# Geological Mapping, Radiometric Survey and Mineralization on part of the Mumford Claim Cardiff Township, Ontario

SO 1500016 (Lots 9-11, Concession 22 and Lot 11, Concession 21)),

By

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May, 2014

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## Introduction

For decades, recreational mineral collectors from around the world have been coming to south eastern Ontario to pursue their fascinating hobby by searching out mineral specimens from the many available collecting sites for which the region is famous. For this reason, many consider the region, often referred to in general as the Bancroft area, the "Mineral Capital of Canada".

A wide variety of minerals are known from hundreds of different occurrences throughout the region. Sadly, over the years, many of these localities have been closed to mineral collectors due in part to park and cottage development and a host of other land access issues. It has been suggested that fewer mineral collectors are coming to the region now than in the past. If this is true it may be in part, because there are fewer collecting sites available to the collector. The Municipality of Highlands East, with the assistance of the Ontario's Highlands Tourism Organization, has acquired a number of mineral claims to explore the possibility of developing these claims as new recreational mineral collecting destinations, thereby providing incentive for mineral collectors to return and stay in the region.

The Mumford claim, located 5 km from the town of Wilberforce, is one of the claims held by the Municipality of Highlands East and is the subject of this report. Superb mineral specimens of apatite, diopside, zircon, uraninite, amphibole, feldspar and titanite from localities in the Wilberforce area are well known among mineral collectors. Many well known mineral collecting sites are located on privately owned land within several kilometres of the Mumford claim. The Schickler Occurrence (Sabina 1986), which lies within the Mumford claim, was a poorly known mineral collecting site until recently. Because the Municipality of Highlands East has recently provided to the public information about the Schickler Occurrence and opened the site, recreational minerals collectors have started returning to the region as tourists. It has become a mineral destination.

It seems reasonable to postulate that additional mineral collecting sites might be found on the Mumford claim. The goal of this study was to explore for and identify additional sites on the Mumford claim that would be attractive to the recreational mineral collector. This was done by mapping geology and conducting a radiometric survey over the north western part the claim. The author and an assistant spent 7 person days on the claim in May 2014 gathering data for this report.

## Claim Information

The Mumford claim was staked on June 3, 2011 and its claim number is SO 1500016. It is currently owned by the Corporation of the Municipality of Highlands East. The Mumford claim covers four concession lots in Cardiff Township, consists of eight claim units and carries a $3,200 annual exploration work commitment. Currently $2,825 of work is required to keep the claim in good standing until June 3, 2015.

## Location and Access

The Mumford claim measures approximately 1.2 by 2.3 kilometres in size and occupies Lots 9-11, Concession 22 and Lot 11, Concession 21 in the township of Cardiff. It is located approximately 27 kilometres east from Haliburton and 25 km west from Bancroft, the two largest towns in the region (Figure 1).

The Mumford claim is approximately 5 kilometres northwest of Wilberforce and 3 kilometres southeast of Harcourt, the two easiest communities from which to access the claim (Figure 2). The claim is located on NTS map 31E/01. To access the claim from Wilberforce, travel along County Road 648 until Mumford road is reached (approximately 4.7 kilometres). Turn right onto Mumford Road and travel 1.0 kilometres. At this point, the western boundary of Mumford claim is reached and Cope Lake Road branches off to the south.

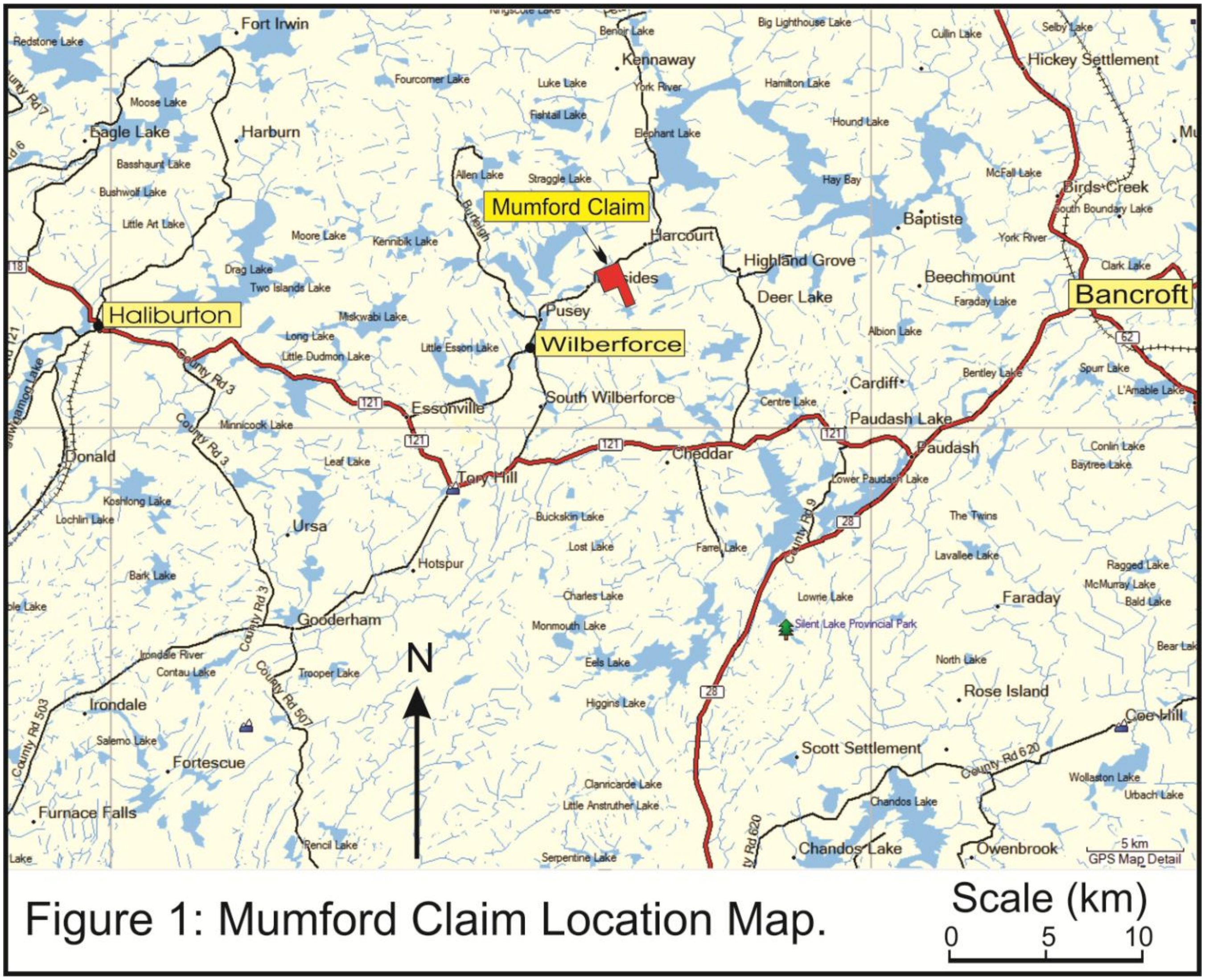


Figure 1: Mumford Claim Location Map.

Although the Mumford claim is surrounded by privately owned land, it is crossed by numerous roads and trails, making access very easy. Along the northern edge of the claim is paved County Road 648. The gravel covered Mumford Road traverses, in an east west direction, the central part of the claim. A narrow gravel road, called Manhire Road, leads to cottages on Cope Lake and provides access to the southern part of the claim. Several trails, used by ATVs in the summer and snowmobiles in the winter, traverse the claim and mineral collectors using these trails should be aware of the possibility of ATV traffic. Located near the centre of the claim is an active land fill site (garbage dump). Located on the north eastern corner of the claim is the abandoned Harcourt Graphite Mine. This old mine was **not** investigated as a potential collecting site during this study.

