Claim 1243865, Eilber Township

Work Report
2001-2002

February 2003
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Summary

Claim block 1243865 is located within Eilber Township in Northern Ontario, and comprises a four-unit block of unpatented, unsurveyed mining claims. The property represents one of many that Northern Shield Resources holds in Northern Ontario and was selected for its potential to host diamondiferous kimberlite. The area falls within the Superior Province of the Canadian Shield and is distinguished by an anomalously thick cratonic crust, which has been shown to be highly favourable for the occurrence of kimberlite magmatism (Helmstaedt and Gurney, 1995). The area also lies adjacent, but not part of, the Kapuskasing Structural Zone, which is currently undergoing intensive diamond exploration at its southern limits. The property is characterized by a lack of previous exploration efforts, with the exception of sporadic work on a small gold occurrence along the southeastern border of McCowan Township. However, the recent interest in diamond exploration to the south of the project is expected to stimulate a similar rush in this area.

A limited heavy mineral sampling program was undertaken within the boundaries of claim 1243865, two heavy mineral samples were taken comprising glaciolacustrine material retrieved from between 1.5 and 2.0m depth. No kimberlite indicator minerals were identified from heavy mineral concentrates, although one low-chrome diopside grain was observed.
Abbreviations/Units

This report uses standard System International (SI) units. The coordinate system used for georeferencing is UTM NAD 27 (Zone 17), with units of meters, and structural data is given in degrees, using the right hand rule convention (dip is always to the right of the strike measurement). For planar features strike measurement is always given first, followed by dip, and for linear features, such as fold axes, it is dip/dip angle.

Some common abbreviations found in the text are defined as follows:

- NSR: Northern Shield Resources Inc.
- OGS: Ontario Geological Survey
- KSZ: Kapuskasing Structural Zone
- KIM: Kimberlite Indicator Mineral
- MSL: Mean Sea Level (0m)
- AGL: Above Ground Level

--- Concentrations below detection (for ease in viewing geochemical data)
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1. Introduction

Claim block 1243865 comprises four unpatented, unsurveyed mining claim units, which selectively targets potential kimberlite magmatism in the Canadian shield of Northern Ontario. Northern Shield Resources (NSR) selected the area owing to the presence of structures shown to be promising for the emplacement of kimberlites in Canada.

The properties lie within the Quetico Subprovince of the Superior Province of the Canadian Shield, a particularly thick portion of cratonic crust, which is favourable for the generation of kimberlite magma (Helmstaedt and Gurney, 1995). The area is underlain by metasedimentary gneisses and granitoid bodies, and lies to the west of the Kapuskasing Structural Zone (KSZ), an area of continental weakness characterized by northeast-trending faults which extend from Lake Superior to Hudson Bay. Mafic dykes of the Matachewan-Hearst Swarm (2450 Ma) are common in the area, and typically trend in a north to northwest direction. A second set of dykes, trending northeast, are also present in the area and may be related to the Sudbury Swarm (1230 Ma). Alkaline magmatism occurs as numerous carbonatite and alkalic complexes within the KSZ, while lamprophyre dikes and sills have been identified in the coral rapids area.

Northern Shield Resources is currently undertaking an extensive exploration programme in the area surrounding claim block 1243865, comprising heavy mineral sampling programmes and airborne geophysical surveys. This report deals with work undertaken by the author and I. Bliss of NSR within the boundaries of the property on June 25th, 2001, and consists of the collection of two deep heavy mineral samples from glaciolacustrine material, which blankets the area.

1.1 Property Location and Access

The property is located within Eilber Township, approximately 40km east of the town of Hearst (Fig. 1.1). Access to the properties is by way of Highway 11, which joins the towns of Hearst and Kapuskasing. Numerous logging roads and trails, originating from the area surrounding the town of Mattice, provide access to the property (Fig. 1.2).

1.2 Land Tenure

The property consists of a single unsurveyed, unpatented claim block of four units wholly owned by Northern Shield Resources (Fig 1.2). The claim is in good standing until March 7, 2003 and $1600.00 in exploration expenditures is required to maintain the block for the following year.
Figure 1.1 Location of Claim 1243865
Figure 1.2 Claim 1243865 work area
1.3 Topography

Claim block 1243685 is part of the Hudson Bay Lowland, an area characterized by a plain of low relief, which gently slopes towards James Bay to the northeast. Elevation in the property area is approximately 250m above means sea level (MSL), with local variations of typically less than 10m. An exception occurs in some river valleys, where elevations can change by up to 30m. Hydrographic features include the Missinaibi River and numerous small creeks and rivers, which form part of the Moose River Basin drainage area. Owing to the thick clay deposits and low relief, the area is poorly drained, resulting in numerous swamp and muskeg areas. Lakes in the area are typically less than 500m in diameter.

1.4 Methodology

1.4.1 Geochemical Sampling Methodology

Two glacial overburden samples were taken by Northern Shield Resources (NSR) within the claim boundary, and were intended to provide information on specific areas of interest through their kimberlite indicator mineral (KIM) abundances.

Samples were collected between 1.5 and 2.0m depths within the dense glaciolacustrine sediments of the Missinaibi Formation (Wolfe et al., 1975) using a muskeg tractor equipped with a hydraulic shovel. Samples ranged in size from 15 kg to 20 kg. Larger samples were collected to compensate for the dilution of heavy mineral grains by the high percentage of clay material found in the areas overburden.

