Ontario

We are committed to providing accessible customer service.
If you need accessible formats or communications supports, please contact us.

Nous tenons à améliorer l’accessibilité des services à la clientèle.
Si vous avez besoin de formats accessibles ou d’aide à la communication, veuillez nous contacter.

Lindsay Hall

Geological Services

Report on the 2022 fieldwork on the Quirke Lake West, Quirke Lake North and Quirke Lake Panel properties in the Elliot Lake Mining Camp held by Radio Fuels Energy Corp.

Lindsay Hall, M.Sc. P.Geo.

December 29, 2022. (modified)

Summary

A five-day (2 days travel, 3 days field work), preliminary reconnaissance field program was undertaken on 16 mining claims in the Elliot Lake Mining Camp (Figure 1, Table 1) on behalf of Radio Fuels Energy Corp. The mining claims are in Bouck and Buckles townships. The work was performed by Lindsay Hall (PGO Member 0891) and Brenda Hodgins. The purposes of this preliminary reconnaissance were to establish an understanding of:

1. Inherited liabilities.
2. The ease of access and associated logistical considerations to undertake a more fulsome field program.
3. Collect surface geological observations (data) as a means of adding to and ground-truthing publicly available data on the properties.

Property

The Quirke Lake West Property consists of 13 contiguous claims (532903 through 532915) between Denison and Quirke lakes that include parts of the historic Denison and Spanish American mines (Figure 1, Table 1). The anniversary date for these claims is Oct. 15, 2022.

The Quirke Lake North Property consists of two contiguous claims (537565 & 537566) on the north shore of Quirke Lake (Figure 1, Table 1). The anniversary date for these claims is Dec. 20, 2022.

The Quirke Lake Panel Property consists of one claim (537565) west of the infrastructure associated with the historic Panel Mine (Figure 1, Table 1). Anniversary date for these claims is Dec. 20, 2022.

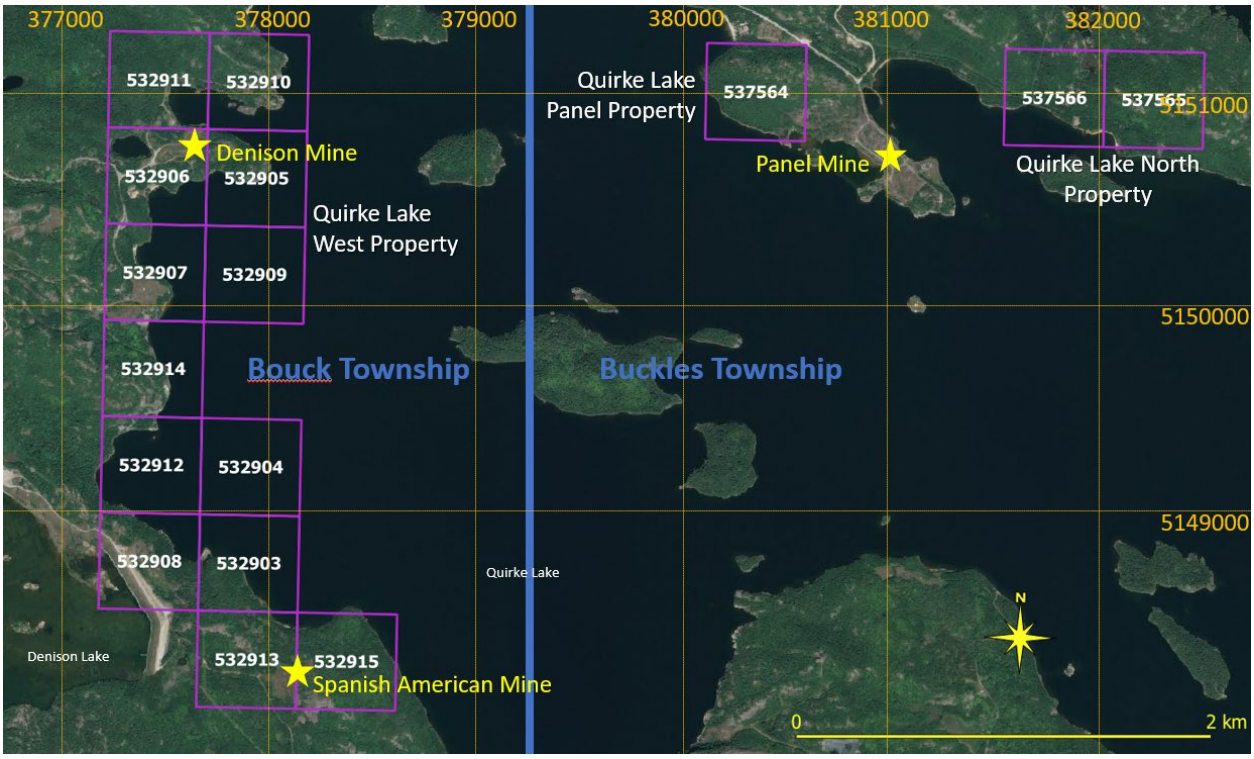


Figure 1: Location of Radio Fuels Resources Corp. Quirke Lake West, Quirke Lake North and Quirke Lake Panel properties evaluated. Historic mines represented with yellow stars.

Table 1: Summary table of Radio Fuels Energy Corp. mining claims in Bouck and Buckle townships.

Claim Number	Cell Number	Township	Ownership	Anniversary Date
532903	N1J07I086	Bouck	Radio Fuels Energy Corp.	October 15, 2022
532904	N1J07I066	Bouck	Radio Fuels Energy Corp.	October 15, 2022
532905	N1J07I006	Bouck	Radio Fuels Energy Corp.	October 15, 2022
532906	N1J07I005	Bouck	Radio Fuels Energy Corp.	October 15, 2022
532907	N1J07I025	Bouck	Radio Fuels Energy Corp.	October 15, 2022
532908	N1J07I085	Bouck	Radio Fuels Energy Corp.	October 15, 2022
532909	N1J07I026	Bouck	Radio Fuels Energy Corp.	October 15, 2022
532910	N1J10A386	Bouck	Radio Fuels Energy Corp.	October 15, 2022
532911	N1J10A385	Bouck	Radio Fuels Energy Corp.	October 15, 2022
532912	N1J07I065	Bouck	Radio Fuels Energy Corp.	October 15, 2022
532913	N1J07I106	Bouck	Radio Fuels Energy Corp.	October 15, 2022
532914	N1J07I045	Bouck	Radio Fuels Energy Corp.	October 15, 2022
532915	N1J07I107	Bouck	Radio Fuels Energy Corp.	October 15, 2022
537565	N1J10A395	Buckles	Radio Fuels Energy Corp.	December 20, 2022
537566	N1J10A394	Buckles	Radio Fuels Energy Corp.	December 20, 2022
537564	N1J10A391	Buckles	Radio Fuels Energy Corp.	December 20, 2022

Significant rehabilitation work was undertaken at both the Denison and Spanish American mines. An illustration of this can be seen in the comparison of the same area in 1997 and 2007 in the photos below.

Access

All the claims that were worked on in this study lie less than 15km north of the City of Elliot Lake, Ontario. The crew traveled to the area by road on the Trans Canada Highway (Hwy 17) turning north on Highway 108 through Elliot Lake and continuing north approximately 12 to 15 km depending upon the claim. Accommodations were provided by Dunlop Lake Lodge approximately 3 km east of the main property area (Figure 2).