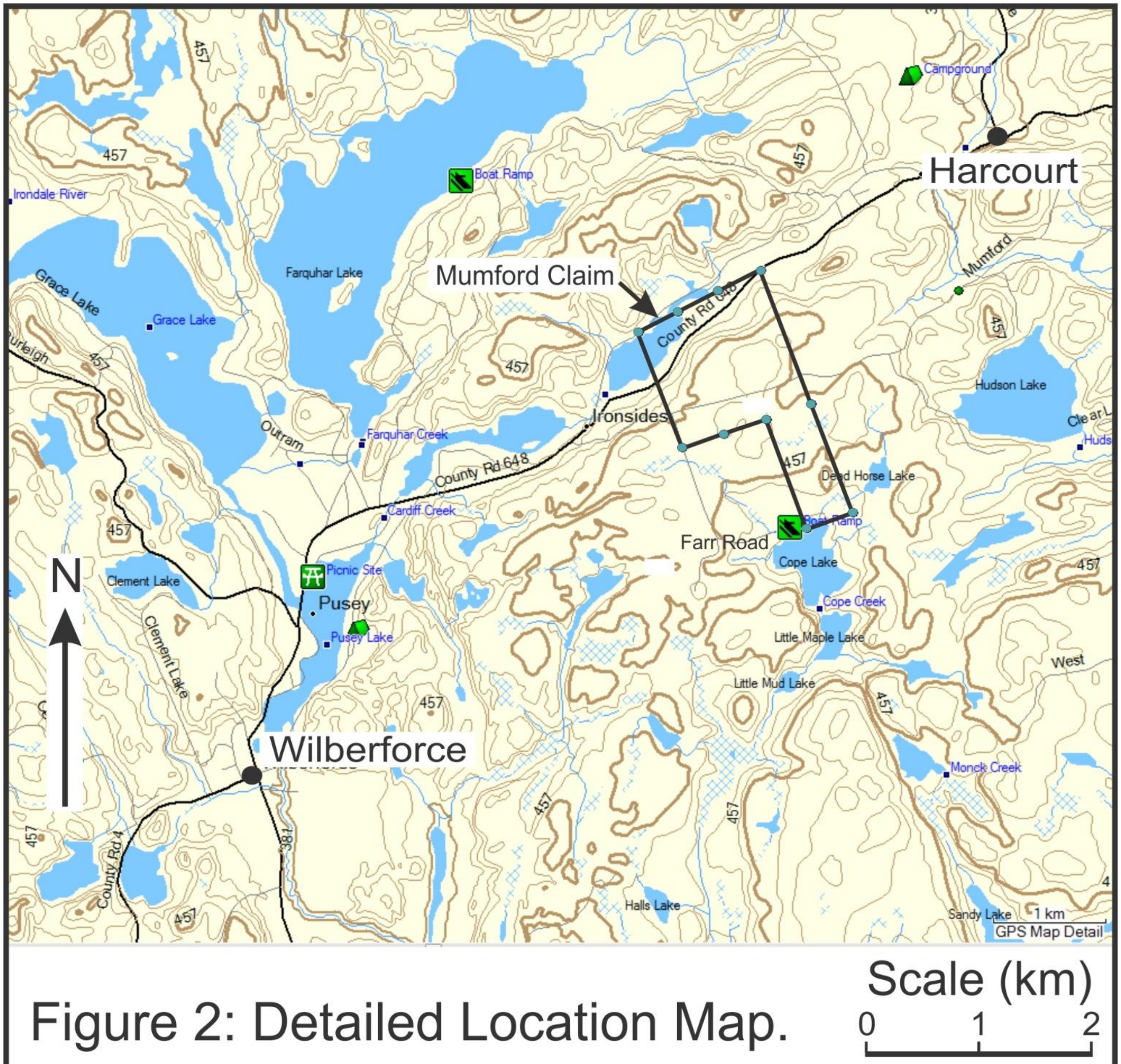


Figure 2: Detailed Location Map.

## Previous Work

The Mumford claim is underlain by rocks of the Grenville Province of the Canadian Shield. On a regional level Grenville Province rocks have been extensively studied and prospected for various ores over the last century. Authors, too numerous to mention, have studied and described these rocks.

A township wide geological report was published in 1959 by Hewitt that included a detailed geologic map covering both Cardiff and neighbouring Faraday Townships. Hewitt's study concentrated on the geology and economic mineral deposits of Cardiff and Faraday Townships and not on occurrences of crystals and minerals suitable for the recreational mineral collector. Hewitt (1959) briefly describes both the Schickler Occurrence and the National (Harcourt) Graphite Property and lists but does not describe a uranium occurrence (D. E. Denfield), all of which lie on the Mumford claim.

Satterly (1957) reports that *circa* 1954, during exploration for radioactive minerals, stripping and trenching was conducted over claims that included Lot 11, Concession 21 (what is now the southern part of the Mumford claim), and that in 1955, a short (43 feet) hole was drilled on the same lot.

A detailed work covering an area around Cope Lake by Ennis (1968) documents geologic and radiometric surveys over a number of claims including what is now the southern part of the Mumford claim. Ennis was searching for radioactive minerals and not potential mineral collecting sites.

Guides to mineral collecting sites in southern Ontario have been published by various authors. One of the more recent guides covering the area is by Sabina (1986). Sabina (1986) describes mineral collecting sites throughout the Bancroft region, including those in the Wilberforce and Harcourt areas.

Two mineral collecting localities that Sabina (1986) describes, lie within the boundaries of the Mumford claim, the Schickler fluorite occurrence and the Harcourt Graphite Mine. In addition, Sabina (1986) describes four collecting localities within a few kilometres of the claim. These are the Clark Mine, Dwyer fluorite Mine, Trip (Nu-Age) Mine and the Richardson (Fission) Mine.

## Fieldwork and Terminology

For ease of reference, the mineral claim covering Lots 9-11, Concession 22 and Lot 11 Concession 21 in the township of Cardiff (SO 1500019) is being referred to in this report as the "Mumford claim". The author spent 4 days mapping and gathering data on the Mumford claim on the following dates; May 8, 9, 10 and 11, 2014. The author was assisted by Robert Beckett on May 9, 10 and 11, 2014. An additional 3 days were spent by the author preparing field maps and writing this report.

Assumptions have been made and a number of terms used by the author in preparing this report. Some of these require clarification. The minerals found on the Mumford claim and those named in this report were identified using standard field identification practices (observations of lustre, hardness, cleavage, crystal form, etc). No analytical work was performed to verify these identifications. Amphiboles belong to a complex group of minerals whose individual mineral species are difficult, if not impossible, to identify without detailed analytical work. Instead of going through the expense and time of having each sample analysed, the author has used the general terms "hornblende" for a black amphibole and tremolite for a lighter coloured amphibole.

## Property Geology

The Mumford claim is underlain by high-grade metamorphic rocks of the Grenville Province of the Canadian Shield. Rocks of the Grenville Province are well known and have been described by many authors. These rocks host virtually all the known mineral and crystal occurrences that attract mineral collectors, both professional and recreational, to the Bancroft area.

A township wide geological report was published in 1959 by Hewitt that included a geology map covering both Cardiff and neighbouring Faraday Townships. Hewitt's geology map shows the Mumford claim being underlain by marble to the north and syenitic and granitic gneiss elsewhere. Included with these gneisses are pegmatite and sedimentary layers.

The author mapped local geology by noting outcrop locations with a hand held GPS device and examining rock types and structures. This was done concurrently with a systematic spectrometer survey and general prospecting for mineral and crystal occurrences of interest to recreational mineral collectors. The area examined during this study is shown in Figure 3. This area, which includes the Schickler trench, was chosen for comparative reasons. The survey started at the Mumford Road and progressed immediately over and beyond the Schickler trench. The survey was limited in area by how much ground could be reasonable covered in four days. Results are shown on the geology map of Figure 4.

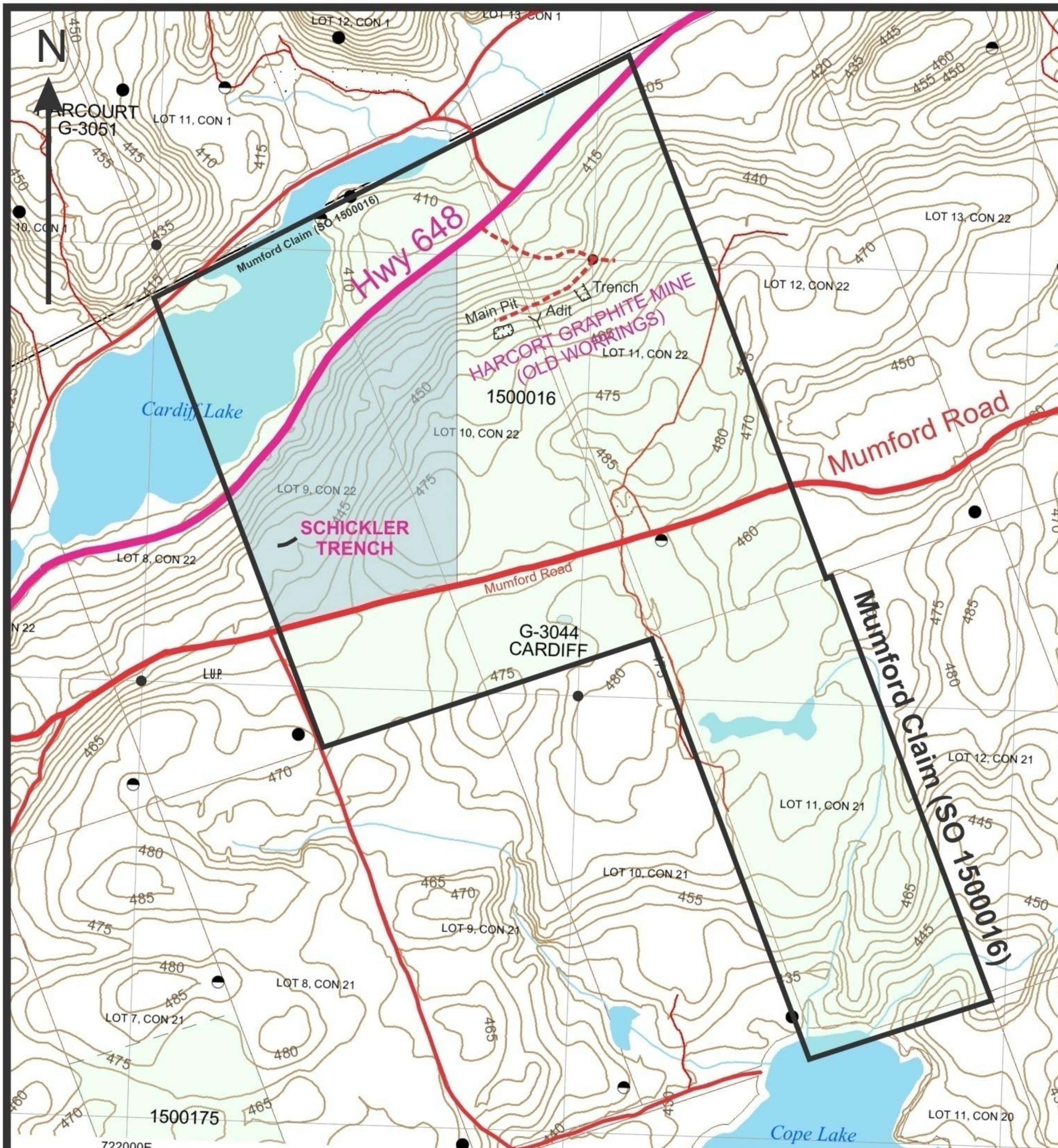


**Figure 3; Map showing area surveyed for this assessment report on the Mumford Claim (1500016), Cardiff Twp.**

0 500 1000

Scale (metres)