The recovery of heavy mineral was accomplished by Overburden Drilling Management (ODM) in Nepean, Ontario (Appendix II) where concentrates were wet sieved into 3 fractions: <1 mm; 1-2 mm; and >2 mm, the latter of which was stored. The finer fractions were passed over a shaking table to remove low density material and to obtain a preliminary gold grain count. The table concentrate was panned and a secondary gold grain count performed. Heavy liquid separation (methylene iodide, specific gravity 3.2) was used to further concentrate heavy minerals, which underwent ferromagnetic separation to obtain magnetic and nonmagnetic fractions. A series of various sieving and washing processes as well as additional magnetic separations, were completed to obtain the final concentrates for indicator mineral picking. If KIM are identified, microprobe analyses are performed on individual grains in order to obtain their chemical compositions.

1.4.2 Geo-positioning

For grid location and geochemical sampling the Garmin GPS XL12 units was used. This system is capable of geopositioning with accuracies of typically less than 5 meters when data is collected in “Average” mode. GPS locations were always corroborated with topographic map references.
to local physiographic features. The UTM coordinate projection NAD 27 was used, with all work carried out in zone 17.

1.4.3 Organization of Data

A unique sample number is associated with each station and is taken from sample booklets containing a numbered series. All data collected in the field was entered into various software programs, ex. Excel and Mapinfo, to ensure the safe storage and organization of the information. It also provided a powerful tool for reviewing material while in the field.

1.5 Previous Work

The region surrounding the property has received very little attention from exploration companies, with the exception of the Filion and Miller gold showings located within the southeastern corner of McCowan Township. Gold was first discovered in the early 1930’s, however, the first serious work was only completed in the 1940’s and resulted in the drilling of the Filion showing in 1946. Drill results were disappointing, with gold values and structure decreasing with depth. Sporadic exploration efforts were undertaken, including drilling, until the mid 1980’s when Northland Exploration began an intensive program of mapping, trenching and geophysics, culminating in a diamond drilling campaign. Unfortunately only low-grade mineralization was intersected and the programme was suspended. In 1967 the OGS produced Miscellaneous Paper 10, Operation Kapuskasing, which detailed the areas geology and mineral deposits (Bennett et. al., 1967). The work represents the only government-funded mapping project to focus on the area. During the 1960’s the area was flown by a provincial magnetic survey, the results of which are available to the public. Recent interest in diamond exploration in Ontario has prompted a number of Kimberlite Indicator Mineral (KIM) studies in the region, two of which provide valuable information for the area. Open file reports (OFR) 6068 and 6044 detail modern alluvium sampling programmes in the Kapuskasing and Coral Rapids areas, respectively, providing identification of KIM and metamorphosed massive sulphide indicator minerals (MMSIM) within stream sediments (Tardiff, 2001).

1.6 Regional Geology

The property is located in the Superior Province of Northern Ontario, the largest craton in the world (1,572,000 km$^2$), which represents 23% of the earth’s exposed Archean crust (Thurston, 1991). The Superior Province is divided into numerous Subprovinces (Fig. 1.3), each bounded by linear faults and characterized by differing lithologies, structural/tectonic conditions, ages and metamorphic conditions. These Subprovinces can be classified as one of four types: 1) Volcano-plutonic, consisting of low-grade metamorphic greenstone belts, typically intruded by granitic magmas, and products of multiple deformation events; 2) Metasedimentary, dominated by clastic sediments and displaying low grade metamorphism at the subprovince boundary and amphibolite to granulite facies towards the centers; 3) Gneissic/plutonic, comprised of tonalitic gneiss
containing early plutonic and volcanic mafic enclaves, and larger volumes of granitoid plutons, which range from sodic (early) to potassic (late); and 4) High-grade gneissic subprovinces, characterized by amphibolite to granulite facies igneous and metasedimentary gneisses intruded by tonalite, granodioritic and syenitic magmas (Card and Ciesieliski, 1986). Claim block 1243865 lies within the Quetico metasedimentary subprovince.

1.6.1 Quetico Subprovince

The property is underlain by rocks of the Quetico Subprovince, which is classified as a metasedimentary Subprovince (Card and Ciesieliski, 1986), dominated by Archean metasediments and containing numerous granitoid intrusions. The Quetico Subprovinces is bounded by the Wabigoon and Wawa Subprovinces, and forms a long, narrow (70km) belt stretching 900km, from Minnesota to central Ontario, where it is bounded by the Kapuskasing

Figure 1.3 The Superior Province of Ontario
Structural Zone (KSZ) (Fig. 1.3). To the east of the KSZ, the metasedimentary belt continues as the Opatica Subprovince, with no significant changes in its geologic character. Boundaries marking the northern and southern limits of the ENE-trending Quetico Subprovince are typically steep and, although dominantly tectonic in origin, may be depositional in certain sections along the Wawa Subprovince contact. The Quetico is dominated by metasedimentary and migmatitic rocks, with precursors consisting of wackes, and siltstones, minor iron formation, conglomerate and ultramafic-derived metasedimentary rocks. Igneous rocks consist of biotite-hornblende-bearing granitoids, mixed mafic and felsic bodies with minor amounts of associated ultramafic rocks, and metaluminus to peraluminous one- and two-mica granites (Fig 1.4).