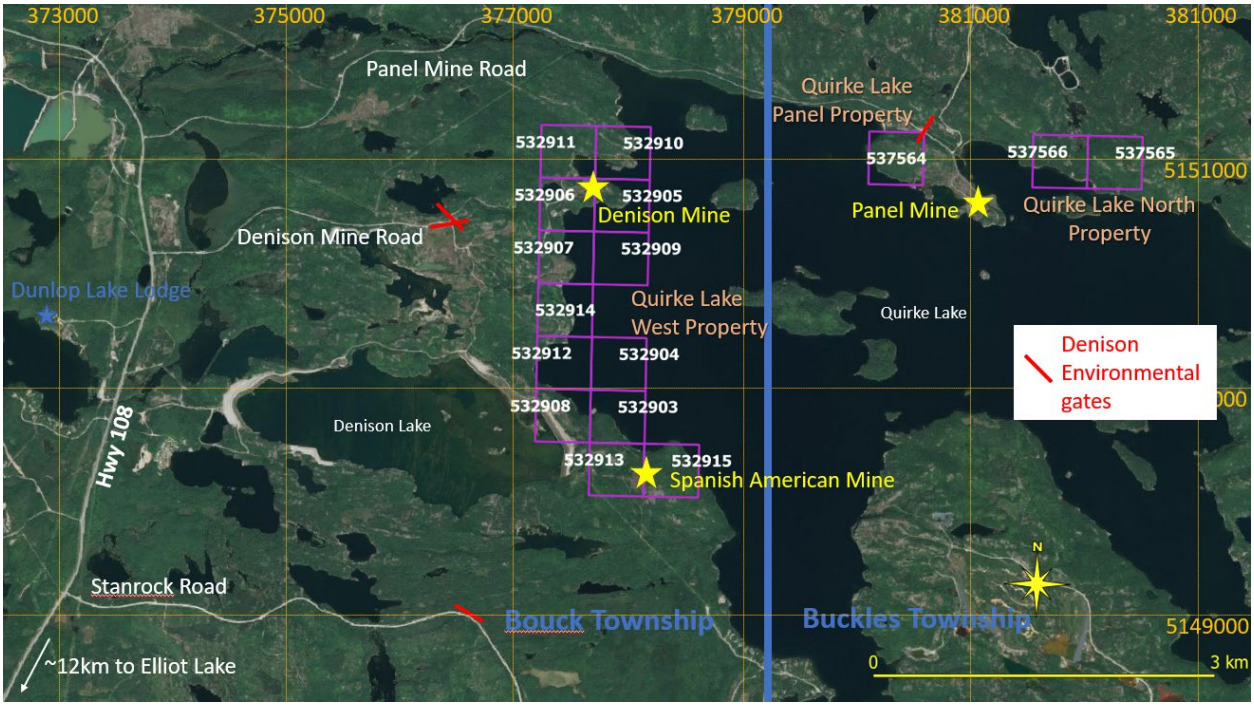


Figure 2: Access to the properties.

The Quirke Lake West Property in Bouck Township (Table 1 – numbers 532903 through 532915, Figure 1) were accessed by two routes, both from Highway 108 (Figure 2). The southern extents of the property were accessed via the Stanrock Road. Approximately 3.6 km from Highway 108 is a gated side road heading northeast (Figure 2). The team parked by the gate and walked the good quality dirt road approximately 2.2 km to the southern claim boundary. The northern part of the property was accessed by the Denison Mine Road. This road can be driven approximately 3 km where it divides and is gated in both directions. The team parked at the northern gate (Figure 2) and followed the paved road approximately 1 km on foot to the eastern side of the claims.

To access the Quirke Lake Panel Property, turn east on the Panel Mine Road from Highway 108. Drive approximately 7.5 km till the road is gated and park in the large area to the north of the road (Figure 2). Proceed on foot across the road and to the west on foot. Follow ATV trails that skirt the east side of the private trailer/cabin park. Continue along the footpath to the shore of Quirke Lake and a narrow footpath that leads up to east parallel to the shore. The path comes close to the large area of exposures on the top of the local hill. Leave the path and make your way up to the outcrops.

To access the Quirke Lake North Property, park at the gate on Panel Mine Road (Figure 2). Bypass the gate on foot and continue along the road to approximately 300 m to where it branches, follow the trail

north. After a further 100 – 110 m follow a smaller path east close to the shore of Quirke Lake. The western edge of claim 537566 is approximately 700 m from this fork.

Regional Setting – the Elliot Lake Mining Camp

Over 300 million pounds of uranium oxide were mined from conglomerate beds near Elliot Lake, Ontario between 1956 and 1996. Rare earth elements were also commercially extracted as a by-product of the uranium. With the increased demand for 'green' rare earth elements and uranium as a fuel source, the Elliot Lake Mining Camp has become an attractive exploration area.

The geology of the Elliot Lake area as summarized by S. Wilson, 2007:

"*The Elliot Lake area lies within the Southern Province of the Canadian Shield. The Southern Province consists of a thick sequence of clastic sediments with minor sequences of marine limestone and extrusive volcanic rocks. The clastic sequence is intruded by mafic and felsic intrusion. The clastic sequence is referred to as the Huronian Supergroup and these sediments were deposited in the early Proterozoic (2450 Ma to 2115 Ma) on Archean-aged metavolcanic and metasedimentary rocks and granite intrusive rocks of the Superior Province. The majority of the uranium occurrences are hosted in the lower portion of the Matinenda Formation which contain the basal sedimentary units of the Huronian. The Huronian sediments were intruded by sills and dykes of the Nipissing diabase that are dated at 2115 Ma.*

In the Elliot Lake area, the Huronian rocks are folded to form a shallow westward plunging, gently folded syncline designated as the Quirke syncline. The limbs of the Quirke syncline generally dip from 10^{o} to 40^{o} towards its axis.

Although the coarser grained quartzite beds in the lower Matinenda Formation commonly contain low-grade uranium mineralization, the higher grade and more consistent zones of uranium mineralization, are hosted within the beds of quartz-pebble conglomerate with disseminated pyrite in the matrix. The uranium-bearing conglomerate beds are found within thicker sections of the Matinenda Formation that overlie depressions in the underlying basement. These depressions are termed channels and the Denison Mine property is located within the Quirke channel on the north flank of the Quirke syncline.

At the Denison Mine, the uranium mineralization is contained within two zones, the Main Zone and the Upper Zone, and each zone contains multiple beds of uraniferous, pyritic, quartz pebble conglomerate, which are commonly called reefs. The Main Zone and the Upper Zone are separated by 120 ft. of quartzite. The reefs strike 105^{o} to 120^{o} and the dip ranges from flat-lying to -60^{o} south. Most of the reefs containing the remaining resources dip at -10^{o} to -20^{o} south.

Each zone consists of interbanded conglomerate reefs and quartzite. Some reefs can be followed for considerable distances, while others pinch and swell and are cut off by cross bedding over relatively short distances. The better grade reefs have a minimal number of thinner quartzite bands, well packed thicker conglomerate beds and coarse pyrite.