Study Area

Paved road

Gravel road

4 wheel drive trail

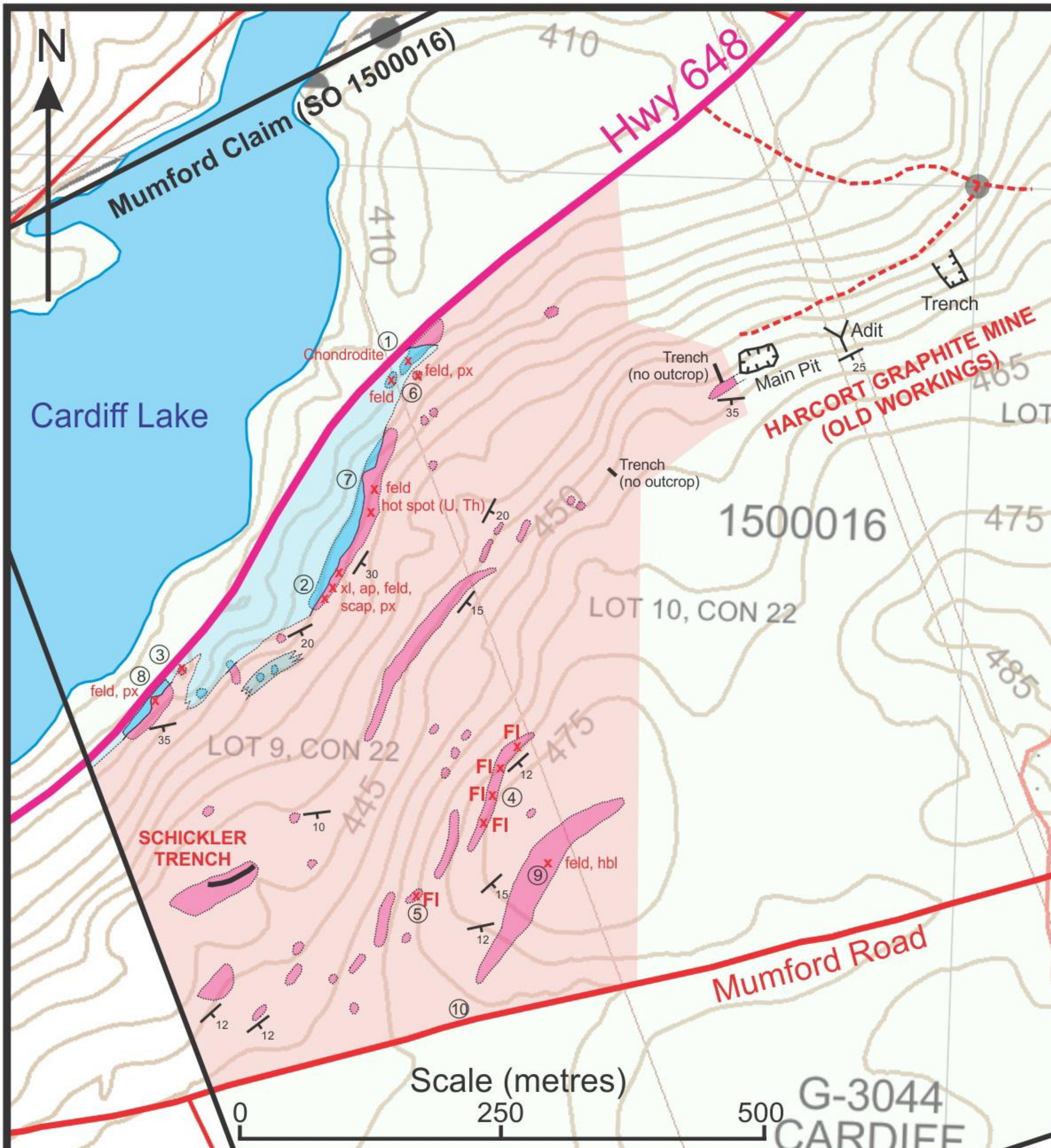


**Figure 4; Geology and Mineralization on part of the Mumford Claim (1500016), Cardiff Twp.**

Mixed, granite gneiss, foliated grey gneiss and pegmatite (underlain, outcrop).

Marble (underlain, outcrop).

Attitude of foliation (strike and dip)

Paved road

Gravel road

4 wheel drive trail

x ⑤ Mineral occurrence of interest.

Fl Fluorite

ap Apatite

scap Scapolite

feld Potassium Feldspar

xl Euhedral crystals

px Pyroxene

hbl Hornblende

Two basic rock units were mapped; marble and gneiss. Marble crops out at lower elevations along Highway 648, the northern edge of the survey area. Marble is exposed in the two mapped road cuts, at the base of the cliffs approximately 50-80 metres south of the road and in several smaller isolated outcrops nearby. This marble is typical for the Grenville Province, consisting of coarse-grained calcite with lesser amounts of non-carbonate minerals, including but not limited to phlogopite, chondrodite, tremolite, diopside and graphite. In weathered outcrops this unit often appears crumbly where calcite grains easily fall apart.

The second unit, which underlies most of the survey area, is a heterogeneous mixture of gneisses and pegmatite. The gneiss varies from well foliated grey gneiss, consisting of variable amounts of feldspar, quartz, hornblende and mica to weakly foliated pink granitic gneiss composed of mostly potassium feldspar, quartz, hornblende and mica. Variable amounts of mafic minerals (as high as 30% or more) help define banding in the foliated grey gneiss, some of which appears quite micaceous on fresh surfaces. In places the foliated grey gneiss contains up to several percent sulphide minerals and can possess very rusty weathering surfaces. Pink granitic gneiss has variably developed foliation, probably a reflection of variable mica and hornblende contents, that grade from weakly foliated to nearly non-foliated. Hewitt (1959) mapped and described these rocks generally as syenite, but within this study area the author found enough quartz in most of these rocks to classify them as granite.

Mixed within these gneissic rocks are layers of heterogeneous granite and pegmatite. In places the pegmatite forms massive foliation-parallel bands up to several metres thick and in other places generally thinner veins and irregular zones of pegmatite cross-cut foliation. In general this unit is a heterogeneous mixture of variably foliated grey and pink gneiss and granitic pegmatite.

The contact between the marble and gneiss, where exposed, is mostly parallel to foliation. Foliation in general is gently dipping, although in one small area on the cliff near Highway 648, foliation was almost vertical. The strike of the foliation is generally in a north to northeast direction and dips gently to the southeast.

## Mineralization

Mineralization on the parts of the Mumford claim covered in this report consist of the previously known Schickler Fluorite Occurrence and a series of previously unknown sites of variable importance. These sites will be referred to by number as shown on Figure 4.

The Schickler Fluorite Occurrence has been described by Sabina (1986) as a calcite vein with granular fluorite that cuts hornblende granite where crystals of apatite, feldspar, pyroxene, scapolite and amphibole occur in white calcite. Sabina (1986) reports that development at the Schickler occurrence consists of a trench 33 metres long, 2 metres wide and 2 to 3 metres deep. The author can confirm the general statements of Sabina (1986), including the approximate size of the trench. Using a GPS device the length of the trench was determined to be 42 metres.

At sites 6, 7, 8 and 9 narrow veins and irregularly shaped zones of calcite are lined or partially lined with euhedral to subhedral crystals of potassium feldspar and/or pyroxene and/or hornblende. Crystals are variable in quality and size but are usually less than 3 cm across. Although these sites may be of interest to determined mineral collectors, their crystal potential is considered fairly low.

Site 10 is very similar to the previous four sites accept that here the veins and irregular zones of calcite occur within boulders at the side of the Mumford Road and not in outcrop.

Sites 4 and 5 consist of zones of abundant fluorite and hornblende in pegmatitic zones. At site 4, fluorite, mostly dark and light purple in colour, can be found in discrete, discontinuous, narrow zones along most of the 120 metre long outcrop. Some of the masses of fluorite are up to 30 cm across. Hornblende cleavage fragments as large as 15 cm across were noted. At site 5 fluorite is less abundant but a hornblende cleavage plane over 50 cm across occurs in the outcrop. It appears that a small trench has been excavated at the side of the outcrop.

Site 3 consists of a small, nearly overgrown outcrop of granitic pegmatite. At its base is a small exposure of very coarse-grained calcite. Although no euhedral crystal were noted, this small outcrop was slightly radioactive (see Figure 8). The author believes this site has some of the features of a potential crystal -bearing zone similar to that at site 2 and recommends this site for future work.

Site 1 is hosted in a course-grained white marble located in the forest at the edge of or just beyond the road cut. Bright orange chondrodite grains up to 1 cm across and grey euhedral tremolite up to 2 1/2 cm across occur within the marble. Additional trenching might reveal more and/or better quality samples.

Site 2 has the greatest potential of all the new sites. Similar to sites 6, 7, 8, 9 and 10, mineralization consists of veins and irregularly shaped zones of calcite exposed near the top of a very steep ridge-like outcrop. The big difference between this site and the others is that here the zones and veins are much larger; up to a metre or more across. And these zones extend discontinuously for more than ten metres along the cliff. Some of the calcite has dissolved away leaving behind mostly weathered and broken crystals of scapolite to 15 cm, apatite to 3 cm and pyroxene to 5 cm across. This would be an awkward spot to collect at, due to loose and potentially dangerous overhanging rock.

## Radiometric Survey - Introduction and Methods

The Schickler Occurrence lies between several former fluorite and radioactive mineral bearing mines (Dwyer Fluorite Mine, Clark Mine, Tripp Mine and Richardson Mine). These mines, along with the Schickler Occurrence have been described by Sabina (1986), Hewitt (1959) and Satterly (1957).