Metasediments

Within metasedimentary sequences four main lithological types are present and consist of wacke, iron formation, conglomerate and ultramafic wacke and siltstone. Monotonous layers of interbedded wacke and mudstone were present prior to metamorphism, consisting of alternating, meter-thick layers of graded to ungraded lithic and feldspathic arenites and siltstones. Iron formations are represented by centimeter-scale laminated chert-magnetite and chert-magnetite-mudstone rocks, while conglomerates consisted of up to 5m thick layers of dominantly volcanic clasts in a sandy matrix (Devaney and Williams, 1989; Williams, 1991). Ultramafic-derived sedimentary layers were comprised of predominantly serpentinized material.

Wackes

Wackes represent the dominant lithology in the Quetico Subprovince (Fig 1.4), and are interpreted to have been deposited in deep water as turbiditic flows (Williams, 1991). They are buff to grey-coloured and display meter-scale bedding of graded and ungraded character. Units show varying degrees of tectonism. Quartz-arenite members are rare, and wackes are typically composed of feldspar, lithic fragments and phyllosilicates. A typical bed consists of a micaceous arenite base, which grades into a homogeneous, rarely laminated, zone, which becomes finer-grained towards the top. These compositional types form turbidite Bouma sequences (Williams, 1991). Sedimentary structures are commonly preserved in the rocks and consist of loading and dewatering structures, scours, graded bedding and ripple marks, which generally point to a northern younging direction (Williams, 1991). Rock types are typically discontinuous on a regional scale, however, metamorphosed equivalents can be traced through the low-grade margins into the southern and central migmatite sections. The majority (80-90%) of the Quetico wackes are now paragneisses and migmatites.

Iron Formation

Oxide facies iron formation, composed of quartz and magnetite, although very rare in the Quetico, can be found scattered throughout the subprovince. Horizons are thin and rarely show on government magnetic surveys, however, they are laterally continuous and, in some cases, can be traced for tens of kilometers (Williams, 1989). Some garnet-cummingtonite-bearing layers within metasediments may represent original silicate iron formation.
Figure 1.4 Regional Precambrian Geology of the Hearst-Kapuskasing area
Conglomerate

Conglomerates within the Quetico Subprovince are typically polymictic and range between clast and matrix supported varieties, with fragments consisting of volcanic lithologies. The beds are usually meters thick, but occur only sporadically throughout the wacke layers. Owing to the infrequent occurrence of this unit, it is thought that they were formed by re-sedimentation of volcanic-derived material transported from volcanic centers of the Wawa Subprovince to the south (Williams, 1989).

Ultramafic-derived metasediments

Rocks falling into this category are found throughout the metasedimentary sequence, although are volumetrically less important than other metasedimentary types. Their origin is uncertain, however, it is thought they result from the accumulation of eroded material from mafic-ultramafic bodies nearby (Williams, 1991). Ultramafic wackes are pale to dark green in colour, with colour dependant on the proportion of metamorphic chlorite in the matrix. Typical sequences consist of pale green, feldspathic wackes which grade into medium-green chloritic wackes containing ripples, scours and cross-lamination. Overlying these horizons are thick (10’s of meters) sections of massive to poorly stratified, chlorite-rich wackes containing fragments of quartz arenite/recrystallized chert. The strata often contain a network of quartz-carbonate veining. Breccias are present in some areas and consist of clasts of ultramafic and quartzofeldspathic rock in a schistose ultramafic matrix.

More felsic wackes found near the ultramafic variety are often distinct from distal occurrences, displaying much more evidence of current reworking, as large ripples, discordances and cross-lamination (Williams, 1991). Overlying the ultramafic wacke, hosted by quartz-feldspathic wackes, is a thin (1m) mafic/ultramafic layer containing rounded fragments of gabbro and quartz-mica schist in an actinolite matrix.

Igneous Rocks

Igneous rocks within the Quetico Subprovince comprise abundant felsic to intermediate intrusions, rare mafic and felsic extrusive suites and scattered gabbroic and ultramafic bodies (Fig. 1.4). All but the younger peraluminous granitoids and leucogranites have undergone metamorphism, producing orthogness. The earliest igneous intrusives are composed of I-type (igneous derived) hornblendites, diorites, syenites and tonalites, which contain mafic and ultramafic xenoliths composed of predominantly amphibole (Williams, 1991). These early intrusive rocks typically occur as inliers within large leucogranite plutons, comprised of one- and two-mica granites, of both I- and S-types (sedimentary origin).
Volcanics

Mafic volcanics are extremely rare in the Quetico Subprovince, partly as a result of how the Subprovince was divided, although a few occurrences are known in the east, within Langemarck Township.

Felsic volcanics occur along the southern boundary of the subprovince, and were originally classified as conglomerates (Williams, 1991). They consist of pale, buff-coloured feldspar-phyric volcanic clasts in a pellitic matrix, and were probably derived from volcanics to the south in the Wawa Subprovince (Williams, 1989).

