Accommodation was at the Fox Lake Lodge, located 1000 metres south of the property.

**MINING CLAIMS & LEASES**

The Spanish River Carbonatite Complex property consisted of 14 mining claims and 6 leased located in Tofflemire and Venturi townships, district of Sudbury. The mining claims are 100% owned by Agricultural Mineral Prospectors Inc. and held in trust by Chris Caron (C38620) and John Slack.

**Table: 1 – Claims and Leases Comprising Spanish River Property**

<u>Mining Claims</u>	<u>Township</u>	<u>Ownership</u>	<u>Recorded Holder</u>	<u>Expiry Date</u>	<u>Work Req'd.</u>
1237466	Tofflemire	AMP Inc.	Chris Caron	Aug 29 2004	3169
1237463	Tofflemire	AMP Inc.	Chris Caron	Dec 08 2003	800
1198345	Tofflemire	AMP Inc.	John Slack	Feb 10 2004	6400
1198344	Tofflemire	AMP Inc.	John Slack	Feb 10 2004	1600



Spanish River Property Location Map

Figure : 1



3002843	Tofflemire	AMP Inc.	AMP Inc.	May 13 2004	1600
1237467	Venturi	AMP Inc.	Chris Caron	Aug 29 2004	6400
1237464	Venturi	AMP Inc.	Chris Caron	Dec 08 2003	1600
1237462	Venturi	AMP Inc.	Chris Caron	Jun 28 2004	1600
1237465	Venturi	AMP Inc.	Chris Caron	Dec 08 2003	800
1214616	Venturi	AMP Inc.	John Slack	Jun 25 2004	400
1214615	Venturi	AMP Inc.	John Slack	Jun 25 2004	800
1198340	Venturi	AMP Inc.	John Slack	Jun 30 2004	800
1198154	Venturi	AMP Inc.	John Slack	Oct 26 2004	987
1136165	Venturi	AMP Inc.	John Slack	May 31 2004	400

Mining Leases    Township    Ownership    Recorded Holder

359399	Venturi	AMP Inc.	AMP Inc.
359400	Venturi	AMP Inc.	AMP Inc.
377231	Venturi	AMP Inc.	AMP Inc.
378212	Venturi	AMP Inc.	AMP Inc.
378894	Tofflemire	AMP Inc.	AMP Inc.
378893	Tofflemire	AMP Inc.	AMP Inc.

**GENERAL GEOLOGY OF SPANISH RIVER COMPLEX**

The Spanish River Carbonatite emplacement occurred between  $1790 \pm 90$  Ma to  $1883 \pm 95$  Ma the same time as the Sudbury norite. This suggests that the to alkalic magmatic events are related and the Sudbury eruptive may account for the alkaline glasses of the Onaping Formation.

The Spanish River Carbonatite Complex is enveloped in a halo of fenitized granitic rocks. Carbonatite rocks with a high silicate mineral content occur along the periphery of the body. Lower silicate carbonatite occurs toward the core. The contact between fenitized wall rock and carbonatite appears to be over a maximum thickness of 300 metres. This observation is based on the trenching program and the Union Carbide drill hole. This area is referred to as the "Transition Zone" and is a banded and brecciated assemblage of layered biotite sovite, fenite and mafic rocks. The transition zone appears to be a result of contact metamorphism and metasomatism. Discreet lenses bands and veins of high purity sovite have been located in this zone. The sovites in this area appear to have higher quantities of magnetite, vermiculite and apatite. The second classification of the complex is



referred to as the "Outer Core". This classification is used for the purpose of describing the trenching program and is adopted from a drill hole completed in 1968, by Union Carbide. The outer core is very similar to the transition zone with exception of a marked increase in sovite (calcite). The third and last classification of the complex is the "Inner Core", comprised almost entirely of sovite.

The main characteristic that distinguishes the Spanish River Carbonatite from other carbonatite complexes in northern Ontario is the very high content of sovite verses mafic rock components.

## REGIONAL STRUCTURAL GEOLOGY

The Spanish River Complex Carbonatite Complex lies within the Abitibi Subprovince of the Superior Province of the Canadian Shield. The complex occurs along a north-south striking fault zone along the west side of the Sudbury Basin. According to the 1987 O.G.S. Study 30 this fault system maybe a graben structure branching off the Ottawa-Bonnechere graben, a system hosting carbonatite-alkalic rock complexes in the Nipissing area.

Airphotos of the region also suggest the complex occurs at the point of intersection of a number of regional lineaments.

## SPANISH RIVER COMPLEX STRUCTURE

Shearing and brecciation of the enveloping quartz monzonite is common. Fractures are commonly filled with mafic pyroxenes, amphiboles and calcite. There is evidence in the trenching and the Union Carbide drill hole that blocks of fenite have peeled of the walls and are incorporated into the complex. Banding of fenites and sovite is common.

Post faulting has not been encountered at this time. The heterogeneous mixture and lack of outcrop makes it very difficult at this time to suggest that post faulting has occurred.

## FENITIZED QUARTZ MONZONITE

The host rock enclosing the Spanish River Complex is massive, medium grained pink quartz monzonite. In contact with the complex the quartz monzonite has been fenitized. The granitic rock becomes mottled pink and green-blue in colour. Sodic amphibole and pyroxene have replaced the quartz in the quartz monzonite.

The fenitized quartz monzonite is brecciated and intruded by dark green mafic veins. Carbonate is commonly associated with the veins and fracture fills. The closer to the intrusive the greater the number of mafic and calcite filled fractures and veins.

## SPANISH RIVER CARBONATITE COMPLEX – TRANSITION ZONE

The transition zone is predominantly fenite, but exhibits less brecciation and more banding. There is a marked increase of sovite veins, lenses and bands. The purity of the sovite in this zone varies from 45% CaCO<sub>3</sub> to nearly pure. The variations and types of accessory mineral found in the sovite is as follows:

- Vermiculite – 0 to 15%
- Biotite – 0 to 15%
- Magnetite – 0 to 5%
- Pyrrhotite – 0 to 5%
- Apatite – 0 to 5%

Numerous lenses and veins of clean calcite (sovite) have been located through the trenching program, which occur in what previously would have been described as the transition zone. It is from one of these lenses that the 1996 bulk sample was taken.