Prior to this study it was not known if radioactive minerals, such as uraninite, thorianite, thorite or zircon, were associated with the other minerals at the Schickler Occurrence or if the site had high background radiation. It seemed reasonable that if some of the other nearby sites were radioactive, such as the Tripp and Richardson Mines, then the Schickler site might be radioactive as well. This might help develop a strategy for exploring for additional mineralized zones on the Mumford claim. If Schickler was radioactive then locating and exposing hidden radioactive zones using a hand-held scintillometer or spectrometer, might reveal new zones of crystallized minerals. Using this logic a hand-held spectrometer was rented and used in this study.

Decades ago the general Bancroft region was heavily explored for radioactive minerals. If new radioactive zones are to be explored for today, it seems prudent to use better equipment than was available in the past, such as a highly sensitive spectrometer. The hand-held instrument used in this survey was the RS-230 spectrometer made by Radiation Solutions Inc. It was rented from Terraplus Inc. in Richmond Hill, Ontario. This very sensitive spectrometer detects ionizing radiation using a bismuth germanate crystal and provides measurements of radiation as counts per minute, of uranium in parts per million (ppm), of thorium in ppm and of potassium in percent.

The RS-230 was carried in the field to prospect for and to detect anomalously high radiation. In addition, the instrument was used to conduct a systematic background radiation survey. Assay reading were taken on the ground at 50 metre intervals on a north-south grid throughout the survey area, shown in Figure 3. Measurements of total counts per minute, U (ppm), Th (ppm) and K (%) were recorded at each site and these data are presented spatially in Figures 5, 6, and 7.

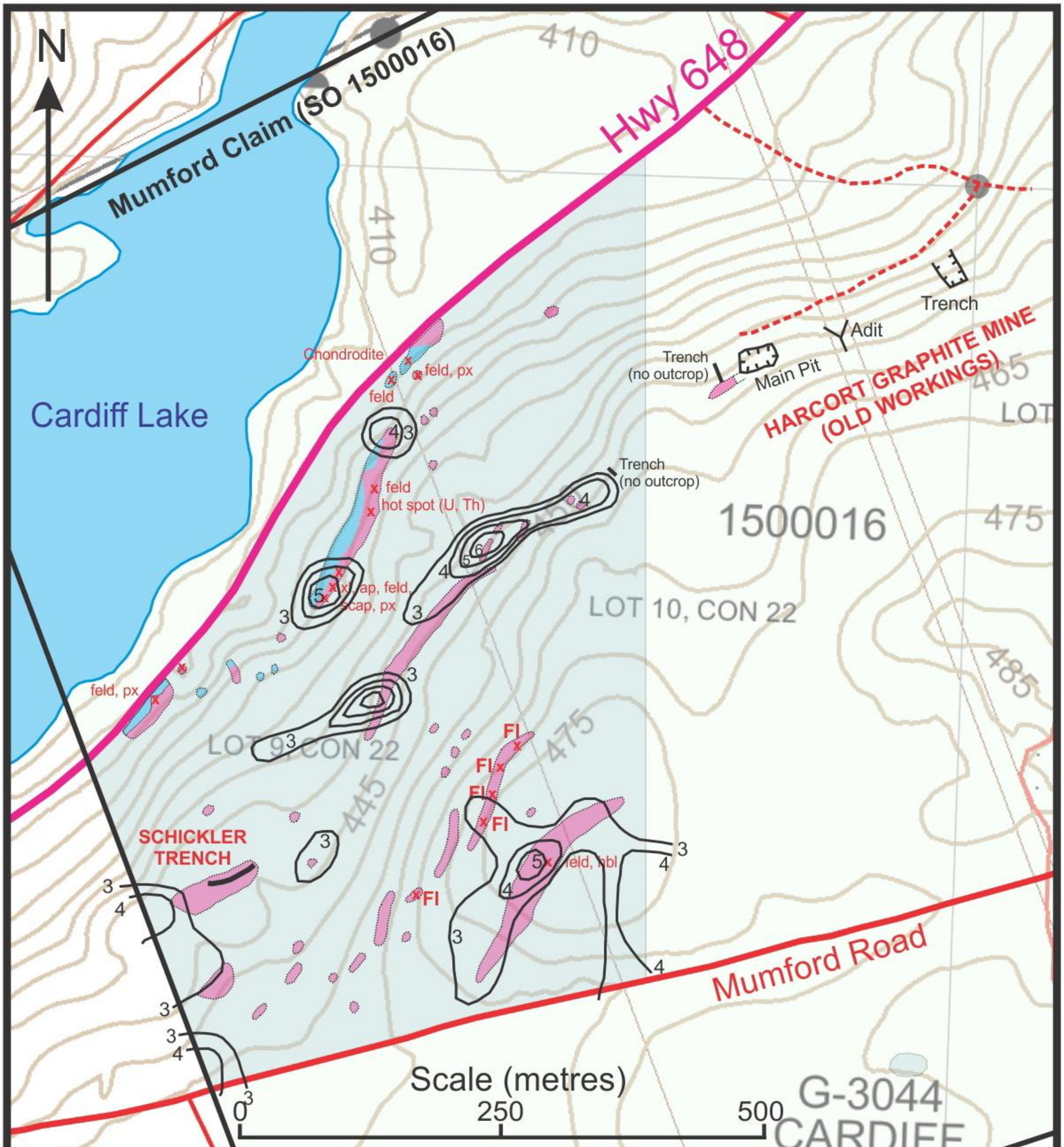


**Figure 5; Background Radiation - Total Counts - on part of the Mumford Claim (1500016), Cardiff Twp.**

Survey area.

Contours joining areas of equal counts per minute x 1000 (3, 4, 5, 6).

Surface outcrop

Paved road

Gravel road

4 wheel drive trail

x Mineral occurrence of interest.
Fl Fluorite
ap Apatite
scap Scapolite
feld Potassium Feldspar
xl Euhedral crystals
px Pyroxene
hbl Hornblende

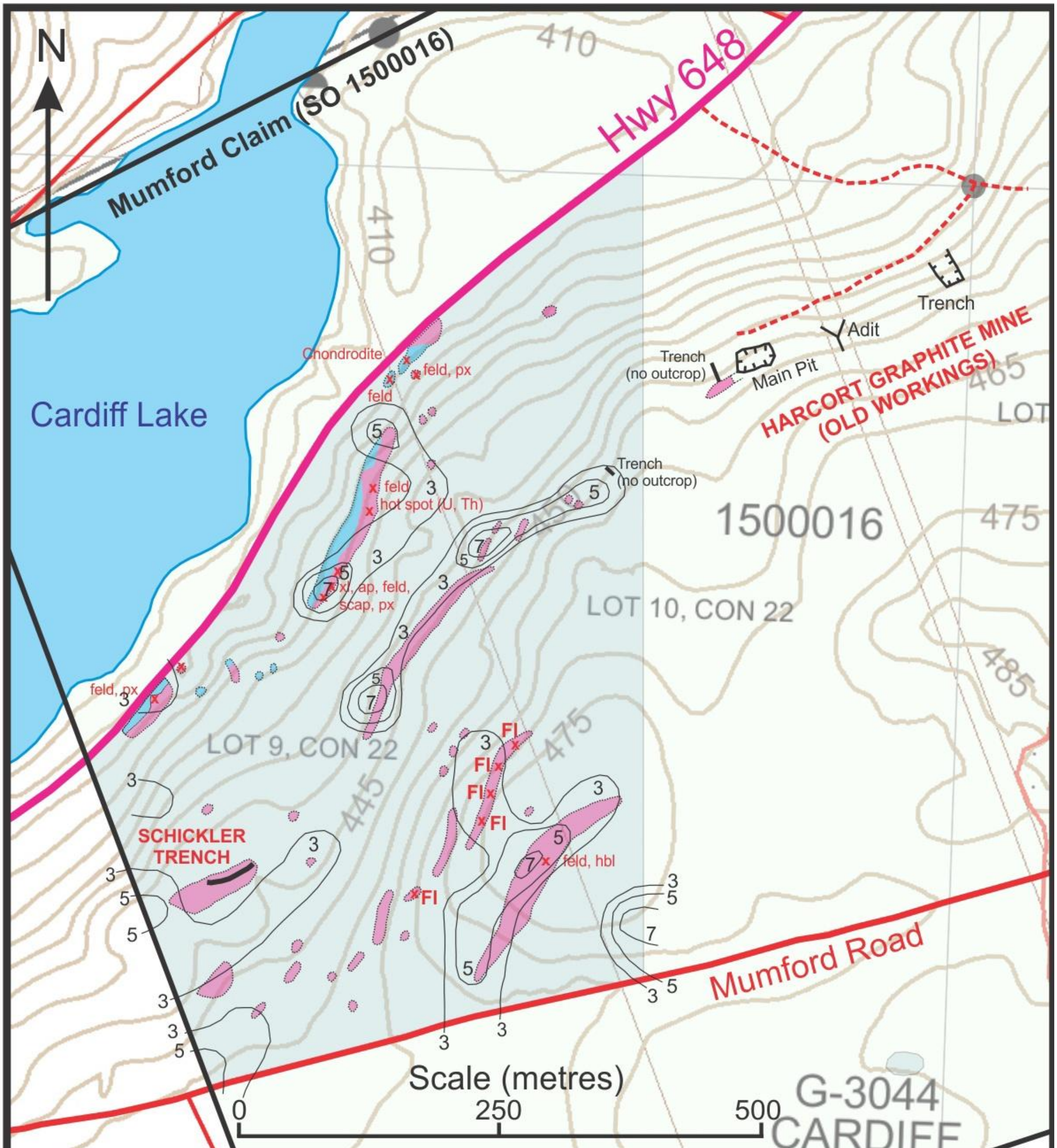


**Figure 6; Background Uranium Content on part of the Mumford Claim (1500016), Cardiff Twp.**

Survey area.