Ultramafic Intrusions

Numerous occurrences of ultramafic lithologies are known throughout metasedimentary layers of the Quetico Subprovince, and exist as plutons, pods and concordant and discordant layers. Metamorphism has caused significant alteration of the units, masking primary contact relationships in most exposures. Ultramafics are recognizable as masses of platy and fibrous chlorite, actinolite and biotite or larger hornblende and peridotite intrusion, which grade into more feldspathic varieties (Pirie, 1978). Pervasive serpentinization, resulting from metamorphism, is obvious at several localities.

Gneissic Tonalite Suites

Concordant sheets of foliated, steeply dipping tonalite and diorite are common throughout the Quetico, and typically intrude paragneisses and migmatites in the central and southern sections of the subprovince (Percival, 1989).

Granodiorite-Granite Suite

Pink, magnetite-bearing biotite leucogranites are found within the high-grade paragneisses of the Quetico Subprovince, and are predominantly migmatitic in origin. In other sections of the Quetico, abundant feldspar-phyric granites and biotite leucogranites occur as concordant and crosscutting bodies and plutons. These lithologies often contain inclusions of paragneiss and mafic rocks, and are typically cut by younger peraluminous and muscovite-bearing granite.

Peraluminous Granite

The youngest, and volumetrically most important, igneous rocks in the Quetico consist of white to grey leucogranite containing cordierite, sillimanite and garnet, and accessory tourmaline, beryl and apatite. Isotopic data is consistent with a sedimentary source for many of these intrusions, and more specifically the host wackes (Percival and Sullivan, 1988).
Diorite and Nepheline Syenite

Silica undersaturated rocks are only found in the extreme western portion of the Quetico Subprovince and are comprised of syenite and nepheline syenite which was coeval with leucogranite.

Mafic Dyke Swarms

One of the most noticeable lithological and structural features of the Superior Province is the presence of more than twelve mafic dyke swarms, most of which were formed in a tectonic environment associated with intraplate rifting or plate margin activity. The most relevant to the property is the Matachewan-Hearst swarm (Fig 1.4), which occurs in the southern and central regions of the Superior Province. Dykes in the swarm trend north to northwesterly and were emplaced at approximately 2454 Ma. The Matachewan-Hearst swarm is the second largest in the Canadian Shield, covering an area of 500 by 700km (Osmani, 1991).

The dykes are best observed to the southeast of the Kapuskasing Structural Zone (KSZ). Dykes to the northwest have been correlated with those to the southeast through lithological, strike, aeromagnetic and paleomagnetic similarities. In most cases they occur as narrow, typically 10m width and rarely exceeding 250m, vertically to sub-vertically dipping bodies composed of plagioclase-phyric quartz diabase. Dykes are not known to occur within the KSZ, most likely as a result of their emplacement prior to development of the KSZ, and above the initial depth of its present surface (<20km). However, although exposed dykes are absent, magnetic data suggests they do occur within the KSZ (Osmani, 1991).

The Matachewan and Hearst swarms converge to the south and is consistent with a failed arm environment with a spreading point to the south, and possibly related to the opening of an ocean prior to formation of the Huronian Supergroup (Osmani, 19XX). The volcanics of the Copper Cliff formation (2450 Ma), as well as layered intrusions, are thought to have been formed in a passive-margin, rift-related setting, and are genetically related to the Matachewan-Hearst swarm (Osmani, 1991).

1.7 Property Geology

Owing to the property’s position within the clay belt of Northern Ontario, little is known about the surface geology of the region (Fig. 1.4). Geological investigations in the property area by the author revealed no mappable exposures, however, reconnaissance mapping by other researchers in the surrounding areas provide some insight into the underlying geology. In 1967 the Ontario Geological Survey published the first, and only, report on the geology of the Kapuskasing area in its Miscellaneous Paper #10, Operation Kapuskasing (Bennet et. al., 1967).

The region is dominated by a northeast-trending quartz–feldspathic metasedimentary gneiss containing a large amount of younger granitic intrusive (Fig 1.4). Basic igneous rocks comprise a
significant proportion of intrusive rock, approximately 10%, occurring as narrow dykes (<250m wide) of the Matachewan-Hearst Swarm. Mafic dykes usually transect the entire length of the property and occur as conjugate sets, consistently trending in 070° and 340° directions. A small horizon of possible pyroclastic material and mafic schists was exposed by trenching in the southeastern corner of the property in McCowan Township. Thin feldspar and quartz-feldspar porphyries cross cut the “volcanic” horizon.

1.7.1 Metasedimentary rocks

Metasediments in the area are dominated by light grey to buff wackes displaying varying grades of gneissic banding. The unit is fine- to medium-grained and is composed of quartz and feldspar with lesser amounts of chlorite, biotite and sericite. Argillitic strata are present within the wackes, however, they make up a very small proportion of the sedimentary sequence. On the banks of the Missinaibi River, southeast of Mattice, is an exposed section of arkosic sandstones, very similar in appearance to the quartzo-feldspathic gneisses, but lacking the gneissic texture. The lack of gneissic banding in these rocks may be due to their presence in a low strain environment. One exposure of conglomerate is mentioned from McCowan Township, and contains rounded quartz pebbles.

1.7.2 Igneous Rocks

Intrusive

Granite intrusives dominate to the the north and northeast of the property area, and occur as fine to coarse-grained, equigranular, buff to pink one- and two-mica granites. Semi-Angular granodioritic clasts have been observed in sediment samples, and this lithology may also occur in the area. In McCowan Township numerous, thin feldspar and quartz-feldspar dykes are exposed intruding a thin package of possible felsic metapyroclastic rocks and mafic schist.