The Elliot Lake deposits are interpreted to be modified paleoplacer deposits and the source rocks are believed to be pegmatitic granite located to the north. The uranium was released from the granites as a result of weathering and transported as uraninite to the site of deposition in channel systems in sedimentary basins formed in the Early Proterozoic. Subsequent diagenesis resulted in the formation of the conglomerate beds intercalated within coarse sandstone with scattered pebbles and siltstone. Pyrite and other heavy minerals were also with the quartz pebbles. In general, the uranium grade increases

with increasing pyrite content and pebble size. At the Denison Mine, the highest-grade uranium mineralization occurred to the lee of basement highs where the flow was more abruptly reduced.

Post-depositional modification of the uranium involved leaching of iron, uranium, thorium, and silica from the detrital grains. The uranium and silica were deposited as coffinite; quartz and detrital monazite were altered to urano-thorite; and uranium reacted with TiO^2 to form brannerite. This post-depositional modification may have been caused by low Eh near-neutral ground water. The uranium in the Denison Mine occurs primarily in the minerals brannerite and uraninite." SEDAR

A simplified geological map with the claim outlines is shown in Figure 3.

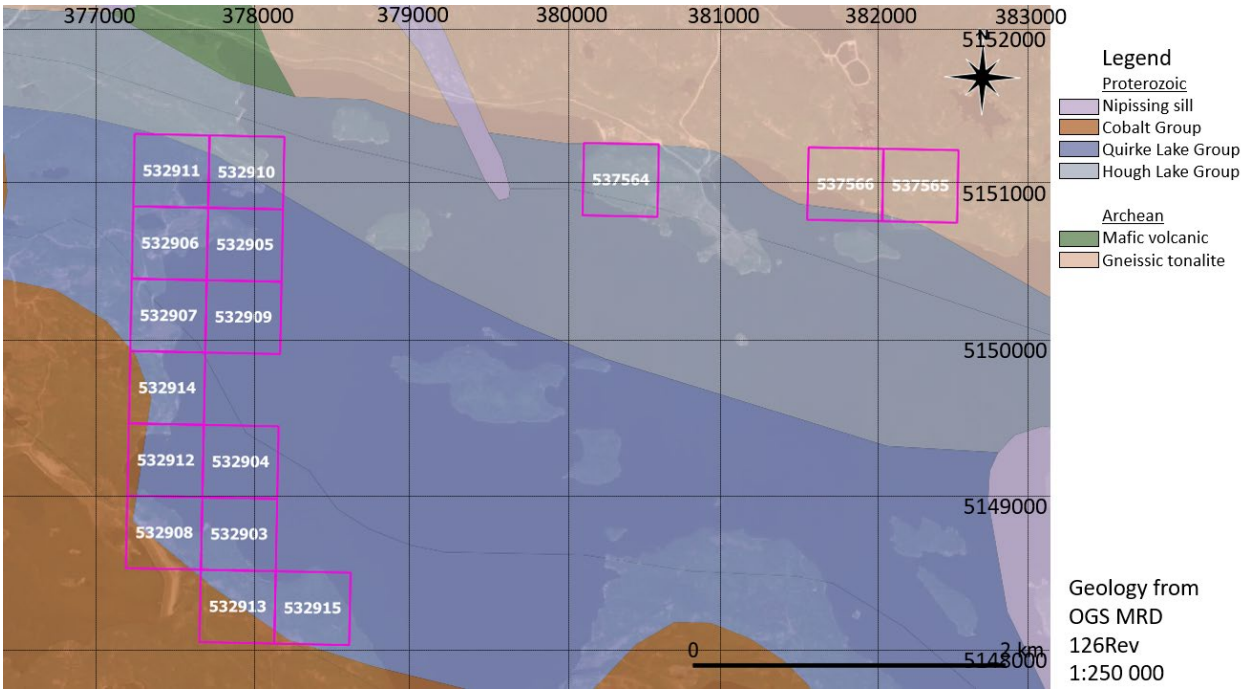


Figure 3: Simplified geology from OGS MRD-126Rev; 1:250 000 scale. Radio Fuels claims outlined in magenta. NAD 83 Zone 17

Compilation

A review of data available on OGSEarth/Geology Ontario was undertaken prior to fieldwork. AMIS (Abandoned Mines Information System), MDI (Mineral Deposit Inventory) now referred to as PMI (Ontario Mineral Inventory), OAFD (Ontario Assessment File Database), ODHD (Ontario Drill Hole Database), and the MRD126-Revised (1:250 00 scale geological bedrock map of Ontario) were compiled.

The Radio Fuels properties at Quirke Lake had three active mines that operated for extensive periods. On the Quirke Lake West Property, the Denison Mine (MDI41J07NE00018) was in production from 1956 to 1992 and Spanish American Mine (MDI41J07NE00035) operated from 1954-1959. On the Quirke Lake Panel property, the Panel Mine (MDI41J07NE00002) operated from 1958 to 1961 then reactivated from 1977 to 1979 as part of Rio Algom's Phase 2 expansion. The work performed on these properties after mining leases were awarded did not require publicly available assessment reporting. As such much of the work done and data available on these properties is not publicly available without an Access to Information (ATI) request.

From ODHD, 28 drillholes were identified that fell within the Quirke Lake West property. These 28 drillholes were described and geolocated in three Assessment Files. A summary of the available data and the Assessment File numbers associated with each of these drill-holes is provided in Table 2. Note that 10 of the drillholes are referred to in two different Assessment Files and interestingly were reported as having been done for two different companies. No drillholes are reported in either the OADF or the ODHD on either the Quirke Lake North or Quirke Lake Panel properties.

Assessment Files pertaining to the three properties visited were reviewed and the salient information was compiled in Table 3. The most significant aspects of these assessment files are summarized below.

Table 2: Drillhole summary for data publicly available. All drillholes are on the Quirke Lake West Property.

Drillhole name	Assessment File	Work year	Company	DDH log available	Results Reported
Q1	41J10SE0049	1953	Preston East Dome & Algom Uranium	Yes	log, section, no analytical
Q5	41J10SE0049	1953	Preston East Dome & Algom Uranium	Yes	log, section, no analytical
Q11	41J10SE0049	1953	Preston East Dome & Algom Uranium	Yes	log, section, no analytical
Q12	41J10SE0049	1953	Preston East Dome & Algom Uranium	Yes	log, section, no analytical
Q7	41J10SE0049	1953	Preston East Dome & Algom Uranium	Yes	log, section, no analytical
Q3	41J10SE0049	1953	Preston East Dome & Algom Uranium	Yes	log, section, no analytical
Q3W	41J10SE0049	1953	Preston East Dome & Algom Uranium	Yes	log, section, no analytical
Q6	41J10SE0049	1953	Preston East Dome & Algom Uranium	Yes	log, section, no analytical
Q4	41J10SE0049	1953	Preston East Dome & Algom Uranium	Yes	log, section, no analytical
Q10	41J10SE0049	1953	Preston East Dome & Algom Uranium	Yes	log, section, no analytical
Q501	41J10SE0049	1955	Preston East Dome & Algom Uranium	Yes	log, section, no analytical
Q503	41J10SE0049	1955	Preston East Dome & Algom Uranium	Yes	log, section, no analytical
Q504	41J10SE0049	1955	Preston East Dome & Algom Uranium	Yes	log, section, no analytical
Q505	41J10SE0049	1955	Preston East Dome & Algom Uranium	Yes	log, section, no analytical
Q86	41J10SE0049	1955	Preston East Dome & Algom Uranium	Yes	log, section, no analytical
Q502	41J10SE0049	1955	Preston East Dome & Algom Uranium	Yes	log, section, no analytical
27	41J07NE0045	1954&1955	Cons Denison Mines	Yes	select intervals U(%), U(lb)
26	41J07NE0045	1954&1955	Cons Denison Mines	Yes	select intervals U(%), U(lb)
11	41J07NE0045	1954&1955	Cons Denison Mines	Yes	select intervals U(%), U(lb)
12	41J07NE0045	1954&1955	Cons Denison Mines	Yes	select intervals U(%), U(lb)
24	41J07NE0045	1954&1955	Cons Denison Mines	Yes	select intervals U(%), U(lb)
4	41J07NE0045	1954&1955	Cons Denison Mines	Yes	select intervals U(%), U(lb)