Contours joining equal background Uranium concentration in parts per million (3, 5, 7 ppm).

Surface outcrop

Paved road

Gravel road

4 wheel drive trail

x Mineral occurrence of interest.
Fl Fluorite
ap Apatite
scap Scapolite
feld Potassium Feldspar
xl Euhedral crystals
px Pyroxene
hbl Hornblende

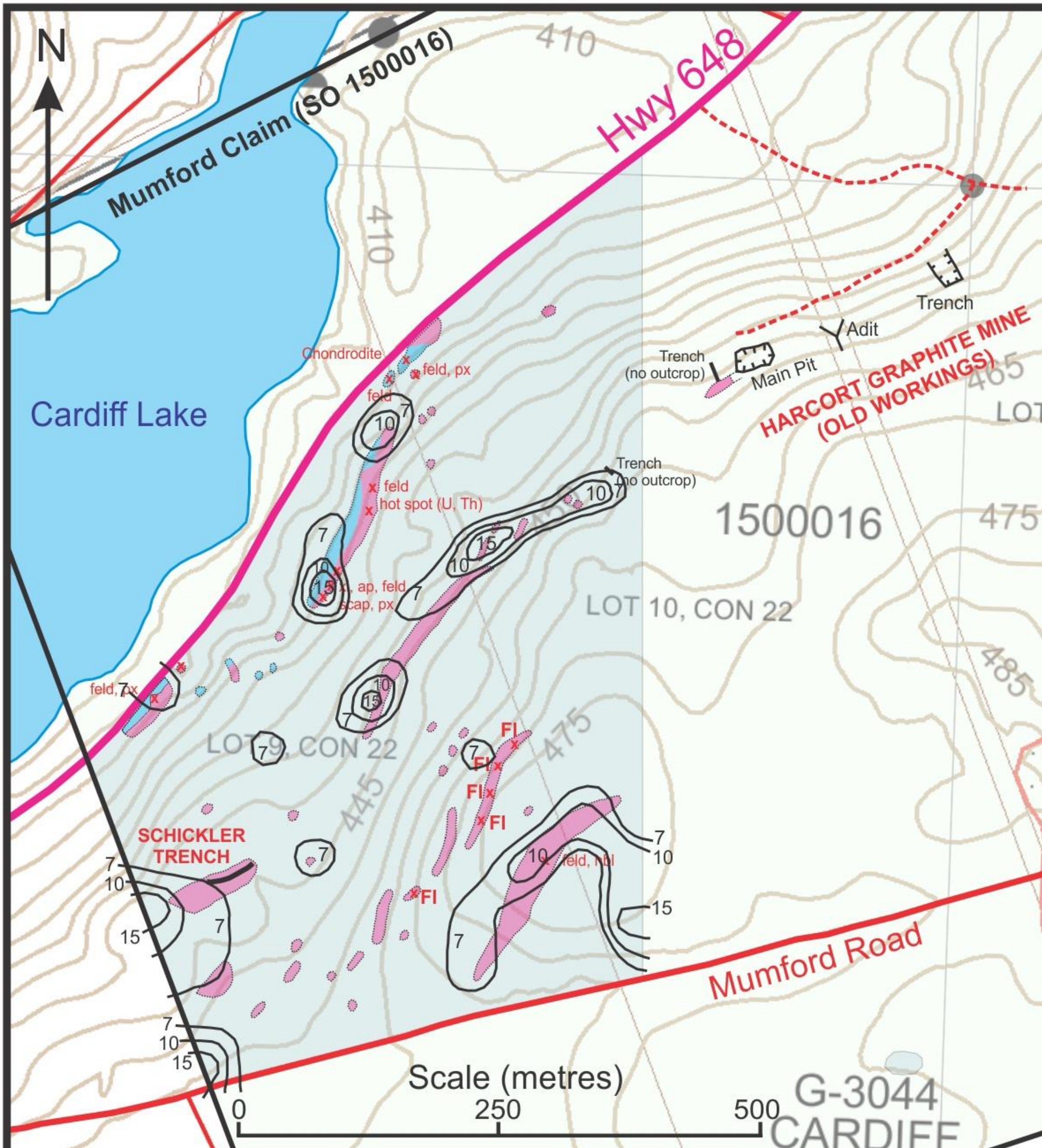


**Figure 7; Background Thorium Content on part of the Mumford Claim (1500016), Cardiff Twp.**

Survey area.

Contours joining equal background Thorium concentration in parts per million (7, 10, 15 ppm).

Surface outcrop

Paved road

Gravel road

4 wheel drive trail

x Mineral occurrence of interest.
Fl Fluorite
ap Apatite
scap Scapolite
feld Potassium Feldspar
xl Euhedral crystals
px Pyroxene
hbl Hornblende

## Radiometric Survey - Results and Discussion

Background radiation levels recorded during the systematic survey range from 1299 to 6275 counts per minute. Background uranium levels range from 0.9 to 8.3 ppm and background thorium levels range from 2.0 to 22.2 ppm. Assay values were plotted and three contour maps showing background levels of radiation, U and Th were created (Figures 5, 6 and 7).

Because total radiation is due in part to U and Th concentration and, U and Th often occur together, it's not surprising that all three maps show somewhat similar and overlapping trends. What is surprising is that the Schickler trench did not stand out as a high with respect to either background radiation or to U or Th levels. Unfortunately this implies that a background spectrometer survey at 50 metre intervals is not capable of identifying "Schickler" style mineralization. Similarly, the fluorite-bearing zone in the south-east had very weak to no response in this survey. Hence, new zones of fluorite mineralization are unlikely to be detected by systematic radiometric surveys.

On the eastern half of the survey area are three roughly parallel and equally spaced northeast trending highs in total counts, U and Th. All three highs roughly correspond to areas of outcrop. The central and strongest high roughly overlays the steepest outcrop/cliff in the survey area. This implies that areas of outcrop have higher background levels of radiation, U and Th. But this relationship doesn't always hold true. The northern high is really two single-point highs at either end of a long cliff-like outcrop. In between the two background highs is the highest "hot spot" (described below) (see Figure 8) which has a measurement of almost 8 million counts per minute; over a thousand times higher than the highest background measurement. The background survey does not pick up on this point source at all. At the south end of this outcrop, coincident with the survey high, is a newly recognized area of euhedral crystal mineralization (site 2 in Figure 4). At this site is another "hot spot", with assays higher than those at the Schickler trench (251 ppm U and 0.1% Th), indicating that this mineralized zone appears to be associated both with higher background levels of radiation, U and Th, and with hot spots.

In addition, slightly higher background levels show up at the southwest corner of the claim and at several single sites in the central area.

Within the survey area (Figure 3) fifteen "hot spots" were found and assayed using the RS-230 spectrometer. They are shown on Figure 8. For the purposes of this report a "hot spot" is defined as a spot or area where the measured local radiation is noticeably above background. Many spotty areas were found where local measurements of radiation were elevated, notably most measurements taken on outcrop were higher than those taken over soil. Readings with the RS-230 were often quite spotty over outcrop as well, especially over pegmatite. This might be due in part to the coarse-grained and heterogeneous nature of pegmatites and their variable concentrations of radioactive minerals. Since pegmatites were a common constituent of the foliated gneiss on the claim, the spotty nature of "hot spots" is not surprising.

Using the RS-230 the Schickler trench was examined for radiation. Although the background radiation in the trench was higher than the surrounding area, these levels were fairly consistent from one end of the trench to the other. Two assays were measured within the Schickler trench; one from each end. These readings are marked in bold and underlined on Figure 8. Both readings were similar, ranging from 34,000 to 37,000 counts per minute, from 38 to 39 ppm U and from 175 to 197 ppm Th. Although this is higher than background in most of the survey area, it is not higher than many of the spot readings associated with pegmatite. For example, four of the five pegmatite associated assays located along the paved road to the north are noticeable higher than those at Schickler (see Figure 8). The non-pegmatite associated assay closest to Schickler was taken in an area of shallow overburden and may actually be over pegmatite. It is much higher than readings taken at Schickler. The down side of these observations is that although Schickler is slightly radioactive, its radiation is not likely high enough to be detected under much overburden.