Diabase dykes have been intersected in diamond drill to the east of the property, and consist of fine- to medium-grained, feldspar phyric quartz-diabase. Two orientations of dikes are present in the area, and although of similar appearance, have widely spaced age dates. The north-northwest trending set was intruded at approximately 2485 Ma (Brown et. al., 1967), and is interpreted to be part of the Hearst-Matachewan swarm, while the northeast-trending dykes give age dates of 1230 Ma (Bennet et. al., 1967), and are probably related to the Sudbury Swarm.

Extrusive

The only known occurrence of metavolcanic rocks exists in the southeastern corner of McCowan Township, and consists of thin pyroclastic and possible mafic flows. Pyroclastic units are described as containing angular felspathic fragments in a grey to green, fine-grained matrix. Mafic units occur as highly chloritized schists, of limited extent and width, within the pyroclastics unit. They were interpreted as thin mafic flows, although they may also be intrusive in nature.
1.8 Economic Geology

As previously discussed, very little exploration has been undertaken in the area of the property, with the exception of the McCowan Township gold showings. The occurrences are the Filion and Miller Showings, and consist of carbonate vein-hosted gold mineralization associated with porphyry dykes intruded into felsic to intermediate volcanioclastics. Mineralization was thought to be intimately associated with disseminated pyrite related to porphyry dykes, however, diamond drilling indicated that, although pyrite mineralization continued at depth, gold grades declined rapidly. Closer examination of the anomalous horizon revealed the presence of visible gold in late carbonate-quartz filled fractures proximal to porphyry dykes. Unfortunately the vein system was limited to the surface exposure, and no further zones were identified.

1.9 Regional Structure

1.9.1 Deformation Events

The Quetico Subprovince went through a protracted period of tectonic development from approximately 2700 to 2660 Ma (Williams, 1991). The earliest expression of tectonism was the soft-sediment deformation (D1), recumbent folding and slumping, which was followed by a D2 deformation event involving layer-parallel shearing and associated folding, which resulted in the development of a regional fabric. This newly formed fabric was then subjected to an upright, D3 folding event and localized shearing.

Early sediment deformation generally resulted in northwest-facing, recumbent folding. It is possible that a S1 fabric was developed, but was incorporated by D2 shearing into the S2 fabric. The second period of deformation produced the dominant cleavage in the area (S2), and was developed parallel to lithological layering and the S1 cleavage. F2 folds are typically steeply plunging, except along the southern subprovince boundary where dextral boundary shearing may be superimposed on F2 fold axes. D2 deformation was heterogeneous and often resulted in narrow areas of high strain shearing separated by large sections exhibiting primary features. The D3 event is characterized by upright to inclined, easterly-trending shallow plunging folds, which deform primary features and S2 fabric (Williams, 1991). Plunge is typically to the east, however, some areas show evidence of westerly plunging folds. The event is interpreted by Williams (1989) to represent a transpressional event. The final period of deformation (D4) resulted in small-scale shearing, which cuts all earlier fabrics. Structural evidence for a south-southeast compressional event, associated with extension of the belt is found in extensional fractures, ductile shear zones and semi-brittle features such as kink bands (Sawyer, 1983; Williams, 1989).
1.9.2 Faulting

The Quetico Subprovince has four major faults, the easterly-trending Quetico Fault, The Rainy Lake-Seine River Fault, the northeasterly-trending Gravel River Fault and the Kapuskasing Structural Zone (Williams, 1989). The Quetico Fault transects, and forms part of, the Wabigoon-Quetico Subprovince boundary, and consists of a regional-scale, dextral shear zone and fault. The Rainy Lake-Seine River Fault is another easterly-trending structure, which is older than the Quetico Fault, and is interpreted to be an early dip slip fault. The Gravel River Fault is a northeast to east-northeast trending system, which displays a sinistral sense of movement (Williams, 1989). The largest structure, which is responsible for the eastern boundary of the Quetico Subprovince, is the Kapuskasing Structural Zone (KSZ), a north-northeast-trending upthrust block, which brings deep-level Quetico rocks to the surface. Owing to its proximity to the property, the KSZ is described in more detail below.

1.9.3 Kapuskasing Structural Zone

The Kapuskasing Structural Zone (KSZ) is a northeast-trending fault zone, which extends from the east shore of Lake Superior to James Bay, and represents a zone of uplift that has brought mid-crustal rocks (20 km depth) to surface (Figs. 1.3). The origin of the KSZ is still uncertain, although it has been interpreted as an upwarp of the Conrad Discontinuity, caused by Paleoproterozoic collision of the Churchill and Superior cratons (Thurston et. al., 1977), a deep, transcurrent shear (Watson, 1980) or an east-verging thrust fault (Percival and Card, 1983). The KSZ is characterized by a high-grade gneiss terrain, which involves alternating bands of mafic and sedimentary rocks, and in the southern part contains a sequence similar to those found at the Wawa-Quetico subprovince boundary. As well, rocks observed in the northern sections of the KSZ are similar to those at the Wabigoon-Quetico contact. In addition to the major fault that delineates the eastern boundary of the KSZ, three other northeast-striking faults can be found within the zone, which dip at steep angles (60° to 70°) to the northwest (Sage, 1991). These faults reflect between 7 and 10 kilometers of uplift (west-side down) and formed from tensional events following the compressional uplift. The pressures and temperatures determined from rocks within the KSZ reflect their formation at midcrustal levels, with average PT conditions of approximately 900°C and 5 to 10 Kbar. Precise age dates for the KSZ are unavailable, however, it pre-dates intrusion of the 1800 to 1900 Ma carbonatites that are found along the KSZ.