## SPANISH RIVER CARBONATITE COMPLEX - OUTER CORE

The actual contact between the transition zone and outer core is not well defined and is based on the degree of sovite versus fenite present and overburden thickness. Where there is a sharp increase in overburden is the logical location for the contact between the complex and altered host rock. The approximate thickness of the outer core based on the above observations would be 200 metres. The outer core appears only to outcrop along the road where Vein No.3 is located. A vertical rotary percussion hole (TP-2) drilled, in 1975, in this vicinity encountered 15 feet of overburden. This is also in the vicinity of test pits, which exposed decomposed sovite very similar to TP-2.

In the O.G.S. Study, "*Spanish River Carbonatite Complex*" the outer core is described as the Outer Phase. The outer phase based on this report is comprised of syenite, pyroxenite, ijolite and biotite sovite.

For the purpose of this report the description of the composition for the outer core is from the Union Carbide drill hole.

*"The Outer Core of the carbonatite-filled diatreme, composed of biotite amphibole sovite with some pyrrhotite and minor chalcopyrite and gramphite. There is no appreciable magnetite between 1066'4" and 1339'. Between 1339' and 1495' coarse magnetite is present in both sovite and the gramphite. For the purpose of logging this core, 3 rock types are recognized, gramphite, sovite inclusions, which may be either sovite with a high proportion of inclusions, or gramphite, which has been carbonated. In either case, the dark minerals constitute up to 50% of the rock. The proportions of sovite, inclusions and gramphite in this section are: 22%, 32% and 46% respectively."*

All previous trenching, geological mapping, bulk sampling has been located in the outer core. Outcrop exposure was poor. Trenching has located sovite mineralization in four separate areas. Prospecting and geological mapping has located sovite bedrock in two localities.

The 1996 trenching program was carried out almost entirely over this zone covering 800 metres of strike length along the western contact of the complex. The approximate thickness of the transition zone – outer core is approximately 300 metres.

The trenching program located several areas of economic interest. For the purpose of describing these areas they will be described as follows:

- Zone No. 1 – area where the 100 tonne bulk sample was taken and the best continuous high grade CaCO<sub>3</sub> has been located to date.
- Zone No. 2 – area that had been stripped for a potential bulk sample in 1996, contained a blend of calcite, apatite, biotite, vermiculite with minor silicocarbonatite and pyroxenitic rocks. In 2000 a 1000 tonne bulk sample was taken. In 2001 the area is the Burns Mine current quarry location.
- Zone No. 3 – area that was originally sampled in 1993 and contained mineral composition similar to Zone No.2. The main difference is a marked increase in biotite and vermiculite content. This area contains large reserves of residuum
- Road Zone – area of high purity calcite banded with magnetite, pyroxene rich sovite.
- Residual Vermiculite – this area measures 82m x 32m and is comprised of at least 50% fine vermiculite.

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#### SPANISH RIVER COMPLEX – INNER CORE

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The inner core of the Spanish River Complex is entirely covered by a thick layer, +100 feet, of overburden. Descriptions provided from various sources all relate back Union Carbide diamond drill hole. All descriptions use calcite content to describe and classify the inner core. Concentrations of calcite (sovite) increase closer to the centre of the complex.

For the purpose of this report Union Carbide's description (refer to Appendix 8) was used to describe the inner core. Union Carbide describes the inner core being comprised almost entirely of biotite/magnetite sovite, with minor sections of graphite. Accessory minerals found were pyrrhotite, chalcopyrite and apatite.