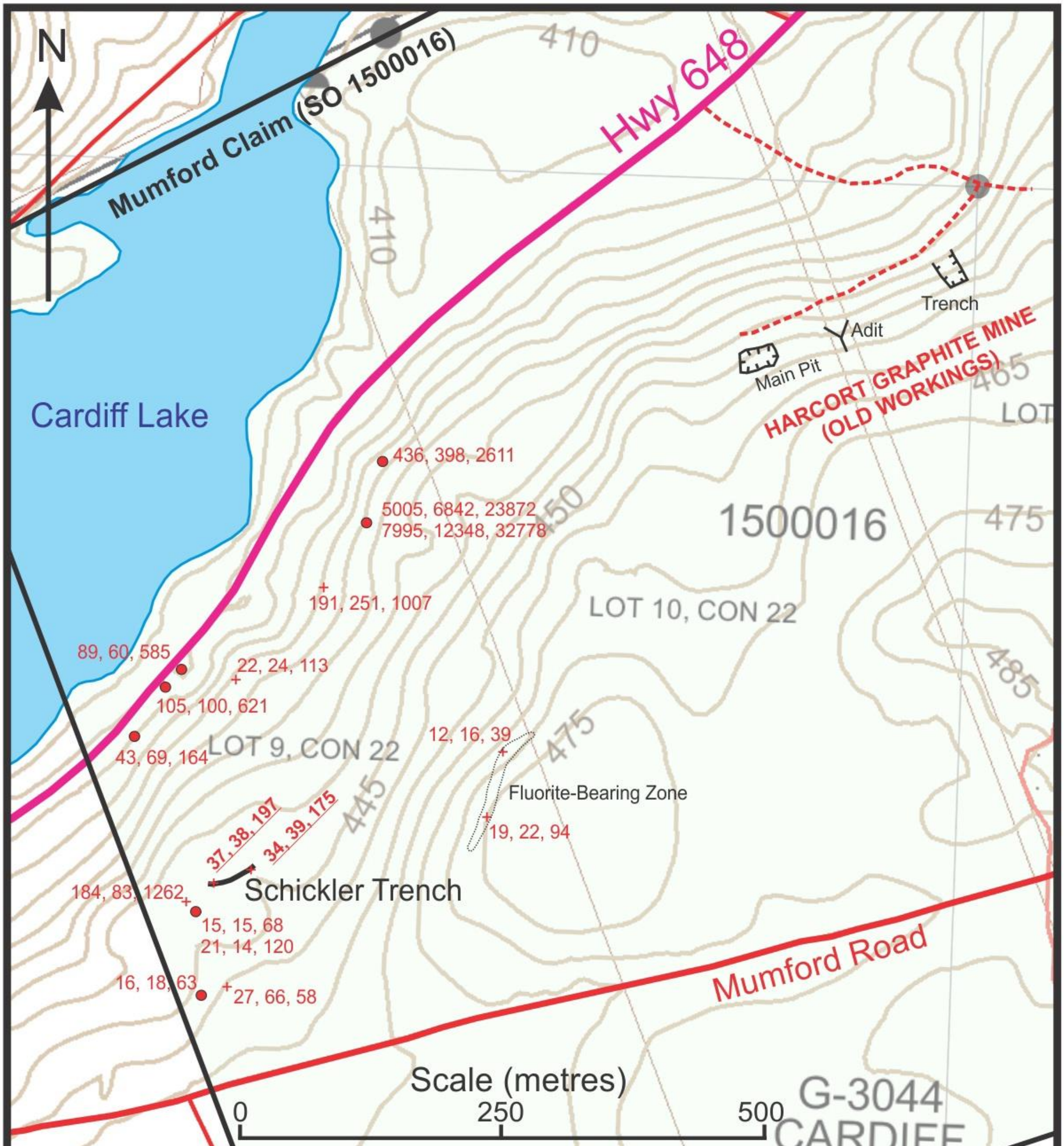


**Figure 8; Radioactive "Hot Spots" on part of the Mumford Claim (1500016), Cardiff Twp.**

+ Location of "Hot Spot"

● Location of "Hot Spot" associated with Granite Pegmatite

27, 66, 58 Total Counts per minute x 1000, Uranium (ppm), Thorium (ppm)

Paved road

Gravel road

4 wheel drive trail

On the eastern side of the survey area an outcrop containing abundant fluorite was identified (marked fluorite-bearing zone in Figure 8). Since fluorite is found in association with radioactive minerals at several former mines in the region (Richardson and Tripp Mines), it might be expected that high levels of radiation would be associated with the fluorite in this zone. At several places along this outcrop only slightly higher levels of background radiation and U, Th concentration were measured. These levels were only slightly elevated compared to measurements elsewhere on the claim.

At the northern part of the survey area, near Highway 648, two sites with high levels of radiation, U and Th were identified. Both appear to be point sources within granitic pegmatite and are likely due to either a single grain or a cluster of grains of a radioactive mineral. The highest of the measurements comes from a point source at the base of an outcrop in a coarse-grained portion of a granitic pegmatite. The assay was nearly 8 million counts per minute, 827% potassium, 1.23 % uranium and 3.28% thorium. Based on discussions with one of the technicians at Terraplus, the owners of the RS-230 spectrometer, it appears that when a sample has very a high concentration of thorium or uranium, the potassium assay is thrown out of calibration. This results in a potassium reading that is unreliable and may even appear "stupid". With a measurement of 827% potassium, this assay appears "stupid". As a confirmation that this reading is due to a point source, a small sample - the size of a coffee cup coaster - was hammered out of the outcrop and placed next to the spectrometer. The sample's assay was 610,000 counts per minute, 0% K, 1075 ppm U and 1535 ppm Th.

## Radiometric Survey - Conclusion

Systematic background spectrometer surveys appear to be of limited use in this part of the Mumford claim. It was hoped that the Schickler Occurrence could be detected with a background survey, but it failed to register in this study. Perhaps the assay spacing needs to be reduced below 50 metres to be affective.

Prospecting with the spectrometer and focusing on "hot spots" found both the Schickler trench and a new zone of mineralization at site 2. Other hot spots in pegmatite were found using the spectrometer which may prove useful at a later date. Hence, this instrument has value as a prospecting tool for mineralization of interest to mineral collectors.

## Summary and Recommendations

Ten new mineral occurrences of interest to mineral collectors were discovered during this survey. Three of these occurrences have the potential to be developed into mineral collecting sites in the future, following the success of development work (Sites 1, 2 and 3). Site 4 has the potential to be a casual mineral destination right now, since it is located tens of metres from the trail between the parking lot and the Schickler trench. Site 4 consists of fluorite exposed intermittently along a 120 metres long outcrop. The site could be developed by simply highlighting its existence in promotional literature and perhaps marking a short trail leading to the base of the outcrop.

Use of a hand held spectrometer to detect and measure ionizing radiation had limited success in discovering new mineral occurrences. Of the ten new mineral occurrences discovered during this survey, three were associated with higher than background levels of radiation (Sites 2, 3 and 4). Despite the indeterminate nature of the results of the systematic background survey, it could still be useful to extend this survey to the rest of the claim. The area the survey covered was relatively small and an extended survey may provide valuable information on background trends and may still reveal slightly higher than background Schickler style mineral occurrences.

The amount of follow up work on this claim is going to depend on budget and the degree of commitment to develop this claim for mineral collectors. Based on the success of this survey the author recommends the following;

**1/ Explore/trench/clean off Site 1.** Site 1 has potential to be developed as a collecting site for chondrodite and tremolite and should be investigated further to see how extensive this zone is. The area around the discovery site should be cleaned off and examined with the final intention being that this site could eventually be added to the mineral collecting inventory on this claim.

**2/ Explore/trench/clean off Site 3.** Site 3 is very intriguing to the author. Although no crystallized minerals were found here, the author believes there is significant potential at this site and only a small amount of work would likely be required to prove this. Site 3 has elevated background radiation (similar to Site 2) coincident with a tiny exposure of extremely coarse-grained calcite. The author recommends digging by hand to expose more of the outcrop and potentially uncover a significant crystal occurrence.

**3/ Explore the potential of Site 2.** Site 2 has the potential to be a significant mineral collecting site. As it sits right now the site is difficult to collect at due to the steepness of the cliff-like outcrop hosting the mineralization. It would be awkward, generally unsuitable and potentially dangerous for the average recreational mineral collector to visit this site. Only the most experienced and cautious collectors should be allow to collect here at the moment. With a limited budget, this site could be cleaned off by hand and investigated further to see if there is enough mineral potential to warrant further expenditures. If there was a budget for it, this site could potentially be developed for a wider collector audience by stripping off the overburden above the mineralized zone with a backhoe, thereby removing the danger of loose rocks on the steep outcrop and exposing a larger area of mineralization for collectors. The author recommends the outcrop be cleaned off by hand and thoroughly investigated prior to bringing in a backhoe.

**4/ Develop Site 4 as a mineral stop along the way to the Schickler trench.** Site 4 has the potential to be a casual mineral destination right now, since it is located only tens of metres away from the trail between the parking lot and the Schickler trench. Site 4 consists of fluorite exposed intermittently along a 120 metres long outcrop. The site could be developed by simply highlighting its existence in promotional literature and then marking a short trail leading to the base of the outcrop.

**5/ Continue exploring the remainder of the Mumford claim with geological mapping and prospecting.** Expand the present survey so it covers the rest of the claim. If budget allows consider the continued use of the RS-230 Spectrometer or similar instrument in conjunction with mapping and prospecting.

**6/ Investigate the potential of the Harcourt Graphite Mine as a destination for mineral collectors.**

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## Appendix I; Condensed Table of Data from RS-230 Spectrometer Gather from the Mumford claim