Over thirteen alkaline intrusions occur within the KSZ (Fig 1.4), exploiting the deep faults that characterize the area, and include the Clay-Howells Alkalic Complex, the Cargill Township Carbonatite Complex, the Valentine Carbonatite Complex and the Hecla-Killmer Alkalic Complex. This alkaline magmatism took place during the Penokean and Grenville-Keweenawan orogenic events and in the Neoproterozoic-Early Cambrian and Jurassic periods.

1.10 Quaternary Geology
Much of the overburden capping the project area is a buff coloured, fine-grained, clay-rich and sand-poor, till interpreted to be reworked glaciolacustrine deposits. Only in a few locations do streams incise down through this glaciolacustrine deposits into basal till which contains representative mineralogy of the bedrock over which the ice has advanced. A compilation of relative ice advances in northern Ontario completed by Veillette and McClenaghan (1996) shows an older ice advance in the 200-240° direction and a much younger one orientated 165-185°. Eskers orientated in the latter direction are common. Morris (pers. comm) suggests that the older ice advance is most likely to create a more prominent dispersion trail as the ice presumably has the largest volume of (untouched) source rock (kimberlite) to erode. Furthermore, subsequent ice advances may not have had access to kimberlite outcrop, which by that time may have been situated deep in an excavated crater. Ideally, any dispersion trail from younger glacial events are smaller and weaker than those formed earlier on. However, the younger ice advances may have "smudged" the older dispersion trains.

2. Kimberlyt Indicator Minerals

2.1 Introduction

Kimberlites represent the primary source of the world’s diamonds and are therefore the target of most diamond exploration. The mineralogy of a kimberlite reflects its unique source area and perhaps the most useful technique in kimberlite/diamond exploration is heavy mineral sampling of unconsolidated surficial material, such as modern alluvium and quaternary deposits, in the search for kimberlite indicator minerals (KIM). Surface erosion of kimberlitic bodies will result in the formation of a dispersal train of key indicator minerals from the source, and, if the direction of transport of these minerals is known, typically from knowledge of glacial advances, the kimberlite can be traced by following this trail back to its origin.

Five kimberlite mineral indicators (KIM) are used to identify a potential kimberlite dispersal train and they are: pyrope garnet; chromite; ilmenite; chrome-diopside and olivine. Although these minerals are not unique to kimberlites, the chemical characteristics of varieties found in kimberlite differ noticeably from examples found in other lithologies. Although a powerful tool, KIMs are often misinterpreted by geologists who do not fully understand the information that they provide. An important aspect of KIM, as well as diamonds, is that most are not formed by a kimberlite melt, but rather transported from their mantle source by this medium. Typically diamonds are formed in peridotite and eclogite residing in the earth’s mantle, and coexist with other minerals, Cr-pyrope, chromite, Cr-diopside, olivine and ilmenite, in the case of peridotitic mantle, and eclogitic garnets for an eclogitic source region. As most diamond deposits have a disproportionately large number of peridotitic diamonds, the selection of KIM is easily understood. An advantage to pyrope garnet and chromite KIMs is that they can also be used to estimate the diamond-potential of a kimberlite based on their mineral chemistry.

It is important to remember that there are many features involved in the use of KIMs in diamond exploration, such as quaternary and fluvial transport history, geochemical discrimination, and
textural identification, and these must always be taken into account in order to properly interpret KIMs.

2.2 Results

Heavy Mineral data was obtained from two till samples taken by Northern Shield Resources (NSR) within the boundaries of claim 1243865 (Fig 2.1, Appendices I & II). Sample results were disappointing with no KIM picked from either sample (Table 2.1). A single low-chrome diopside, of unknown affinity, was recovered from sample 215808.

Table 2.1 KIM results from heavy mineral samples, claim 1243865

<table>
<thead>
<tr>
<th>Sample</th>
<th>Township</th>
<th>Type</th>
<th>gp</th>
<th>go</th>
<th>dc</th>
<th>im</th>
<th>cr</th>
<th>fo</th>
<th>lcd</th>
<th>cp</th>
<th>ghn</th>
<th>KIM</th>
</tr>
</thead>
<tbody>
<tr>
<td>215808</td>
<td>Eilber</td>
<td>till</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>215956</td>
<td>Eilber</td>
<td>till</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

cp-chalcopyrite; cr-chromite; dc-chrome diopside; fo-forsterite, ghn=gahnite; im-ilmenite; go-eclogitic garnets; gp-pyrope garnets, lcd-low chrome diopside

3. Conclusions

Claim block 1243865 is underlain by a geological setting favourable for hosting kimberlite intrusions, however, initial heavy mineral sampling within the property boundaries failed to identify KIM dispersal trains. The lack of results may be due to the surficial material available for sampling, consisting of a high proportion of lacustrine sediments, and low amounts of glacial till.