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#### LITHOLOGIC UNITS FOR THE SPANISH RIVER CARBONATITE

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##### CENOZOIC

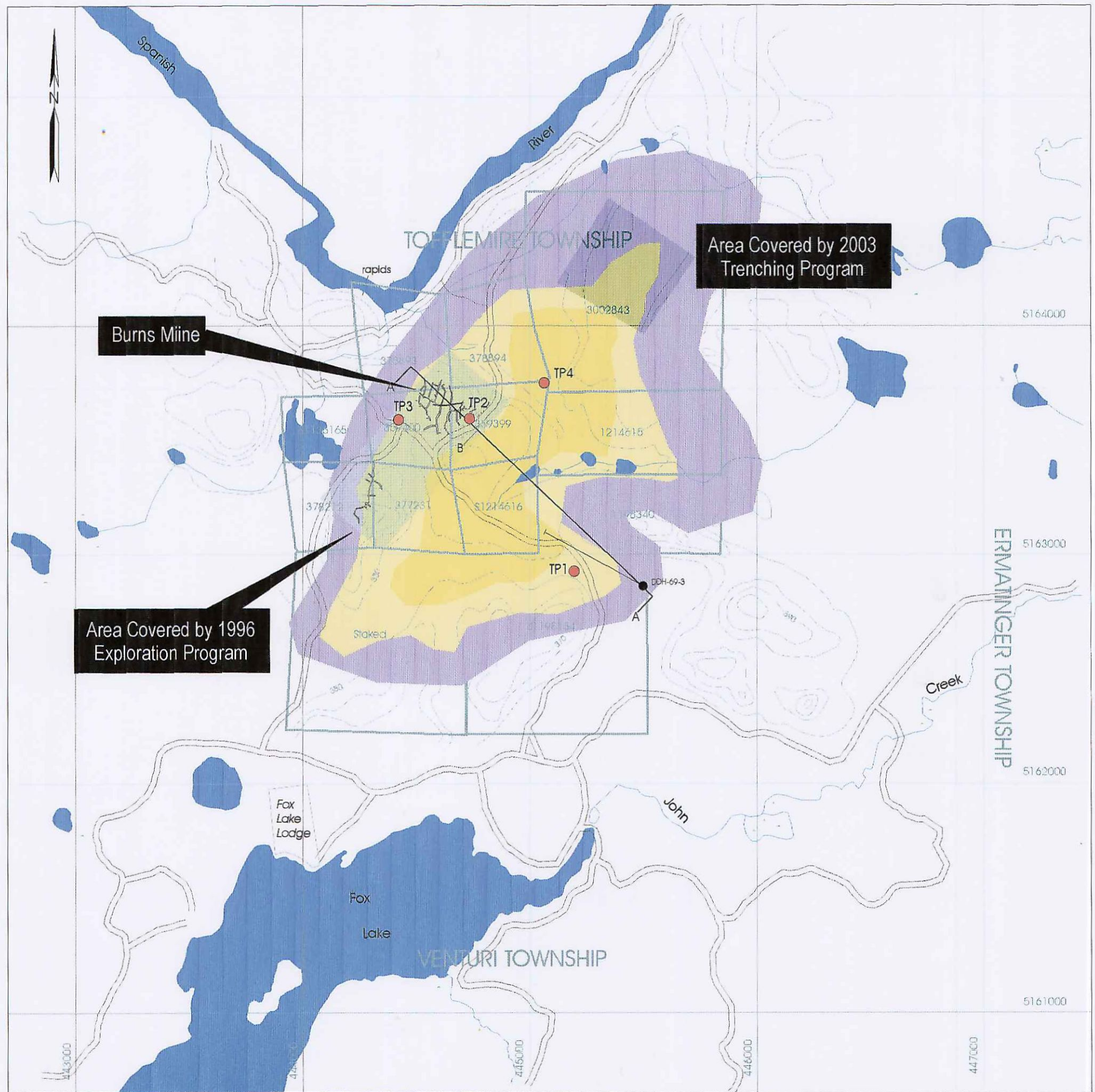
##### PLEISTOCENE AND RECENT

River deposits, stream and swamp deposits, Glacial Deposits – sand and gravel

*Unconformity*

##### PROTEROZOIC

##### SPANISH RIVER CARBONATITE COMPLEX



**LEGEND**

-  **Carbonatite Complex - Inner Core**  
Clean Sovite - white massive, fine grain to decomposed granular texture, in excess of 50% CaO. Minor iron oxide and magnetite, .5% to 5% P2O5, minor to abundant vermiculite and biotite.
-  **Carbonatite Complex - Outer Core**  
Biotite Sovite - white to grey with black banding, moderate to abundant biotite & vermiculite, 5% iron oxide, 2% to 5% P2O5. Often interbanded with biotite pyroxene.
-  **Alteration Zone - Transition Zone**  
Fenite - altered quartz monzonite, fine to coarse grain unit. Carbonatite veins present, 2% to 5% K2O.

**SYMBOLS**

-  Road
-  Trail
-  Trench
-  Diamond Drill Hole
-  TP3 Reverse Circulation Drill Hole
-  S1198154 Claim Number
-  Claim Boundary
-  Township Boundary

Venturi Tp. - Tofflemire Tp.  
**Property Geology**  
 Agricultural Mineral Prospectors Inc



Inner Core

Outer Core

Fracture fillings

## ARCHEAN

Fenitized and brecciated quartz monzonite

Quartz monzonite

*(Adapted from Table: 1 pg 10, OGS Study 30, Spanish River Carbonatite Complex, Ron Sage, 1987)*

## SPANISH RIVER CARBONATITE - AGRICULTURAL APPLICATIONS

Virtually all calcium carbonate (agricultural lime) deposits are sedimentary or secondary in origin. Relatively rare Carbonatites are igneous in origin and thus primary in nature.

The Spanish River is a well-known destination for paddlers and naturalists alike. It is the location of one of the last stands of old growth white pine forests and is considered one of the best brook trout habitats in Ontario. The influence of the Spanish River Carbonatite on the health and growth of the majestic forests and the buffering effect of the pristine aquatic habitat is certain. We often refer to the Spanish River Carbonatite as the heart of the area. The surrounding area bedrock is extremely siliceous granite; ill equipped to buffer the natural environment against the ravages of acid rain, yet the health of the area is undeniable.

Carbonatites belong to the family of alkaline ultramafic rocks, a very unique group of "high reactivity" rocks. The mineral constituents, sitting at the top of "solubility and reactivity series", upon releasing their metal cations and ions form high-energy clays like vermiculite and illite. Alkaline, also described as alkalic rocks have been subject to intense geoscientific investigation over the past 50 years. The alkalic rocks are characterized by rarity, high concentrations of volatiles (CO<sub>2</sub>, H<sub>2</sub>O, etc.), incompatible elements, lithophile elements, (lithophile elements are those with a strong affinity for oxygen, having a greater free energy of oxidation) and wide spectrum of rock and mineral types. The alkalic rocks show a strong correlation with major continental fractures, which penetrate to the mantle (Sage O.G.S. OFR 5436, 1983). Bowen described greater mineral instability to greater disequilibrium with the environment; the extreme depths magma is sourced characterize alkalic rocks.

No other igneous rocks have provoked such fascination. Although alkaline rocks comprise less than 1% of all igneous rocks one third of all rock names are designated alkaline, totaling more than 250. The overriding characteristic of alkalic rock formations is the incredible variations they exhibit in mineralogy, texture and grain size. Carbonatite complexes can be both very simple to the most complex mineralogy types of igneous rocks. Consisting almost entirely of calcite and dolomite to a variety of carbonates accompanied by silicates, phosphates, sulfates, iron oxides, RE carbonates, sulfides, fluorides and niobium oxide minerals. In excess of 50 minerals have been found in carbonatites (Pecora, 1956). The group of rocks called Carbonatites represent approximately 30% of alkaline ultramafic rocks therefore the total known area of exposed carbonatite is in the order of 200 square miles.

## **MINERALOGY OF THE SPANISH RIVER CARBONATITE**

The brief description of mineral constituents found in SRC is only a partial list. But it does highlight the need to understand the mineralogical and geochemistry components both within the unweathered rock and overlying residuum cap. Understanding this detail will unquestionably aid in understanding mineral reactivity within soil systems and begin to describe why SRC has been effective in agricultural applications.

### **CALCITE**

We use the term “reactive” to describe the rate at which natural rock forming minerals weather in the soil. It has been our contention that rocks do not weather at the same rate when applied to soils. Even when comparing mineralogical and geological similar deposits, each deposit carries its own unique physical and chemical properties, which will either accelerate or hinder the natural weathering process. Flu gas operators routinely test calcium carbonate sources for reactivity and purchase reactive black limestone from Michigan on this basis (Hendrik Veldhuyzen, surficial geologist). Nelson R. Shaffer, a research scientist with the “Indiana Geological Survey” at Indiana University has spent several years studying the chemical, mineralogical and physical properties of Indiana limestone deposits to determine what makes some limestone more effective in scrubbers than others. Shaffer’s work shows that similar limestone deposits can differ by more than a thousand percent in the amount of sulfur dioxide they can absorb. Shaffer describes the effectiveness of limestone in terms of reactivity, “as the measurement of how rapidly and completely a particular limestone absorbs sulfur dioxide”. Physical factors that significantly effect reactivity is porosity and hardness. Chemical properties such as magnesium will have a pronounced negative effect on reactivity.

The igneous calcite found in the Spanish River Carbonatite™ (SRC) is by far the most reactive calcium carbonate we have tested in North American. This is evident in on going trials and farm applications of Spanish River Carbonatite. The average quarried grade of CaCO<sub>3</sub> is 65%. Ongoing exploration of the complex has located large zones of 95% plus CaCO<sub>3</sub>.