| Brad's GPS | Id | Total[cpm] | K[%] | U[ppm] | Th[ppm] | Latitude | Longitude | Altitude |
|---|---|---|---|---|---|---|---|---|
| | | | | | | | | |
| 1 | 19818 | 2,376 | 1.4 | 3 | 5.4 | 45.065895 | -78.175643 | 455 |
| 2 | 19844 | 1,614 | 1.1 | 2 | 3.1 | 45.066347 | -78.17559 | 462 |
| 3 | 19911 | 2,399 | 1.5 | 2.4 | 6 | 45.066755 | -78.175582 | 460 |
| 4 | 19939 | 2,656 | 1.5 | 3.4 | 6.2 | 45.06721 | -78.17548 | 455 |
| 5 | 19961 | 2,156 | 1.4 | 1.6 | 5.3 | 45.067633 | -78.175412 | 454 |
| 6 | 19986 | 1,821 | 1.2 | 1.8 | 4.1 | 45.068075 | -78.175465 | 437 |
| 7 | 20295 | 3,207 | 2.1 | 2.8 | 7.2 | 45.068522 | -78.17547 | 436 |
| 8 | 20308 | 2,479 | 1.6 | 2.1 | 5.6 | 45.068905 | -78.175375 | 424 |
| 9 | 20345 | 2,163 | 1.6 | 2.4 | 4 | 45.069403 | -78.175463 | 421 |
| 10 | 20397 | 2,445 | 1.9 | 1.8 | 5.3 | 45.069823 | -78.175385 | 416 |
| 11 | 20420 | 1,931 | 1.3 | 1.8 | 4.8 | 45.070295 | -78.175247 | 422 |
| 14 | 19795 | 4,849 | 1.9 | 6.3 | 16.3 | 45.065907 | -78.176237 | 462 |
| 15 | 19769 | 2,342 | 1.3 | 2.6 | 4.5 | 45.066358 | -78.17626 | 456 |
| 16 | 19698 | 3,153 | 1.6 | 3.7 | 8.7 | 45.066715 | -78.176192 | 459 |
| 17 | 19665 | 2,447 | 1.3 | 2.2 | 7.8 | 45.067267 | -78.17619 | 459 |
| 18 | 20567 | 2,345 | 1.3 | 2.7 | 6.9 | 45.06762 | -78.17607 | 455 |
| 19 | 20534 | 2,630 | 2.1 | 1.5 | 5.8 | 45.068132 | -78.176245 | 438 |
| 20 | 20510 | 1,960 | 1.4 | 1.6 | 3.5 | 45.068575 | -78.176185 | 436 |
| 21 | 20489 | 2,378 | 1.5 | 2.8 | 4.5 | 45.06902 | -78.17606 | 436 |
| 22 | 20453 | 2,557 | 1.5 | 2.7 | 6.7 | 45.069475 | -78.176085 | 411 |
| 24 | 19523 | 4,329 | 1.5 | 5.1 | 15.1 | 45.067223 | -78.17667 | 451 |
| 25 | 19490 | 1,683 | 1.3 | 2 | 2.5 | 45.067687 | -78.176662 | 441 |
| 26 | 19460 | 2,737 | 1.7 | 3.1 | 6 | 45.06819 | -78.176795 | 446 |
| 27 | 19434 | 1,683 | 1.2 | 1.9 | 3.6 | 45.068627 | -78.17674 | 423 |
| 28 | 19344 | 2,706 | 1.4 | 3.3 | 7.8 | 45.069022 | -78.17676 | 402 |
| 29 | 20639 | 1,719 | 1.2 | 1.3 | 4.4 | 45.066285 | -78.174797 | 467 |
| 30 | 20692 | 1,862 | 1.3 | 1.4 | 3.9 | 45.066793 | -78.174932 | 466 |
| 31 | 20716 | 1,886 | 1.4 | 1.5 | 4.5 | 45.067255 | -78.174828 | 457 |
| 32 | 20741 | 3,708 | 2.4 | 3.5 | 8.5 | 45.067648 | -78.174882 | 450 |
| 33 | 20771 | 2,083 | 1.2 | 2.5 | 5.3 | 45.068072 | -78.174863 | 457 |
| 34 | 20819 | 2,943 | 2.3 | 2.9 | 5.6 | 45.068558 | -78.17487 | 447 |
| 35 | 20911 | 2,122 | 1.3 | 1.8 | 6.8 | 45.06898 | -78.174812 | 446 |
| 36 | 20937 | 1,648 | 1.1 | 1.6 | 3.8 | 45.069448 | -78.174837 | 430 |
| 37 | 21003 | 5,641 | 2.1 | 7.1 | 21.6 | 45.069943 | -78.174863 | 420 |
| 38 | 21252 | 2,838 | 1.7 | 2 | 8.8 | 45.070357 | -78.17476 | 419 |
| 39 | 21292 | 1,799 | 1.4 | 2 | 3 | 45.070782 | -78.174688 | 410 |
| 40 | 21317 | 1,874 | 1.5 | 1.4 | 4.2 | 45.0712 | -78.174428 | 410 |
| 42 | 22571 | 1,568 | 0.6 | 2.5 | 3.4 | 45.066237 | -78.17448 | 468 |
| 43 | 22522 | 1,974 | 1.1 | 1.9 | 5.1 | 45.06677 | -78.174325 | 468 |
| 44 | 22466 | 1,727 | 1.1 | 1.3 | 3.4 | 45.067133 | -78.174223 | 469 |
| 45 | 22388 | 1,850 | 1.3 | 1.2 | 4.5 | 45.06767 | -78.174292 | 456 |
| 46 | 22359 | 1,598 | 1.1 | 1.4 | 3.5 | 45.068075 | -78.174245 | 453 |
| 47 | 22319 | 2,267 | 1.3 | 1.8 | 5.6 | 45.068543 | -78.174213 | 447 |
| 48 | 22277 | 5,998 | 3.1 | 7.7 | 15.8 | 45.068897 | -78.174158 | 439 |

| Brad's GPS | Id | Total[cpm] | K[%] | U[ppm] | Th[ppm] | Latitude | Longitude | Altitude |
|---|---|---|---|---|---|---|---|---|
| | | | | | | | | |
| 49 | 22136 | 2,694 | 1.7 | 2.6 | 6.1 | 45.06947 | -78.17414 | 449 |
| 50 | 22099 | 1,968 | 1.3 | 2 | 3 | 45.069932 | -78.174143 | 447 |
| 51 | 22021 | 2,687 | 1.4 | 3.9 | 6 | 45.070332 | -78.174095 | 444 |
| 52 | 21548 | 1,599 | 0.9 | 1.6 | 2.1 | 45.070765 | -78.174128 | 438 |
| 53 | 21356 | 4,588 | 1.8 | 5.9 | 14.6 | 45.071147 | -78.174003 | 421 |
| 56 | 22639 | 1,807 | 1.3 | 2.1 | 2.7 | 45.066242 | -78.173652 | 462 |
| 57 | 22668 | 1,654 | 1.2 | 1.3 | 3.2 | 45.066662 | -78.173623 | 490 |
| 58 | 22708 | 2,060 | 1.2 | 2.5 | 3.5 | 45.067122 | -78.173583 | 474 |
| 59 | 23059 | 1,857 | 1.3 | 2.1 | 3.3 | 0 | 0 | 0 |
| 60 | 23190 | 1,974 | 1.3 | 2.4 | 5.5 | 0 | 0 | 0 |
| 61 | 23232 | 2,114 | 1.4 | 2.1 | 5.9 | 0 | 0 | 0 |
| 62 | 23261 | 2,121 | 1.1 | 2.1 | 6.1 | 0 | 0 | 0 |
| 63 | 23316 | 2,217 | 1.2 | 2.6 | 5.3 | 0 | 0 | 0 |
| 64 | 23397 | 3,778 | 2.6 | 3.6 | 9.6 | 0 | 0 | 0 |
| 65 | 23456 | 2,016 | 1.3 | 1.8 | 3.8 | 0 | 0 | 0 |
| 66 | 23540 | 2,443 | 1.2 | 3 | 4.7 | 45.070648 | -78.173307 | 469 |
| 67 | 23596 | 2,046 | 1.3 | 2.2 | 4.1 | 45.071083 | -78.173328 | 507 |
| 68 | 23644 | 1,885 | 1.4 | 1.9 | 3 | 0 | 0 | 0 |
| 69 | 23702 | 2,020 | 1.6 | 1.8 | 4.2 | 45.072088 | -78.173545 | 423 |
| 71 | 24551 | 3,974 | 2 | 5.3 | 7.9 | 45.06685 | -78.172938 | 471 |
| 72 | 24530 | 3,751 | 1.4 | 6.5 | 7.1 | 45.067212 | -78.172947 | 472 |
| 73 | 24496 | 1,957 | 1.3 | 1.9 | 4 | 45.0676 | -78.172962 | 476 |
| 74 | 24455 | 3,106 | 2 | 3.4 | 6.9 | 45.067983 | -78.172913 | 483 |
| 75 | 24188 | 2,654 | 1.2 | 3.9 | 7.2 | 45.06856 | -78.172912 | 464 |
| 76 | 24127 | 1,867 | 1.4 | 1.2 | 4 | 45.068962 | -78.172968 | 464 |
| 77 | 24152 | 1,806 | 1.2 | 2.2 | 3.4 | 45.069358 | -78.17291 | 461 |
| 78 | 24084 | 1,627 | 0.9 | 1.4 | 3.9 | 45.06989 | -78.17278 | 456 |
| 79 | 24035 | 6,275 | 2.2 | 7.5 | 22.2 | 45.070283 | -78.172833 | 447 |
| 80 | 23998 | 1,770 | 1.2 | 1.7 | 3 | 45.070778 | -78.172837 | 443 |
| 81 | 23898 | 1,637 | 1.1 | 1.7 | 2.8 | 0 | 0 | 0 |
| 82 | 23872 | 1,780 | 1.2 | 1.8 | 3 | 0 | 0 | 0 |
| 83 | 23845 | 2,018 | 1.6 | 1.8 | 4.9 | 0 | 0 | 0 |
| 84 | 23760 | 2,398 | 1.7 | 1.9 | 6.2 | 0 | 0 | 0 |
| 87 | 25046 | 1,957 | 1.6 | 1.2 | 4 | 45.072885 | -78.172085 | 419 |
| 88 | 25025 | 1,612 | 1.2 | 1.3 | 3.7 | 45.072457 | -78.172082 | 422 |
| 89 | 24986 | 1,927 | 1.3 | 1.9 | 3.3 | 45.072032 | -78.172135 | 441 |
| 90 | 24962 | 1,931 | 1.4 | 2.2 | 3.4 | 45.071665 | -78.172235 | 446 |
| 91 | 24933 | 2,085 | 1.6 | 1.8 | 4.6 | 45.07114 | -78.17224 | 463 |
| 92 | 24899 | 2,169 | 1.5 | 1.8 | 3.8 | 45.070618 | -78.172122 | 463 |
| 93 | 24872 | 1,728 | 1.1 | 1.8 | 3.3 | 45.070258 | -78.17219 | 469 |
| 94 | 24830 | 1,299 | 0.9 | 1.3 | 2.4 | 45.069748 | -78.172223 | 473 |
| 95 | 24807 | 1,630 | 1.1 | 1.1 | 3.4 | 45.069377 | -78.172208 | 471 |
| 96 | 24782 | 1,840 | 1.3 | 1.6 | 3.5 | 45.068895 | -78.172217 | 472 |
| 97 | 24749 | 1,937 | 1.2 | 1.6 | 5.1 | 45.068465 | -78.172282 | 482 |