4. Recommendations

Although initial heavy mineral sample results are disappointing, it is believed that the sampling medium does not accurately portray the glacial history of the area. In order to fully assess the property's potential a deep overburden-sampling program should be considered.
Figure 2.1 Claim 1243865 - location of heavy mineral samples
5. Certificate

David Palmer, Ph.D., P.Geo.
Chief Geologist, Northern Shield Resources
1600 – 150 Metcalfe Street
Ottawa, Ontario K2P 1P1

I, David Palmer, do hereby certify that:

1. I graduated with a Bachelor of Science degree from St. Francis Xavier University in 1991; a Master of Science degree from McGill University in 1994 and a Doctor of Philosophy degree from McGill University in 1999.

2. I am a member, in good standing, of the Association of Professional Geologists of Ontario.

3. I have worked as a geologist for a total of 12 years since my graduation from university.

4. I have read the definition of “qualified person” set out in National Instrument 43-101 (“NI 43-101”) and certify that, by reason of my education and past relevant work experience, I fulfill the requirements to be a “qualified person” for the purposes of NI 43-101.


6. I am not aware of any material fact or material change with respect to the subject matter of the Technical Report that is not reflected in the Technical Report, the omission to disclose which makes the Technical Report misleading.

Dated this 27th Day of February, 2003.

[Signature]

Signature of Qualified Person

David Palmer, Ph.D., P.Geo.

Print name of Qualified Person

Northern Shield Resources
6. References


Tardiff, N., 2001, Results of modern alluvium sampling, Kapuskasing-Fraserdale area, Northeastern Ontario – Operation Treasure Hunt – Kapuskasing Structural Zone, OGS Open File Report 6044


APPENDIX I

Heavy Mineral Sample Locations
### Appendix I UTM coordinates for heavy mineral sample locations

<table>
<thead>
<tr>
<th>Sample</th>
<th>Easting*</th>
<th>Northing*</th>
</tr>
</thead>
<tbody>
<tr>
<td>215808</td>
<td>338505</td>
<td>5502658</td>
</tr>
<tr>
<td>215956</td>
<td>338316</td>
<td>5502528</td>
</tr>
</tbody>
</table>

* UTM NAD 27 projection, zone 17
APPENDIX II

Heavy Mineral Identification

Certificates
DATA TRANSMITTAL REPORT

DATE: 16-Oct-01

ATTENTION: Mr. Ian Bliss

CLIENT: Northern Shield Resources Inc.
44 Farnham St.
Ottawa, On
K1K 0G2

FAX NO.: 613-749-6097

NO. OF PAGES:

PROJECT: VR-001, FC-215808 and WR-215809

FILE NO: Northern Shield Resources Inc. 01-2001

NO. OF SAMPLES: 3

THESE SAMPLES WERE PROCESSED FOR: KIMBERLITE INDICATORS GOLD

SPECIFICATIONS:
Submitted by client: One 4.8 kg sand + silt sample and one 12.8 kg till sample.
Heavy liquid separation specific gravity: 3.20.
Samples picked for indicator minerals.

REMARKS:

Remy Huneault
Laboratory Manager
OVERBURDEN DRILLING MANAGEMENT LIMITED
LABORATORY SAMPLE LOG

Project:
Total of 2 samples
Filename: Northern Shield Resources Inc. 10-2001

<table>
<thead>
<tr>
<th>Sample Number</th>
<th>Weight (kg)</th>
<th>Clasts &gt;2.0 mm</th>
<th>Matrix &lt;2.0 mm</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Bulk Rec'd</td>
<td>Table Split</td>
<td>+2 mm Clasts</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Size V/S</td>
<td>GR LS OT</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Sand Clay Org</td>
<td>Class</td>
</tr>
<tr>
<td>FC-215808</td>
<td>5.30</td>
<td>4.80 0.00</td>
<td>4.80 No Clasts</td>
</tr>
</tbody>
</table>
## Kimberlite Indicator Mineral Counts

### Project:
- Total of 2 samples
- Filename: Northern Shield Resources Inc. 10-2001

**<2.0 mm Table Concentrate**

<table>
<thead>
<tr>
<th>Sample Number</th>
<th>Total Heavy Liquid Lights</th>
<th>Total Magnets</th>
<th>Total</th>
<th>&lt;0.25 mm</th>
<th>0.25 to 0.5 mm</th>
<th>0.5 to 1.0 mm</th>
<th>1.0 to 2.0 mm</th>
<th>Total KIMs</th>
</tr>
</thead>
<tbody>
<tr>
<td>FC-215808</td>
<td>154.8</td>
<td>152.9</td>
<td>0.2</td>
<td>1.7</td>
<td>0.3</td>
<td>0.0</td>
<td>1.2</td>
<td>0.03</td>
</tr>
</tbody>
</table>

**Heavy Liquid Separation S.G 3.20**

<table>
<thead>
<tr>
<th>Sample Number</th>
<th>Total</th>
<th>Nonmagnetic Fraction</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Total</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Sample Number</th>
<th>Total</th>
<th>Nonmagnetic Fraction</th>
</tr>
</thead>
</table>