Drillhole name	Assessment File	Work year	Company	DDH log available	Results Reported
8	41J07NE0045	1954&1955	Cons Denison Mines	Yes	select intervals U(%), U(lb)
2	41J07NE0045	1954&1955	Cons Denison Mines	Yes	select intervals U(%), U(lb)
13	41J07NE0045	1954&1955	Cons Denison Mines	Yes	select intervals U(%), U(lb)
25	41J07NE0045	1954&1955	Cons Denison Mines	Yes	select intervals U(%), U(lb)
6	41J07NE0045	1954&1955	Cons Denison Mines	Yes	select intervals U(%), U(lb)
23	41J07NE0045	1954&1955	Cons Denison Mines	Yes	select intervals U(%), U(lb)
Q1	41J07NE0068	1953	Spanish American	No	3 maps, 1 section
Q5	41J07NE0068	1953	Spanish American	No	3 maps, 1 section
Q11	41J07NE0068	1953	Spanish American	No	3 maps, 1 section
Q12	41J07NE0068	1953	Spanish American	No	3 maps, 1 section
Q7	41J07NE0068	1953	Spanish American	No	3 maps, 1 section
Q3	41J07NE0068	1953	Spanish American	No	3 maps, 1 section
Q3W	41J07NE0068	1953	Spanish American	No	3 maps, 1 section
Q6	41J07NE0068	1953	Spanish American	No	3 maps, 1 section
Q4	41J07NE0068	1953	Spanish American	No	3 maps, 1 section
Q10	41J07NE0068	1953	Spanish American	No	3 maps, 1 section

Table 3: Summary of salient contents of all Assessment files pertaining to the Radio Fuels properties.

Assessment File	Property	Work Done	Contents
41J07NE0020	Quirke Lake West	Line-cutting, geologic mapping, Geiger survey	No Geiger results provided, only one anomalous area noted, geologic mapping of cut-lines and shore. Two maps provided, of questionable value.
41J07NE0031	Not on property	DDH 259 - Algom Uranium Mines	AF appears on property but DDH is not.
41J07NE0045	Quirke Lake West	DDH summarized in Table 2	12 DDH with logs and U(%), U(lb) on select intervals
41J07NE0068	Quirke Lake West	Geological map of Spanish American Mines	Map with drillhole locations and cross-section showing DDH Q3 & Q7 with fault and radioactive horizons at depth
41J07NE0069	Quirke Lake West	DDH Q1 & Q2 by Kinloch Mining - relogged and reported in AF41J07NE0068	
41J07SE0008	Quirke Lake Panel	Geological plan and field notes	Geology map with DDHs, Sections showing area of surface radioactivity with interpreted dip and intersections in DDH; interpreted folded shale unit
41J10SE0049	Quirke Lake West	many of DDH Q1-Q520 Preston East Dome & Algom Uranium- relogged and reported in AF41J07NE0068	16 DDH logs, most with sections within the property. Included with many other DDH that do not lie within the property. Sections and interpretations of the Quirke Quarry limestone and its geochemistry (possibly for a flux?)

41J07NE0020: *Geological Mapping and Geiger Survey of Consolidated Denison Mines Limited; Blind River Uranium Property, Sudbury Mining Division*

Work done: Line-cutting (35 line miles cut at 400' intervals with 50' pickets and grid mapping, Geiger counter survey. No Geiger counter results provided (only one anomalous locality noted).

Mapping on cut lines, from a boat for shorelines, islands traversed by pace and compass.

Significant observations:

- Along the west shore of Quirke Lake, a complete cross-section of Mississauga Fm. quartzites; Bruce Fm. conglomerates, limestones and impure quartzites: Espanola Fm. argillites, greywackes with interbedded quartzites and limestones; and Serpent Fm. quartzites. The various formations are nonconformable with each other. (lowest/oldest unit)
- Commonly cross bedded, Mississauga quartzites are green with sericite and serpentine. Narrow (up to 30cm) pebble conglomerates occur at the base of the quartzites.
- Conglomerates of the Bruce Formation were characterized as 'Tillite' with boulders up to 30cm in wacke matrix. Sandstones are dirty. 2nd oldest/lowest unit.
    - 115' (~35m) of limestone was intersected in drill-hole under the shore of Quirke Lake
- Espanola sedimentary rocks have fragments of Mississauga and Bruce formations in them (up to 30 m above the bottom contact of the unit, indicating a significant depositional hiatus/unconformity.

- Serpent quartzites are massive with obscure bedding.
- Cobalt Group conglomerates occur west of the Quirke Lake shoreline and unconformably overlie the other formations. (aside from Lindsay – Cobalt Group conglomerates are interpreted as diamictites in the Cobalt Camp)
- A 'flattening' of the bedding was noted in the Espanola rocks on the shore of Quirke Lake and the islands – interpreted as a 'shelf' that coincides with positive drill results by Algom Uranium Mines.
- Approximately 2000 readings were taken along the cut lines and island traverses. The only anomalous radioactivity recorded occurred in narrow pebble conglomerate horizons on the most northerly island in Quirke Lake (Mississauga Fm??).

41J07SE0008

Surface geology and geological cross-sections that include parts of the Quirke Lake Panel Property. Cross-sections show interpreted sub-surface trace of surface radioactivity and interpreted complex, subhorizontal folding (apparent from the section, Figure 4) constrained within a shale unit. Best reported values from drilling are shown in Section E10 – 0.11% over 5' at a depth of 1900'.