Currently, many end users are replacing high calcium limestone with SRC. This is because of reactivity, (field results in same year of application), lower application rates, (average of 1000lbs/acre required) and credit for phosphorous, potassium and micronutrients.

### **CALCIUM PRODUCT DEVELOPMENT**

Over the last two years SRC has been used in ongoing layer trials. The results from these trials have been exceptional. These trials have been conducted with 3800 laying hens. The grower is under the Frey group. Frey’s feed company wants SRC registered as a feed supplement as soon as possible.

A summary of findings is:

1. 0 to 3% egg cracks verses 13% for the Frey average.
2. Significant reduction in feed consumption.
3. Improved bird health.
4. Productivity maintained well past expected cull age.

AMP is completing trial summaries and cost savings as a result of these changes.



## APATITE

Weathering of carbonatite deposits is economically important, because phosphate mineral content are markedly upgraded through weathering. There are two main weathering sequences, which result in apatite concentration, 1) phosphate is remobilized by weathering then reprecipitated into a secondary phosphate deposit, and 2) the more soluble components, particularly carbonates are weathered leaving residual phosphate.

The phosphate content of residuum quarried at the Spanish River Complex is currently 3.14% and the phosphate content in underlying bedrock is averaging 5%. Unlike other carbonatites evaluated there is not apatite accumulating in the residual sands. Further geological and mineralogical interpretation is required to describe this very unique phenomenon. The geological aspects of the Spanish River Carbonatite that may explain why apatite concentrations in the residuum are low is:

1. the intrusion has very low fluorine content suggested by the absence of the mineral pyrochlore  $(Ca,Na)_2(Nb,Ta)_2O_6F$  (Hogarth, 1989).
2. uranium, thorium, cadmium, arsenic and other heavy metal contents are low (Sage 1897a) particularly compared with other Carbonatite complexes (Hogarth, 1989, Sage 1987b).

These observations are important, particularly low fluorine content, which precludes the formation of pyrochlore and the corresponding accumulation of radioactive ions and heavy metals (Hogarth 1989). Low fluorine also results in the substitution of chlorine for fluorine in the apatite mineral. Chlorapatite is considered more soluble than fluorapatite (Veldhuyzen, 2002). The complex is almost entirely comprised of sovite, (igneous calcite). This would result in a higher proportion of volatile elements (OH, CO<sub>2</sub>). With the lack of fluorine OH and carbonate substitution is also likely. These geological conditions would result in the formation of very reactive apatite and thus no accumulation of apatite in the residual sands.

As well as influencing the size and shape of the apatite crystal carbonate substitution weakens the crystal structure therefore resulting in increased solubility. *‘High carbonate substitution is advantage in francolites; “it allows the use of such a phosphorite by “direct application” or, in other words, the use of this phosphorite as a fertilizer without chemical pre-treatment,”* (Pg. 281 Nriagu J.O. and Morre P.B. (1984) Phosphate Minerals). This is very significant, preliminary analysis of SRC clay fraction indicates highest phosphorous content found in clay size fraction.

## APATITE PRODUCT DEVELOPMENT

Current quarried SRC contains an average P<sub>2</sub>O<sub>5</sub> of 2.5 to 3.0%. AMP will have developed a rock face this fall to commence product for the retail/professional market and supply pit run SRC, which contains +5% P<sub>2</sub>O<sub>5</sub>.

AMP has started detailed mineralogical and chemical analysis of SRC. In part this is in response to numerous inquiries about unique phosphate mineralogy and supplement grade phosphorous. SRC has been recognized as one of most reactive and cleanest sources of natural rock phosphate.

Through simple gravity and magnetic concentration upgrading of phosphorous and calcium component of complex is possible. Processing trials will commence this fall.

Target grades of calcium and phosphorous components are +65% CaCO<sub>3</sub> and +10% P<sub>2</sub>O<sub>5</sub>

## CLAY MINERALS

The clay minerals are layer-type aluminosilicates, ever-present on our planet in rocks, soils and oceans. The role of clay in soil is fundamental, it is their permanent structure and colloidal size, with their unique surface reactivity that play a major role in the biochemical cycling of plant nutrients.

*“The transformation of biotite to vermiculite with the release of the interlayer K is perhaps the most important biologically mediated geochemical reactions occurring in the rhizosphere”* (Banfield, *Proc. Natl. Acad. Sci. USA* 96, (1999)). As the potassium is released the exchange capacity is increased and is characteristic of the clay mineral illite. With complete removal of K interlayer planes vermiculite and montmorillonite clay minerals are produced, Hinsinger, P., Elsass, F. Jaillard, B. & Robert, M. (1993) *J. Soil Sci.* 44, 525). The transformation of biotite to vermiculite within the soil system is rapid. Experiments conducted by Mortland (1956), Spyridakis et al. (1967) and Weed et al. (1969) documented biotite functioned as well as soluble salt (KCl) as a source of K.

Vermiculites are classified as high activity clays. This means that this group of clays have a wide range of mineralogy resulting in a wide range of compositions where the interlayer spaces are charged and hydrated to various extents resulting in a wide diversity in behavior, Pedro (1997). Clays being tiny nanocrystalline particles are essential components of the earth's surface. *“ Any clay, even a monomineral clay is a population of different particles. Each particle is itself a population of micro-domains. When the environment changes, each micro-domain and each particle starts changing. Each of them shift towards a new thermodynamic equilibrium according to its own speed: population dynamics are going on. Population dynamics apply to clay mineralogy today”* Millot (1989).

The Spanish River Carbonatite is an exceptional source of both biotite and vermiculite. Though not widely recognized in agriculture today, ongoing research will result in highlighting the very real problem of clay destruction through progressive acidification and clay remineralization will be key to soil fertility.

#### **PYROXENE**

Large areas of biotite – pyroxene have been located on the property. AMP has commenced distribution of these zones to address not only calcium deficiencies but also magnesium and potassium. The pyroxenite/biotite zones are the most reactive facies of the complex. Biotite weathering to vermiculite, pyroxenite weathering to the illite, both superior, high energy, agricultural clay minerals. In the process both primary minerals supplying soils with potassium and magnesium.

With selective mining we target the pyroxenite/biotite facies to grade 5% K<sub>2</sub>O, 5% MgO, 25% CaO and 3.0% P<sub>2</sub>O<sub>5</sub>. The upgrading of these zones will also result in producing calcium and phosphorous concentrates.