**Selected PseudoKIMs**

- 1.0-2.0 mm
- 0.5-1.0 mm
- 0.25-0.5 mm

**KIM Count** (*species not rigorously picked; excluded from total)*

<table>
<thead>
<tr>
<th>Sample Number</th>
<th>Total</th>
<th>1.0 to 2.0 mm</th>
<th>0.5 to 1.0 mm</th>
<th>0.25 to 0.5 mm</th>
</tr>
</thead>
<tbody>
<tr>
<td>FC-215808</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Values greater than 0.1 g were weighed only to one decimal place; the zero was added in the second decimal position to facilitate column alignment.*
<table>
<thead>
<tr>
<th>SAMPLE NO.</th>
<th>REMARKS:</th>
</tr>
</thead>
<tbody>
<tr>
<td>FC-215808</td>
<td>Hematite-almandine-orthopyroxene/epidote-diopside assemblage. SEM checks from 0.25-0.5 mm fraction: 3 CR versus crustal ilmenite candidates = 2 crustal ilmenite and 1 Ti-andradite.</td>
</tr>
</tbody>
</table>
DATE: 15-Oct-01

ATTENTION: Mr. Ian Bliss

CLIENT: Northern Shield Resources Inc.
44 Farnham St.
Ottawa, On
K1K 0G2

FAX NO.: 613-749-6097

NO. OF PAGES:

PROJECT:

SAMPLE NUMBERS: FC-215954 to 215958 and WR-215959 to 215961

FILE NAME: Northern Shield Ian Bliss October 2001

BATCH NUMBER: 659

NO. OF SAMPLES: 8

THESE SAMPLES WERE PROCESSED FOR: Kimberlite Indicators Gold

SPECIFICATIONS:
1. Submitted by client: 9.7 to 20.2 kg bulk till and alluvial sediment samples.
2. Heavy liquid separation specific gravity: 3.20.
3. 0.25-2.0 mm nonferromagnetic heavy mineral fraction picked for indicator mineral grains.
4. All other sample fractions are presently stored.

REMARKS:

Remy Huneault
Laboratory Manager
<table>
<thead>
<tr>
<th>Sample Number</th>
<th>Weight (kg)</th>
<th>Clasts &gt;2.0 mm</th>
<th>Matrix &lt;2.0 mm</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Bulk</td>
<td>Rec'd</td>
<td>Table</td>
</tr>
<tr>
<td>FC-215956</td>
<td>9.7</td>
<td>9.2</td>
<td>0.1</td>
</tr>
</tbody>
</table>
OVERBURDEN DRILLING MANAGEMENT LIMITED
LABORATORY SAMPLE LOG
KIMBERLITE INDICATOR MINERAL COUNTS

Filename: Norther Shield Ian Bliss October 2001
Total Number of Samples in this Report = 8
Batch Number: 659

<table>
<thead>
<tr>
<th>Sample Number</th>
<th>Total</th>
<th>0.25-0.5 mm</th>
<th>0.5-1.0 mm</th>
<th>1.0-2.0 mm</th>
<th>KIM Count (* species not rigorously picked; excluded from total)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Total</td>
<td>Heavy Liquid Separation S.G 3.20</td>
<td>1.0 to 2.0 mm</td>
<td>0.5 to 1.0 mm</td>
<td>0.25 to 0.5 mm</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Nonferromagnetic Fraction</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Total</td>
<td>0.25-0.5 mm</td>
<td>0.5-1.0 mm</td>
<td>1.0-2.0 mm</td>
</tr>
<tr>
<td>FC-215956</td>
<td>311.5</td>
<td>246.1</td>
<td>65.3</td>
<td>0.02</td>
<td>0.07</td>
</tr>
</tbody>
</table>

** Values greater than 0.1 g were weighed only to one decimal place; the zero was added in the second decimal position to facilitate column alignment.
<table>
<thead>
<tr>
<th>SAMPLE NO.</th>
<th>REMARKS</th>
</tr>
</thead>
<tbody>
<tr>
<td>FC-215956</td>
<td>Undersized concentrate; therefore not electromagnetically separated and assemblage not listed. Main minerals are almandine, hematite, ilmenite and green epidote.</td>
</tr>
</tbody>
</table>
# Work Report Summary

Transaction No: W0360.00421  
Status: APPROVED

Recording Date: 2003-MAR-04  
Work Done from: 2001-JUN-25

Approval Date: 2003-MAR-18  
to: 2001-JUN-25

Client(s): 392612  
NORTHERN SHIELD RESOURCES INC.

Survey Type(s): ASSAY

## Work Report Details:

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<th>Claim#</th>
<th>Perform Approve</th>
<th>Applied Approve</th>
<th>Assign Approve</th>
<th>Reserve Approve</th>
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External Credits: $0

Reserve: $1,303  
Reserve of Work Report#: W0360.00421

Total Remaining: $1,303

Status of claim is based on information currently on record.
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 STEVEN BENETEAU by email at steve.beneteau@ndm.gov.on.ca or by phone at (705) 670-5855.

Yours Sincerely,

Ron Gashinski
Senior Manager, Mining Lands Section

Cc: Resident Geologist
    Northern Shield Resources Inc.
    (Claim Holder)  
    Assessment File Library
    Northern Shield Resources Inc.
    (Assessment Office)