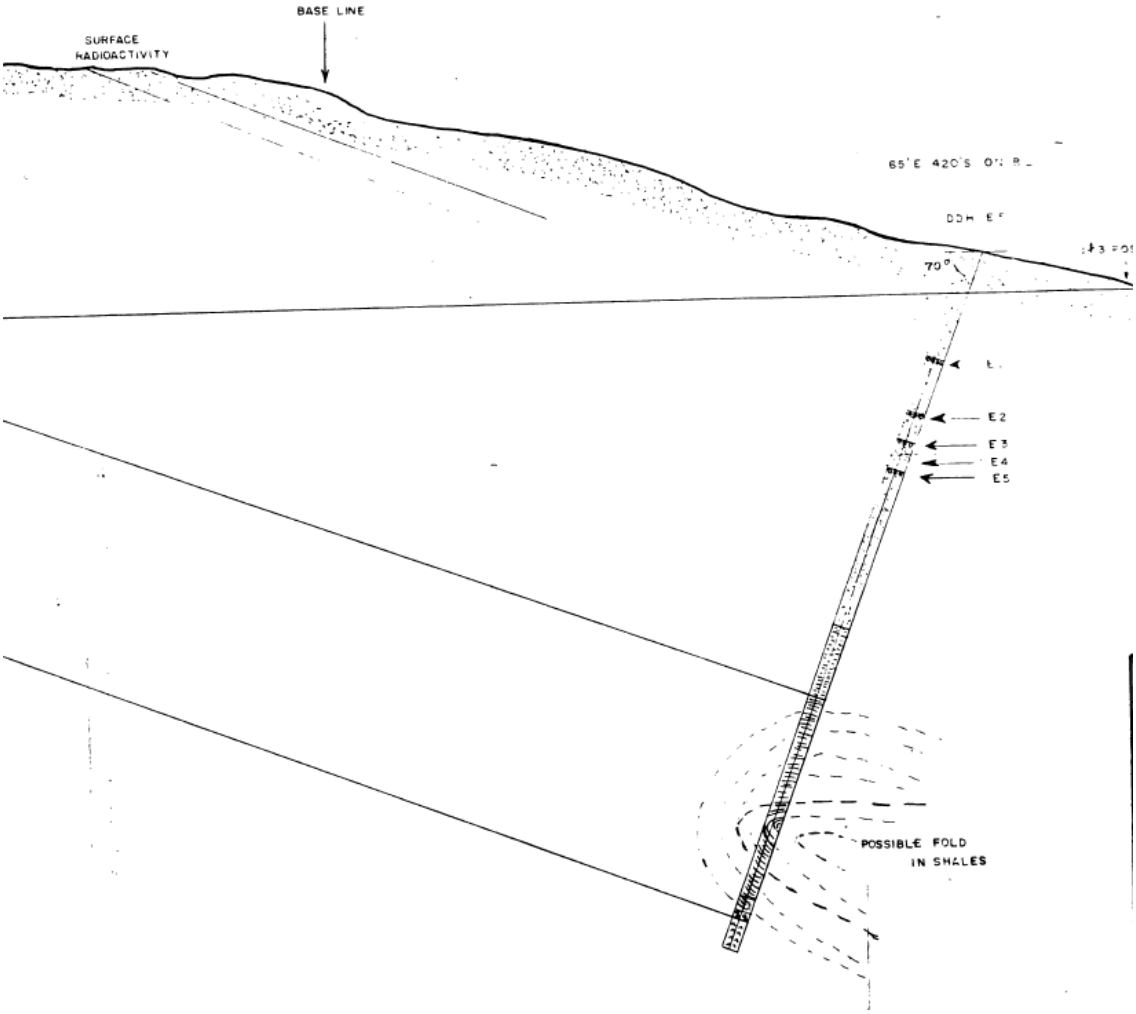


Figure 4: Cross-section from AF 41J07SE0008.

Field Program Summary

All station data including GPS coordinates (NAD 83), feature and geologic descriptions, structural measurements, the operational manual for the Radiation Solutions RS-125/230 Gamma Ray Spectrometer measurements are included in Appendix 2.

August 1

Lindsay Hall and Brenda Hodgins traveled by road from Shawville, Quebec to the Dunlop Lake Lodge where field work preparations were completed.

August 2

Initiated the reconnaissance, mapping, sampling, and prospecting on the Quirke Lake West Property. It was immediately clear that the property was gated off. Lindsay Hall proceeded on foot to initiate the technical work. Brenda Hodgins proceeded to determine how to secure access through the gates and collected the borrowed Radiation Solutions RS-125/230 Gamma Ray Spectrometer from the District Geologist Office in Sault Ste. Marie. Appendix 1 provides the operational manual for the Radiation Solutions RS-125/230 Gamma Ray Spectrometer.

Lindsay Hall's GPS tracks from August 2 can be seen on Figure 5. 13 outcrops and several historic mine features were mapped, 11 samples were collected. Collected samples were analysed ("Assay"; Appendix 1) with the Gamma Ray Spectrometer on returning to camp. All samples, including a float sample and an outcrop sample from stations 22-LAH-011 and 22-LAH-012 respectively that are from close to 30 m outside the western boundary of claim number 532907 (Figure 6) were submitted for analysis. The costs of shipping and analysis for samples 22-LAH-011 and 22-LAH-012 have been deducted from the analytical costs submitted herein. Stations and areas of rehabilitated waste rock piles are plotted on Figure 6.

All outcrops observed were described as clastic sedimentary rocks except for some carbonaceous ("marl") interbeds up to 30 cm thick and a very thin (up to 4-5 cm thick) and discontinuous cherty horizon noted at outcrop 22-LAH-009.

Brenda Hodgins acquired the Gamma Ray Spectrometer and organized a visit from the Resident Geologist Office staff for August 4. She visited the Denison Environmental office in Elliot Lake and initiated a formal request for access to the property (i.e., borrowing keys for the gates). No resolution on this request was achieved by the close of business on August 2.