#### **TRACE ELEMENTS – RARE EARTHS**

On a visit to the Spanish River Carbonatite Complex, Ron Sage, a geologist employed with the Ontario Geological Survey was asked his opinion of why the melting temperatures for carbonatites was so low and was there a correlation between this phenomena and why the Spanish River Complex was reacting so quickly in our test applications. His reply was, he believed the melting temperature of the calcite in carbonatites may have been impacted by catalytic trace elements and this could transcend into the unique reactivity properties exhibited in our test work. Dr. Sage went on to say, like most geologists studying carbonatites, he was always impressed with the exceptional forest growth associated with these deposits. In the late 1970s he published an internal government report stating that he thought carbonatites were a source of natural fertilizer.

It is our feeling that the complexity and exceptional diversity of mineralogy sets SRC apart from other sources of trace elements. The unique mineral composition of carbonatites not only supply essential macro and micro nutrients but catalytic minerals, which do not have to be part of the mineral structure to enhance reactivity.

Research conducted by Taunton, Welch and Banfield describes rare earth phosphates and rare earth aluminum phosphates promoting the dissolution of apatite. Rare earth elements are an important trace component of the Spanish River Carbonatite. The use of rare earth elements (REE) as trace nutrients is widely practiced in the People's Republic of China. The physiological responses include increases in chlorophyll content resulting in darker green foliage, enhanced root development, greater production of roots, stronger thicker stems and better colored fruit in crops such as apples, oranges and watermelons. Yield responses included increases in crops such as wheat, increased sugar content in sugar cane, increased vitamin C content in grapes and apples, and increased fat and protein content in soybeans. These gains were made without any known impact on ecological sustainability or biodiversity. In 1993 Australia commenced trials using REEs. For the most part the Chinese research could be duplicated in glass house trials but results were sporadic in field trials.

Our results suggest the role REEs may play in the physiology of plants is by enhancing the role of calcium within the soil system. Responses to REE applications in the Chinese and Australian experiences maybe the result of better utilization of calcium both by plants and soil microbes, REEs acting as a catalyst. The documented improvements to crops, with REEs are identical to influences created by adequate calcium and our field trials with Spanish River Carbonatite.

#### CONTAMINATE STUDIES

AMP's exploration search parameters for agrominerals is first and for most contaminate free. This is in response to growing concerns of metal contaminate levels in existing fertilizers and resulting environmental legislation effecting the agricultural industry. Rules effecting farm inputs will become more stringent and AMP has realized early on that the cleanest agromineral products will demand a premium.

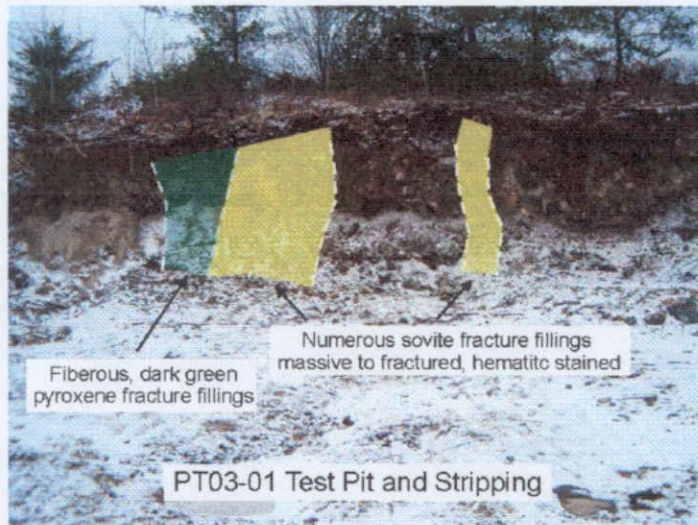
Five composite samples were taken and submitted to Chemex Labs Ltd. and Process Research Associates Ltd. to evaluate potential contaminant levels in Spanish River Carbonatite. The tests were performed in accordance with the B.C. Waste Management Act – Special Waste Regulation – Schedule 4, B.C. Reg. 63/88. This act covers potential metal leachate from mine waste and tailings facilities. The tolerable levels established under this act are far more stringent then any currently regulating the agriculture industry.

The five composite samples represented the different facies of material extracted from mining operations. They are residual high calcite, residual high biotite-vermiculite and fresh sovite rock ores. All five samples pasted under these regulations by a substantial margin. Spanish River Carbonatite has been subject to scrutiny through the Canadian Food Inspection Agency and is registered as a fertilizer under the Canadian Fertilizer Act.

Spanish River Carbonatite has been registered and approved for organic use by Organic Producers and Processors (OCPP) and the Organic Mineral Review Institute (OMRI). Both organic regulatory bodies have adopted the Canadian Waste Management Guidelines to test farm inputs. These guidelines are less stringent then the B.C. Special Waste Regulations.

TR01-J01 TO TR02-J04, PIT03-01

The original trenching in 2002, comprising of six trenches, were established in a northeast direction parallel to the perceived complex contact. Trenches TR02-J02 through TR02-04 located a strong vein of massive sovite over a strike length of 100 metres. Sovite mineralization is typical of other fracture fillings found throughout Zone 4. The calcite is massive, fine grain, bright white to fractured, brecciated sugary with iron oxide coatings. As well as calcite numerous seams of fibrous pyroxene are found throughout. The vein is hosted in fractured, oxidized pale white fenite, where the predominant mineralization is albite. In all trenches quartz was absent. Subsequent to trenching stripping on the strongest section of the vein was conducted.