| Brad's GPS | Id | Total[cpm] | K[%] | U[ppm] | Th[ppm] | Latitude | Longitude | Altitude |
|---|---|---|---|---|---|---|---|---|
| | | | | | | | | |
| 98 | 24702 | 1,679 | 1.3 | 1.3 | 3.2 | 45.06796 | -78.172323 | 486 |
| 98 | 24716 | 1,760 | 1.4 | 1.6 | 2.6 | 45.067863 | -78.172357 | 471 |
| 99 | 24660 | 5,030 | 2.4 | 7 | 13.6 | 45.06761 | -78.172253 | 485 |
| 100 | 24613 | 2,538 | 1.5 | 2.9 | 5.4 | 45.067097 | -78.172382 | 484 |
| 101 | 24587 | 1,890 | 1.2 | 2 | 3 | 45.066748 | -78.17242 | 472 |
| 102 | 25739 | 2,259 | 1.1 | 2.8 | 5.2 | 45.066673 | -78.171732 | 475 |
| 103 | 25715 | 1,917 | 1.3 | 1.7 | 4.1 | 45.067082 | -78.17178 | 485 |
| 104 | 25688 | 2,042 | 1.2 | 2.3 | 4.2 | 45.067622 | -78.171692 | 483 |
| 105 | 25628 | 3,588 | 1.9 | 4.6 | 10.2 | 45.067985 | -78.171633 | 484 |
| 106 | 25601 | 1,542 | 1.1 | 1.8 | 3.1 | 45.068438 | -78.17174 | 475 |
| 107 | 25578 | 1,472 | 1.1 | 1.1 | 3.1 | 45.068845 | -78.171657 | 472 |
| 108 | 25537 | 2,017 | 1.5 | 1.8 | 3.5 | 45.069397 | -78.171598 | 468 |
| 109 | 25500 | 1,696 | 1.3 | 1.3 | 3.7 | 45.069793 | -78.171605 | 466 |
| 110 | 25477 | 1,332 | 0.6 | 1.6 | 2.3 | 45.070118 | -78.171485 | 466 |
| 111 | 25438 | 4,950 | 2.5 | 5.4 | 12.6 | 45.070738 | -78.171542 | 467 |
| 112 | 25424 | 1,774 | 1.2 | 1.3 | 4 | 45.071153 | -78.171483 | 471 |
| 113 | 25381 | 1,889 | 1.2 | 1.3 | 4.3 | 0 | 0 | 0 |
| 115 | 25346 | 2,007 | 1.5 | 1.9 | 3.3 | 0 | 0 | 0 |
| 116 | 25099 | 1,986 | 1.6 | 1.3 | 3.9 | 45.072495 | -78.171355 | 430 |
| 117 | 25072 | 2,089 | 1.3 | 2.1 | 4.4 | 45.072853 | -78.171498 | 434 |
| 119 | 25774 | 4,966 | 1.1 | 8.3 | 16.5 | 45.067107 | -78.171102 | 485 |
| 120 | 25821 | 3,387 | 1.6 | 2.5 | 13.5 | 45.067548 | -78.171092 | 489 |
| 121 | 25846 | 1,609 | 1.1 | 1.5 | 2.4 | 45.068007 | -78.171003 | 485 |
| 122 | 25868 | 1,759 | 1.2 | 1.3 | 4 | 45.068423 | -78.171057 | 488 |
| 123 | 25896 | 1,753 | 1.1 | 0.9 | 5 | 45.068892 | -78.170945 | 483 |
| 124 | 25920 | 1,711 | 1.2 | 1.9 | 2.8 | 45.069368 | -78.170927 | 478 |
| 125 | 25940 | 1,554 | 1.1 | 1.9 | 2 | 45.069747 | -78.170942 | 478 |
| 126 | 25954 | 1,402 | 0.8 | 1.6 | 2.2 | 45.070215 | -78.170952 | 473 |
| 127 | 25970 | 1,857 | 1.2 | 2.1 | 2.8 | 45.070717 | -78.170922 | 475 |
| 128 | 25991 | 1,841 | 1.3 | 2 | 3.3 | 45.071133 | -78.17089 | 467 |
| 129 | 26024 | 1,991 | 1.4 | 1.6 | 4.1 | 45.071617 | -78.170933 | 482 |
| 130 | 26064 | 2,185 | 1.4 | 1.7 | 4.5 | 45.07204 | -78.170867 | 439 |
| 131 | 26122 | 2,028 | 1.5 | 2.1 | 3.6 | 45.072563 | -78.170895 | 438 |
| 132 | 26148 | 1,677 | 1.3 | 1.7 | 3.2 | 45.072927 | -78.170805 | 418 |
| Camp | 19193 | 3,133 | 2.1 | 4.1 | 6.7 | 45.073067 | -78.168387 | 446 |
| 690 | 17810 | 2,084 | 1.4 | 1.7 | 5.3 | 45.065912 | -78.175615 | 480 |
| 691 | 17840 | 16,094 | 2.8 | 17.5 | 75.9 | 45.066525 | -78.176247 | 472 |
| 693 | 17988 | 27,439 | 2.8 | 66.1 | 58.7 | 45.066617 | -78.175943 | 456 |
| 694 | 18016 | 2,792 | 1.2 | 3 | 8.2 | 45.067023 | -78.176023 | 446 |
| 695 | 18043 | 14,754 | 3.8 | 14.6 | 68 | 45.067213 | -78.1763 | 461 |
| 695 | 18069 | 21,445 | 4.1 | 13.7 | 119.8 | 45.067143 | -78.176278 | 450 |
| 696 | 18092 | 183,697 | 10 | 83.4 | 1261.9 | 0 | 0 | 0 |
| 698 | 18200 | 37,005 | 3.7 | 38.1 | 197 | 45.067345 | -78.176152 | 433 |
| 700 | 18276 | 34,391 | 3 | 39.1 | 175.2 | 45.067625 | -78.175767 | 458 |

| Brad's GPS | Id | Total[cpm] | K[%] | U[ppm] | Th[ppm] | Latitude | Longitude | Altitude |
|---|---|---|---|---|---|---|---|---|
| | | | | | | | | |
| 701 | 18311 | 5,819 | 4.1 | 3.8 | 17.1 | 45.067323 | -78.176043 | 444 |
| 702 | 18512 | 1,685 | 1.1 | 1.4 | 5 | 45.068393 | -78.176315 | 439 |
| 703 | 18580 | 42,815 | 7.2 | 68.7 | 164.2 | 45.068772 | -78.177283 | 423 |
| 707 | 18719 | 105,486 | 7.3 | 100 | 621.4 | 45.069508 | -78.176838 | 463 |
| | 18836 | 99,572 | 4.3 | 65.5 | 655.6 | 45.069345 | -78.176637 | 430 |
| 708 | 18856 | 88,681 | 3.8 | 60 | 584.6 | 45.069173 | -78.176483 | 435 |
| 713 | 19017 | 21,895 | 3.3 | 23.5 | 112.5 | 45.069162 | -78.175853 | 426 |
| | | | | | | | | |
| | 19766 | 2,371 | 1.4 | 2.6 | 5.7 | 45.066325 | -78.176247 | 456 |
| 730 | 21082 | 191,387 | 5.1 | 251.5 | 1006.6 | 0 | 0 | 0 |
| 734 | 21462 | 436,371 | 18.5 | 398.1 | 2610.8 | 45.071008 | -78.173995 | 416 |
| 740 | 21638 | 5,004,842 | 381 | 6842.1 | 23872.6 | 45.070502 | -78.174328 | 433 |
| | | | | | | | | |
| 156 | 21983 | 2,537 | 1.1 | 3.7 | 6.3 | 45.070128 | -78.174342 | 439 |
| ?? | 23343 | 10,332 | 2.9 | 14.4 | 35.9 | 0 | 0 | 0 |
| 740 | 23971 | 7,995,475 | 827 | 12348.9 | 32778.1 | 0 | 0 | 0 |
| 740 | 23972 | 610,826 | 0 | 1074.8 | 1535.3 | 0 | 0 | 0 |
| | | | | | | | | |
| 196 | 24293 | 11,983 | 4.1 | 15.7 | 39.4 | 0 | 0 | 0 |
| 197 | 24389 | 19,178 | 3.2 | 21.9 | 94.4 | 0 | 0 | 0 |

# Appendix 2;

## Statement of Qualifications of the Author

I, Bradley S. Wilson of P.O. Box 352, Kingston, Ontario, K7L 4W2, do hereby state that I:

1/ graduated from Queen's University in 1982 with an Honours B.Sc. degree in Geology.
2/ graduated from Carleton University in 1987 with a M.Sc. degree in Geology.
3/ received a degree in gemmology in 1991 from the Canadian Gemmological Association (F.C.Gm.A).
4/ worked as an independent consultant on over 20 coloured gemstone projects since 1991.
5/ worked for mineral exploration companies during parts of 23 of the last 35 years either as a consultant or as a seasonal employee.
6/ conducted gemstone exploration on my own behalf nearly continuously since 1982.
7/ have no interest, direct or indirect, in the Mumford claim (SO 1500016).
8/ performed the work described in this report.

Bradley S. Wilson

May 30, 2014