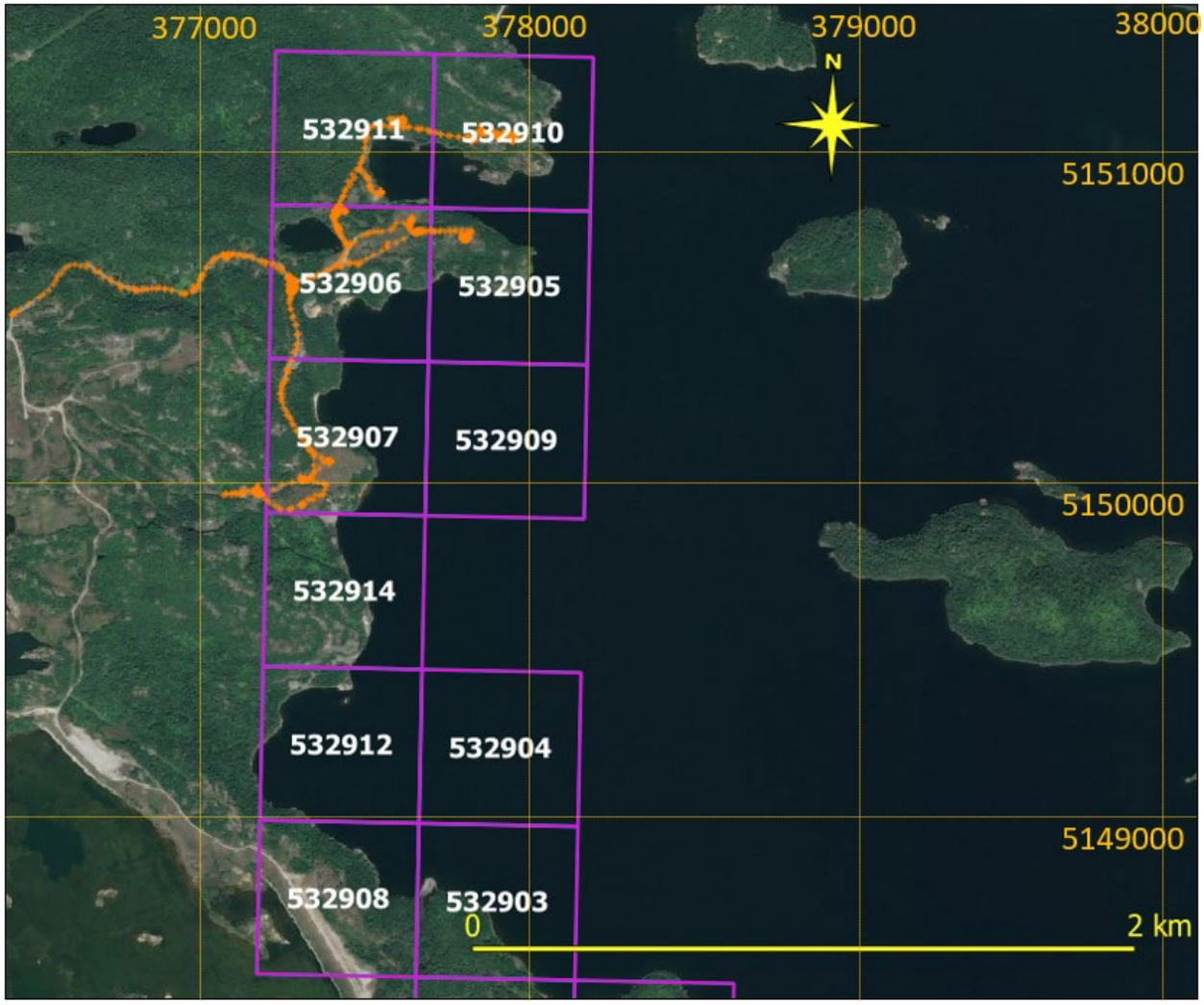


Figure 5: Tracks (orange points) from the traverse on the northern Quirke Lake West Property on August 2, 2022. NAD 83 Zone 17

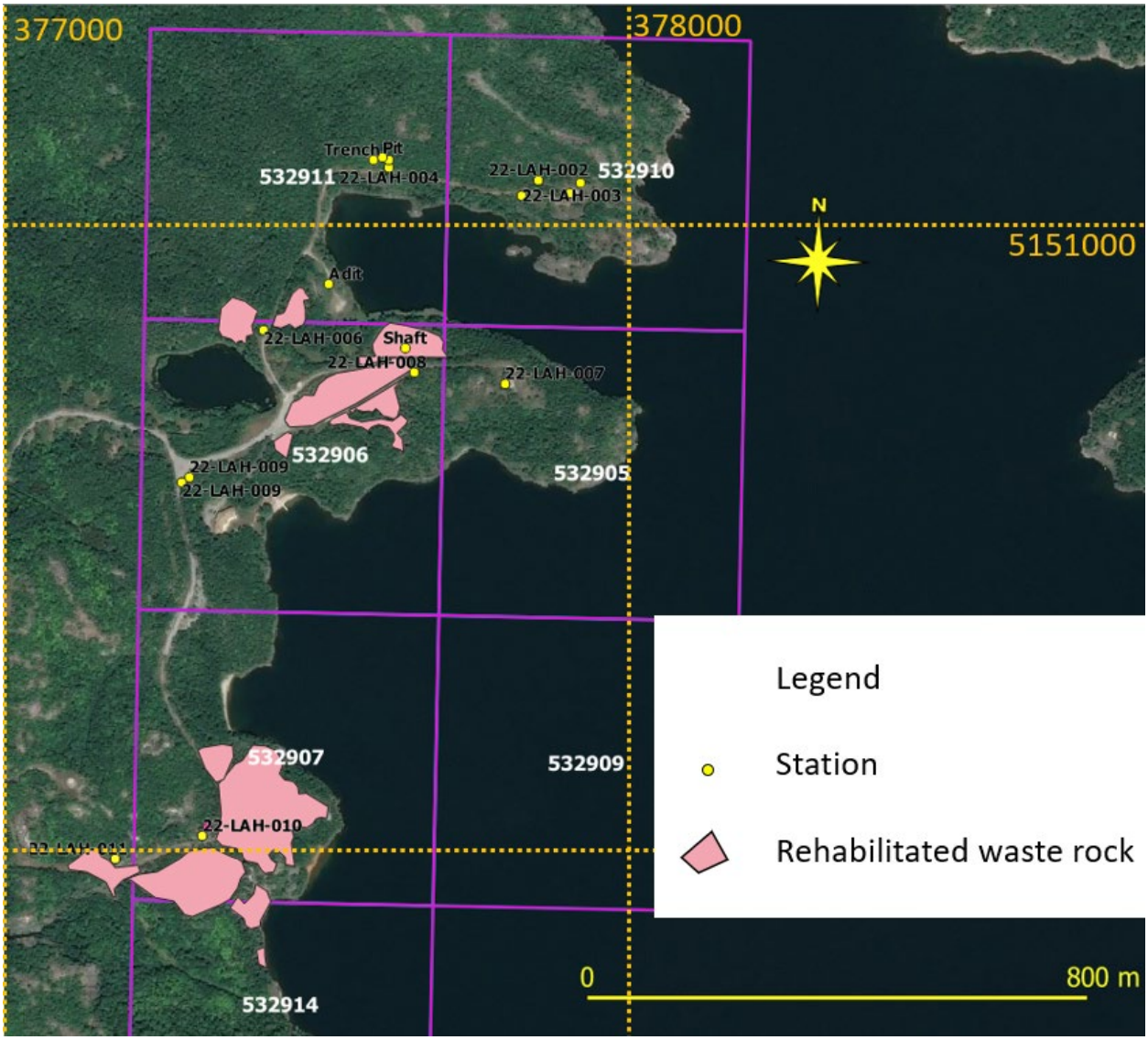


Figure 6: Stations made, and rehabilitated waste rock areas mapped on August 2, 2022. NAD 83 Zone 17

August 3

On the morning of August 3, Denison Environmental declined our request for access, refusing to provide keys to the gates.

Brenda Hodgins and Lindsay Hall visited the Quirke Lake North and Quirke Lake Panel properties in the morning and the southern section of the Quirke Lake West Property in the afternoon. The traverses were made with the Gamma Ray Spectrometer. GPS tracks from August 3 can be seen on Figure 7.