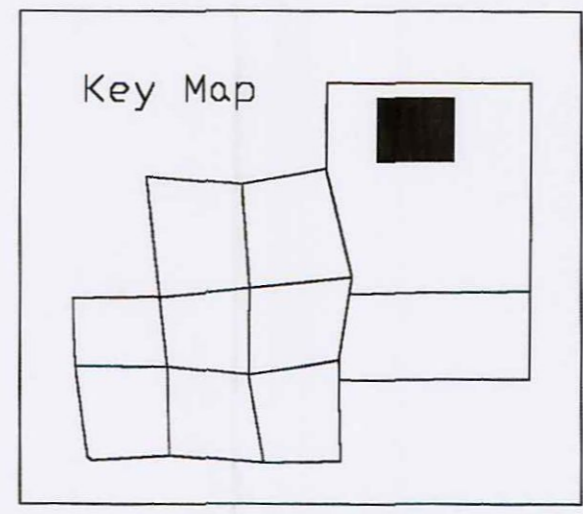
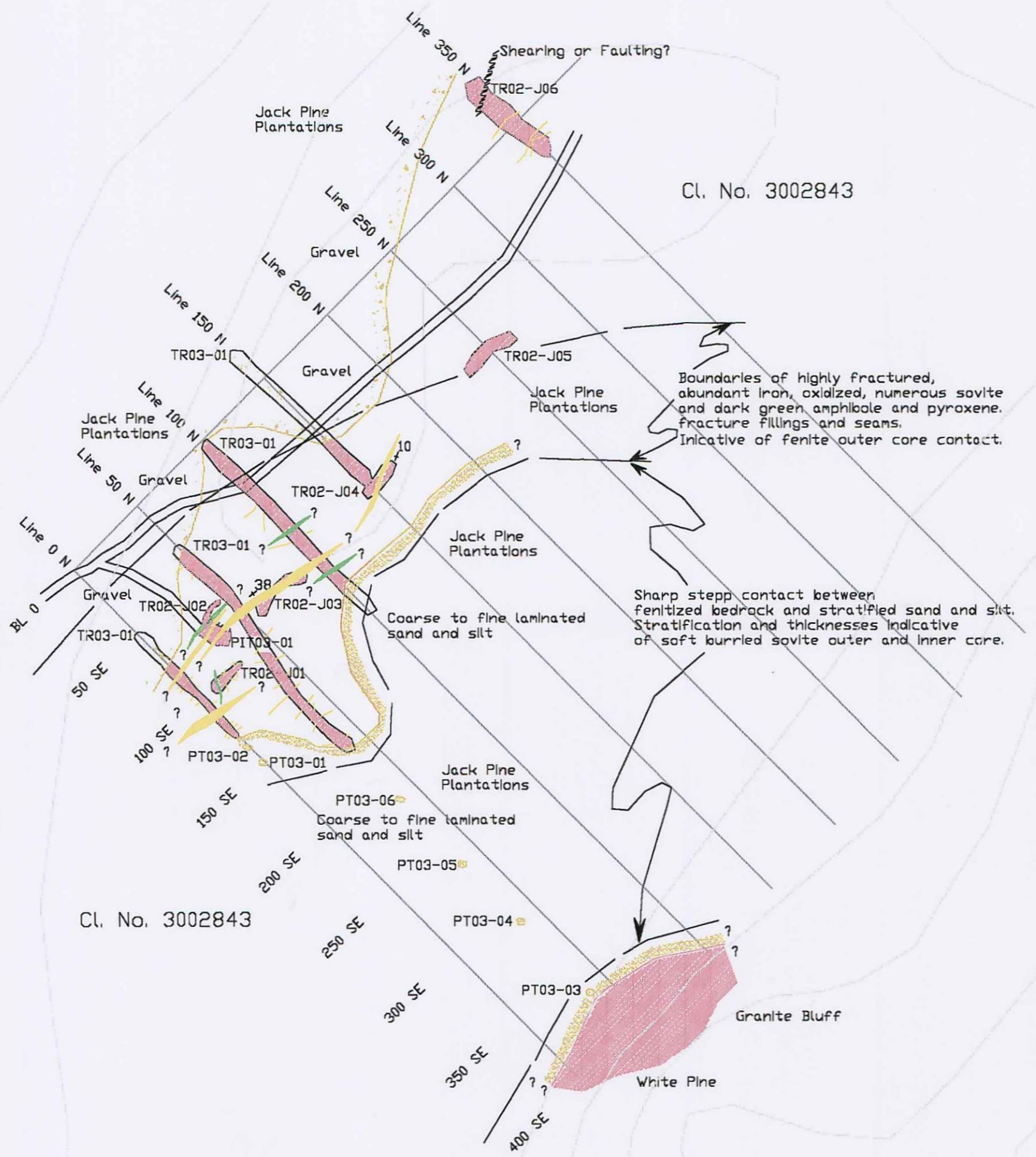
TR02-J05 & TR02-J06

In trenches J5 and 6 no significant calcite or pyroxene mineralization was located. The granitic rocks in the vicinity are more competent with less pitting and oxidization. The rocks are mottled grey green in color with sections comprised entirely of albite. Minor calcite and pyroxene veins occur. These trenches are furthest to the northeast and represent a change in alteration intensity.

TR03-01 TO TR03-04

The 2003 trenching orientation was southeast to ensure the potential contact between the host quartz monzonite and Spanish River complex was exposed. A total of 4 trenches and 6 test pits were dug to test this area.

All trenches started in gravel overburden. This gravel deposit is a topographic high and may represent a section of the Cartier moraine system. Bedrock encountered was a fenitized quartz monzonite with numerous brecciated fracture fillings of calcite and dark green, black veins of pyroxene and amphibole. Unlike sovite found in other areas of the property there is no biotite, vermiculite and apatite associated. The intensity of fracturing, pitting, oxidization and frequency of sovite/pyroxene veins increase to the southeast.



LEGEND

- Unconsolidated Material  
Coarse sand to fine silt, stratified.
- Coarse gravel, boulders in coarse sand matrix
- Sovite - fine grain, massive to granular, crushed calcite. Traces of green fibrous amphibole along fracture planes.  
Often in contact with dark green to black pyroxene. Clean to abundant iron oxide inclusions. Biotite and apatite absent.
- Aegirine/Augite - dark green to black, fibrous pyroxene and amphibole occurring as fracture filling.
- Fenite - altered quartz monzonite, fractured iron oxide rich. Main mineral constituents, sodic feldspar and sodic amphibole.

SYMBOLS

- Road
- Trench & Identification
- Pit & Identification
- Topographic contours
- Strike

2.26790

Zone 4 - Geology Plan  
Tofflemire Twp.  
Sudbury District



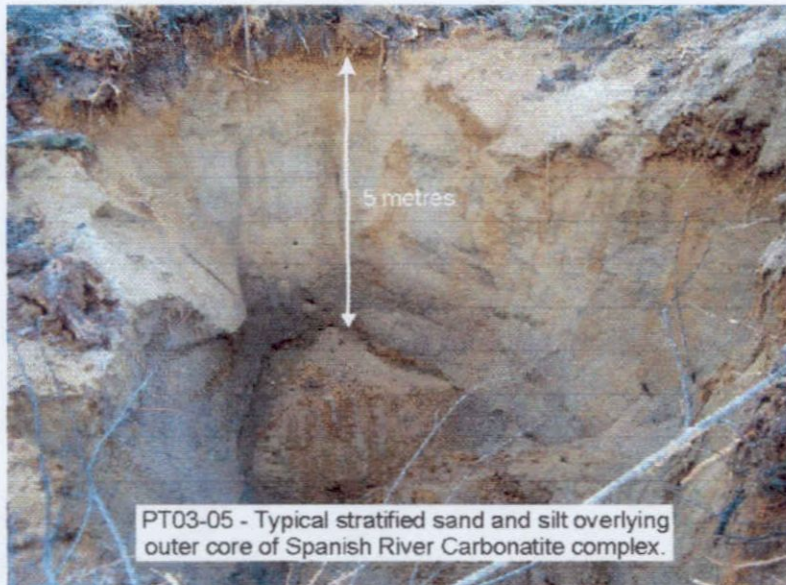
December 4 2003

Figure: 5

TR03-03 - Typical fenite exposure, brecciated and fractured, pitted and oxidized, fenitized quartz monzonite. Abundant fracture fillings of massive to sugary, iron stained sovite and dark green, black pyroxene and amphibole.



The southeast overburden contact is abrupt. The bedrock plunges steeply to the southeast under stratified sand. This stratified sand is very different than the gravel overburden found immediately to the northeast. Visually the sand deposits are identical to sand overburden, which covers the inner core of the complex.



PT03-05 - Typical stratified sand and silt overlying outer core of Spanish River Carbonatite complex.

## CONCLUSIONS & RECOMMENDED EXPLORATION PROGRAM – NO. 4 ZONE

Zone No.4 represents the contact between intensely altered, fractured quartz monzonite and the Spanish River complex. The intensity and abundance of calcite and pyroxene fracture fillings increase to the south-southeast before bedrock sharply plunge under stratified sand. The outer core of the complex was not exposed due to overburden thicknesses.

Though the program was unable to locate large lenses of calcite it did establish the northern limb of the Spanish River Carbonatite Complex. The current quarry outline represents approximately 1000 metres of strike length by 300 metres in width. The Zone 4 contact zone extends the confirmed west and north rim of the complex an additional 800 metres.

No further work is recommended in this area with the exception of geophysics and seismic surveys over buried outer and inner core areas. Future exploration once surveys have been completed would entail reverse circulation and diamond drilling of the core.

## REFERENCES

Sage R.P., (1987) *Spanish River Carbonatite Complex, Study 30*, Ontario Geological Survey, Ministry of Northern Development and Mines.

Heinrich, E. Wm., (1966) *The Geology of Carbonatites*, Rand McNally & Co.


Proudfoot David, (1971) *Petrology of the Carbonatite Complex in Township 107-108*, Carleton University



**Appendix 1**  
**Letters of Authorization**

I Peter Slack;

1. Supervised trenching and exploration activities on mining claim 3002843 in Tofflemire Township, District of Sudbury.
2. The work was performed between the dates November 16<sup>th</sup> to 27<sup>th</sup>. 2003.
3. I concur with all information contained in this report and is an accurate description of work performed.
4. I am a professional engineer and have been practicing my profession since 1992.
5. I reside in the town of Erin, County of Wellington, Ontario.

Date: Dec. 05 2003 Signature: 

I John Slack;

6. Did perform geological mapping, surveying and sampling work on mining claim 3002843 in Tofflemire Township, District of Sudbury.
1. The work was performed between the dates November 24<sup>th</sup> and November 27<sup>th</sup> 2003.
2. Prepared all maps and drawings and wrote this report.
3. I concur with all information contained in this report and is an accurate description of work performed.
4. I reside in the Township of Erin, County of Wellington.
5. I am a graduate of the Haileybury School of Mines and have been practicing my profession since 1980.
6. I am the holder of an Ontario prospecting license C38249

Date:

Signature:

DEC 05/03



Date: 2003-DEC-15

GEOSCIENCE ASSESSMENT OFFICE  
933 RAMSEY LAKE ROAD, 6th FLOOR  
SUDBURY, ONTARIO  
P3E 6B5

AGRICULTURAL MINERAL PROSPECTORS INC.  
GENERAL DELIVERY  
ERIN, ONTARIO  
N0B 1T0 CANADA

Tel: (888) 415-9845  
Fax: (877) 670-1555

**Submission Number:** 2.26790  
**Transaction Number(s):** W0370.01920

Dear Sir or Madam

**Subject: Approval of Assessment Work**

We have approved your Assessment Work Submission with the above noted Transaction Number(s). The attached Work Report Summary indicates the results of the approval.

At the discretion of the Ministry, the assessment work performed on the mining lands noted in this work report may be subject to inspection and/or investigation at any time.

If you have any question regarding this correspondence, please contact BRUCE GATES by email at [bruce.gates@ndm.gov.on.ca](mailto:bruce.gates@ndm.gov.on.ca) or by phone at (705) 670-5856.

Yours Sincerely,



Ron C. Gashinski  
Senior Manager, Mining Lands Section

**Cc:** Resident Geologist

John Malcolm Slack  
(Claim Holder)

Agricultural Mineral Prospectors Inc.  
(Claim Holder)

Assessment File Library

Christopher Michael Caron  
(Claim Holder)

Agricultural Mineral Prospectors Inc.  
(Assessment Office)