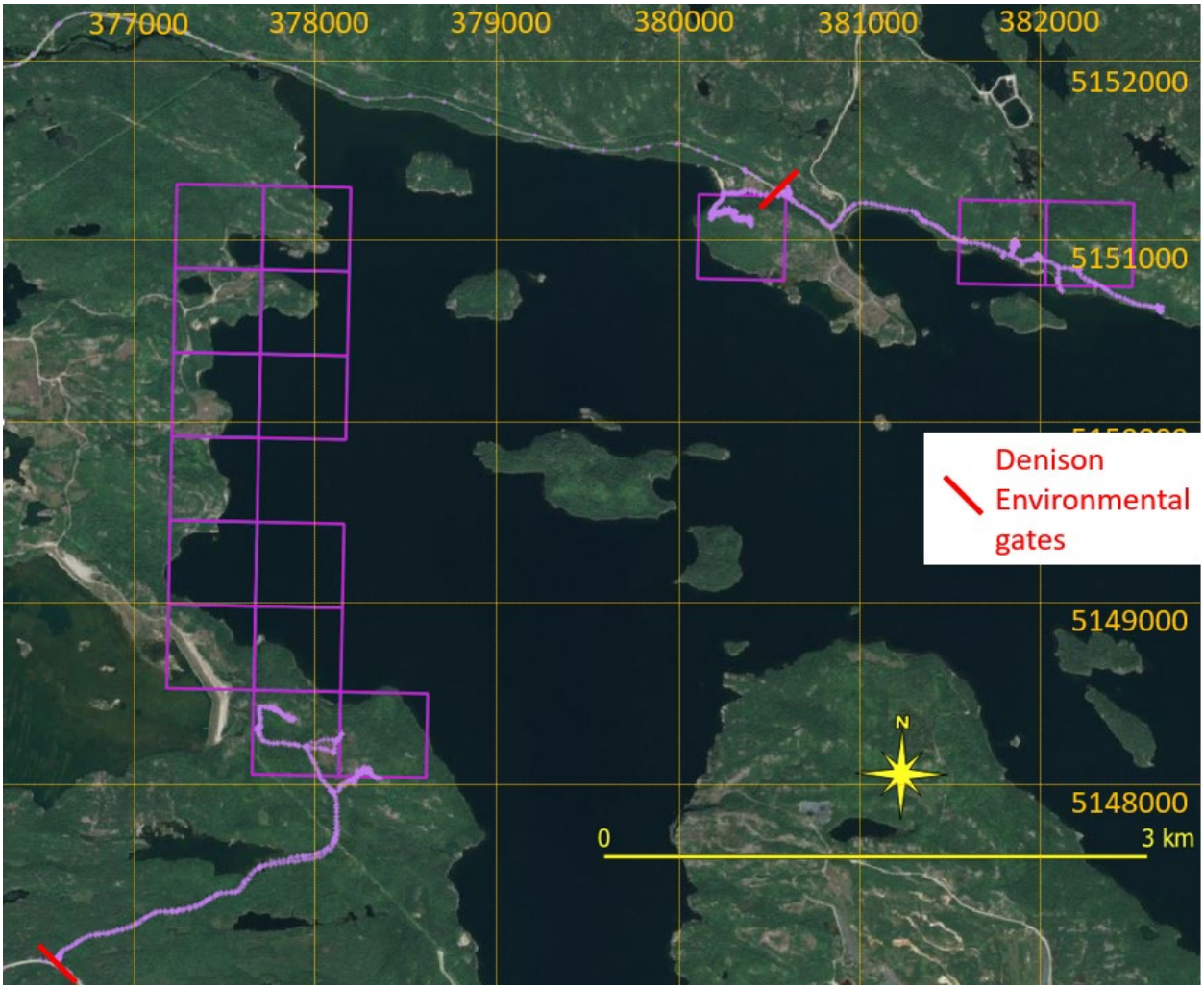


Figure 7: Tracks (magenta points) from the traverses made on August 3, 2022. Traverses in the morning in the northeast and in the afternoon in the southwest. NAD 83 Zone 17

7 outcrops were mapped and described (Figure 8), 4 samples were taken, and 6 Gamma Ray Spectrometer measurements were collected on the Quirke Lake North Property. No outcrops but significant sandy overburden was encountered along the traverse through claim 537565. To better understand the geological context of the area, the traverse continued to the east of the claim until outcrop was encountered (station 22-LAH-013). All outcrops observed on this short traverse were described as granitoid. This marks a significant departure from the geology represented in Figure 3. Sample 22-LAH-013 was collected outside the property, therefore shipping and analytical costs for this sample will not be included in the costs applied to this assessment report.

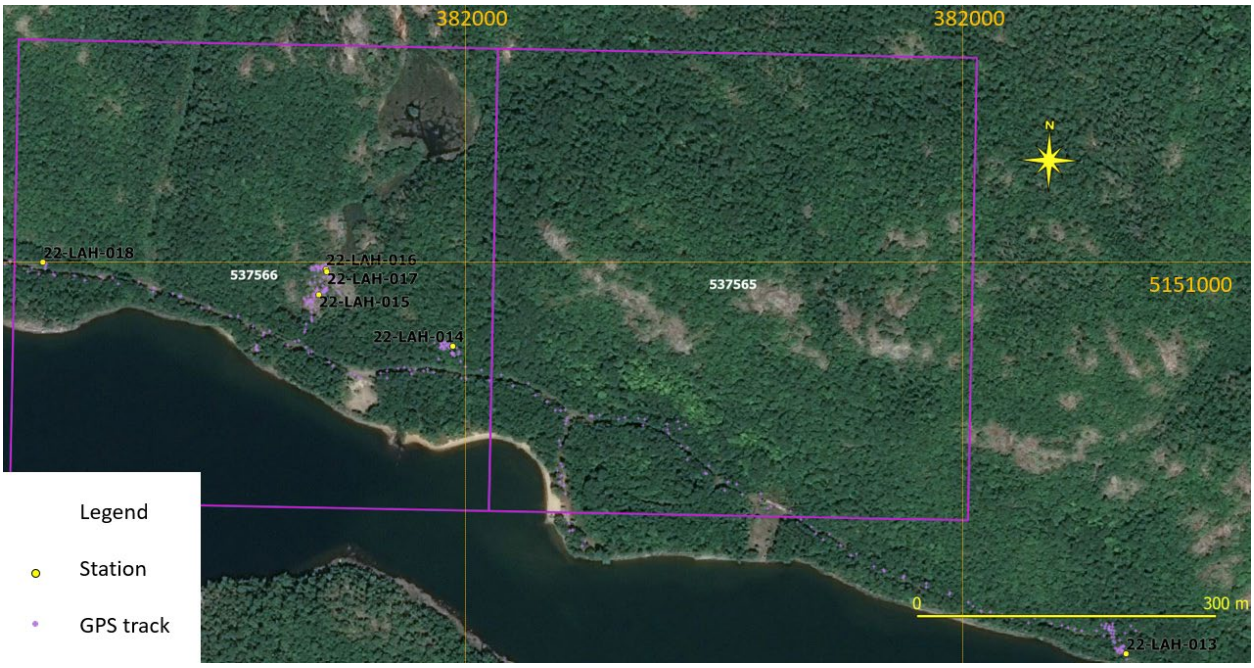


Figure 8: GPS tracks and stations made on the first traverse of August 3, 2022. NAD 83 Zone 17

A large area of outcrop at the top of a high hill that cores the Quirke Lake Panel Property was explored (Figure 9). Two stations were described at which two samples were taken and two measurements on the Gamma Ray Spectrometer were collected. The lithologies at both stations were described as quartzite.