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ONTARIO CANADA

MINISTRY OF NORTHERN DEVELOPMENT AND MINES PROVINCIAL MINING RECORDERS OFFICE

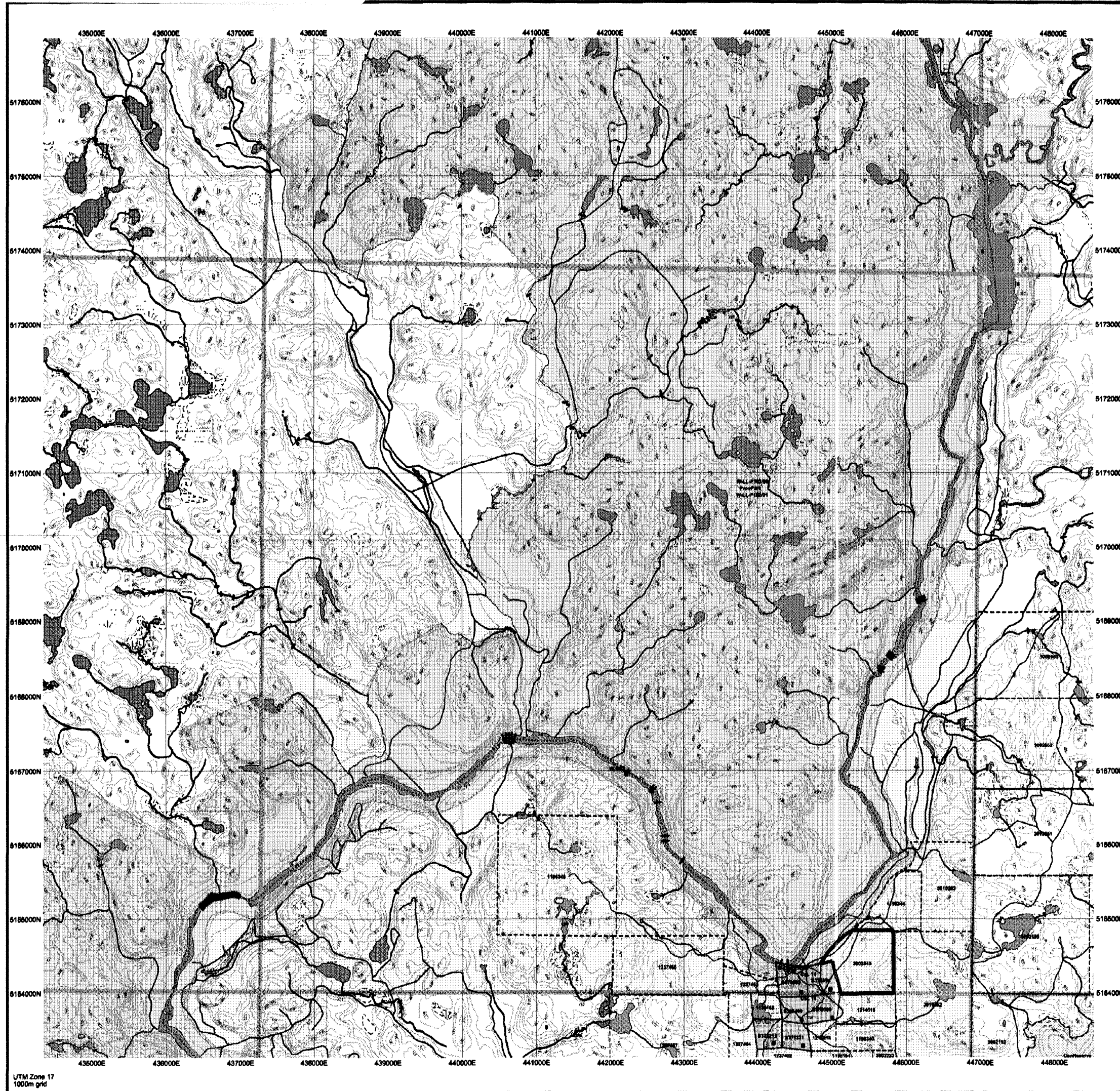
Mining Land Tenure Map

Date / Time of Issue: Mon Dec 15 09:56:02 EST 2003

TOWNSHIP / AREA PLAN TOFFLEMIRE G-2987

ADMINISTRATIVE DISTRICTS / DIVISIONS

Mining Division Sudbury Land Titles/Registry Division SUDBURY Ministry of Natural Resources District SUDBURY

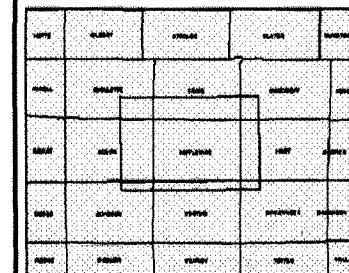


TOPOGRAPHIC

- Administrative boundaries, Township, Concession Lot, Provincial Plan, Mines Reserve, Cliff, P&F File, Contour, Mine Shaft, Mine Headframe, Railway, Road, Trail, Natural Gas Pipeline, UTM Grid, Tower

Land Tenure

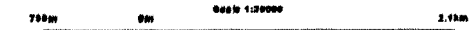
- Freehold Patent: Surface And Mining Rights, Surface Rights Only, Mining Rights Only; Leasehold Patent: Surface And Mining Rights, Surface Rights Only, Mining Rights Only; License of Occupation: Open Pit Operation, Surface And Mining Rights, Surface Rights Only, Mining Rights Only; Landed Use Permit; Order In Council (that opens for a bid); Water Power Lease Agreement; Mining Claim; Piled Only Mining Claims



LAND TENURE WITHDRAWALS

- 1234 Area Withdrawal Point Disposition; Mining Act Withdrawal Types: Mining Act Withdrawal, Surface Rights Only Withdrawal, Order In Council Withdrawal, Surface And Mining Rights Withdrawal, Surface Rights Only Withdrawal, Mining Rights Only Withdrawal; W.P. Water Power Lease Agreement; W.P. Water Power Lease Agreement

IMPORTANT NOTICES



LAND TENURE WITHDRAWAL DESCRIPTIONS

Identif.	Type	Date	Description
011	Wm	May 10, 2001	Appropriate Permit 882538 for Bedrock
012	Wm	Dec 21, 2000	Carleton Place 882538 for Bedrock
013	Wm	May 12, 1999	SEC 35 W-L-1152/99 ONT MAY 12 1999 1445 - 1445, this withdrawal area has no
014	Wm	Jul 21, 2001	SEC 35 W-L-1152/99 ONT JULY 21 2001 1445
015	Wm	Jul 21, 2001	SEC 35 W-L-1152/99 ONT JULY 21 2001 1445
016	Wm	Feb 1, 2000	SEC 35 W-L-1152/99 ONT FEB 1 2000 1445
017	Wm	Oct 20, 2000	SEC 35 W-L-1152/99 ONT OCT 20 2000 1445
018	Wm	Jul 20, 2001	SEC 35 W-L-1152/99 ONT JULY 20 2001 1445
019	Wm	May 17, 1999	SEC 35 W-L-1152/99 ONT MAY 17 1999 1445 (200 m FROM WATERS EDGE)
020	Wm	Jul 14, 1992	SEC 35 W-L-1152/99 ONT JULY 14 1992 1445

2.26790 INDUS

Those wishing to make mining claims should consult with the Provincial Mining Recorder's Office of the Ministry of Northern Development and Mines for additional information on the status of the lands shown herein. This map is not intended for navigational, survey, or land title determination purposes as the information shown on this map is compiled from various sources. Completeness and accuracy are not guaranteed. Additional information may also be obtained through the Best Land Title or Registry Office, or the Ministry of Natural Resources.

General Information and Limitations

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Map Data: Map Data: MMD 93, Tel: 1 800-495-9545 and 416-392-1111, Fax: 416-392-1111

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