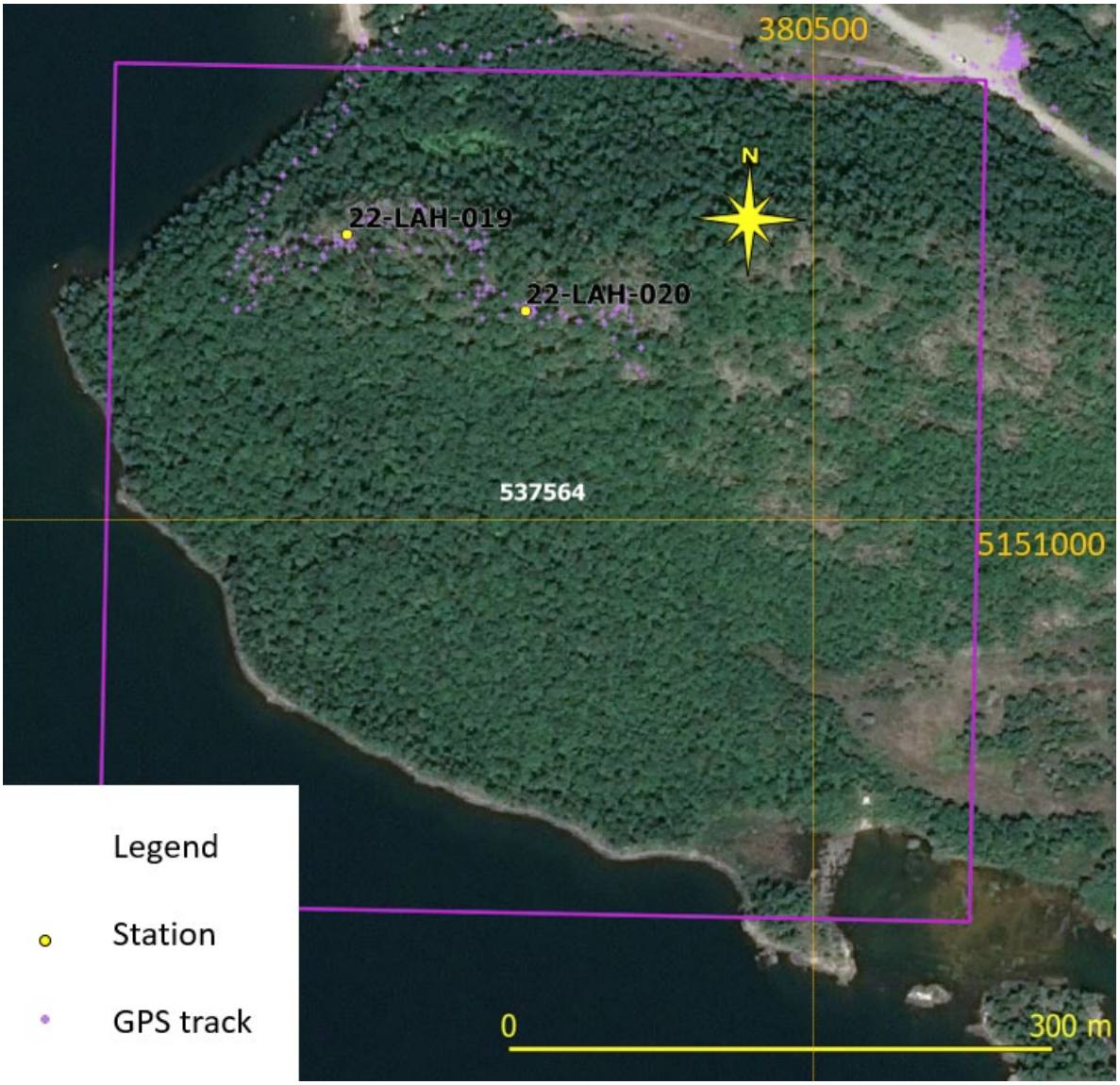


Figure 9: GPS tracks and station locations from the traverse on the Quirke Lake Panel Property on the morning of August 3, 2022. NAD 83 Zone 17

In the afternoon of August 3rd, the southern region of the Quirke Lake West Property was visited. Eight stations were established at which geological and man-made features were described (**Error! Reference source not found.**); three samples were taken, and three Gamma Ray Spectrometer measurements were collected. All outcrops were described as matrix supported conglomerate (possibly diamictite; Figure 11). Pyrite-mineralized and significantly radioactive (according to readings from the Gamma Ray Spectrometer) boulders were described as quartz pebble conglomerate (Figure 12) and sampled for analysis (Figure 10, station 22-LAH-022). This material was collected and submitted for analysis to better characterize the nature of the buried mineralization that was mined underground at the Spanish-American Mine.

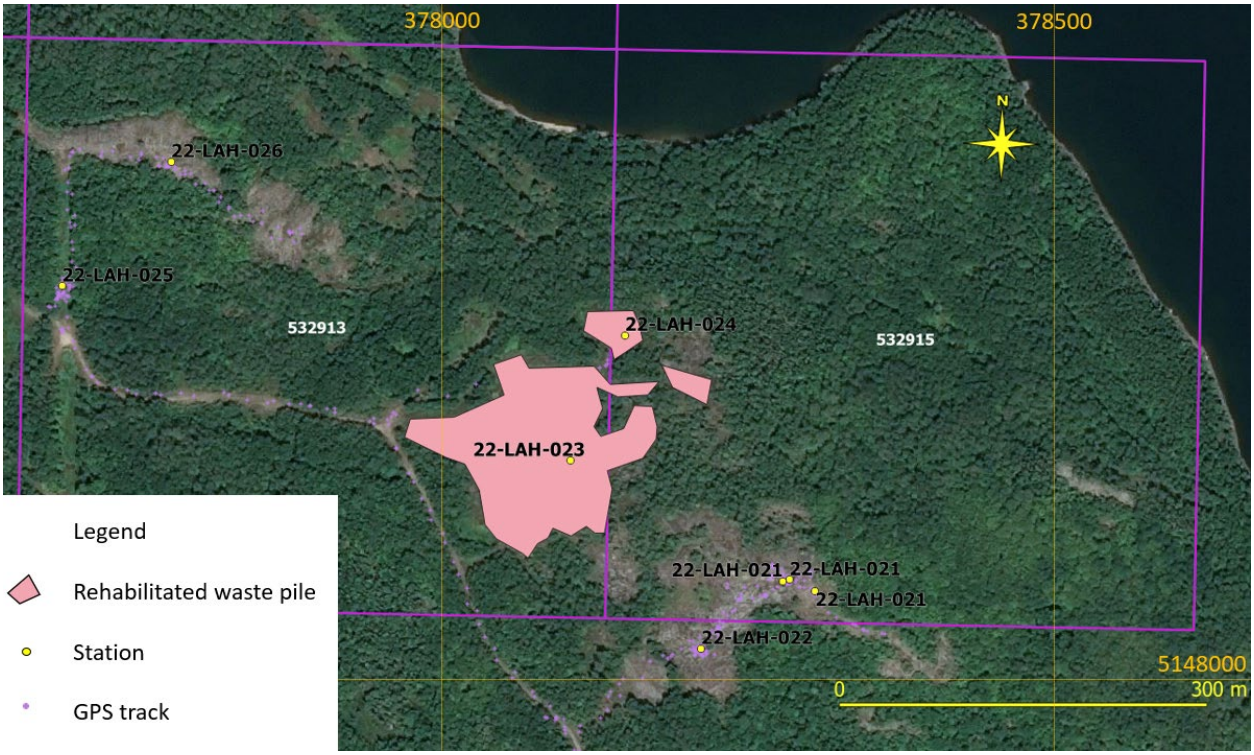


Figure 10: GPS tracks, station locations and rehabilitated waste rock piles mapped on the southern claims of the Quirke Lake West Property in Bouck Township. NAD 83 Zone 17.

Figure 11: Interpreted diamictite from strippings at stations labelled 22-LAH-021.

Figure 12: Fragment of pyrite mineralized, quartz pebble conglomerate boulder (sample 22-LAH-022).

August 4

Lindsay Hall and Brenda Hodgins returned to the northern region of the Quirke Lake West Property with the Gamma Ray Spectrometer. The morning was spent applying the Gamma Ray Spectrometer in Assay mode to the various beds at outcrop 22-LAH-009 then proceeding to the south to identify any potential radioactive materials in the waste rocks and outcrops visited August 2. In the afternoon the team was joined by the staff of the Sault Ste. Marie District Geologist Office and visited the northern most claims (532911 and 532910). Figure 13 shows the tracks and stations mapped on August 4, 2022.

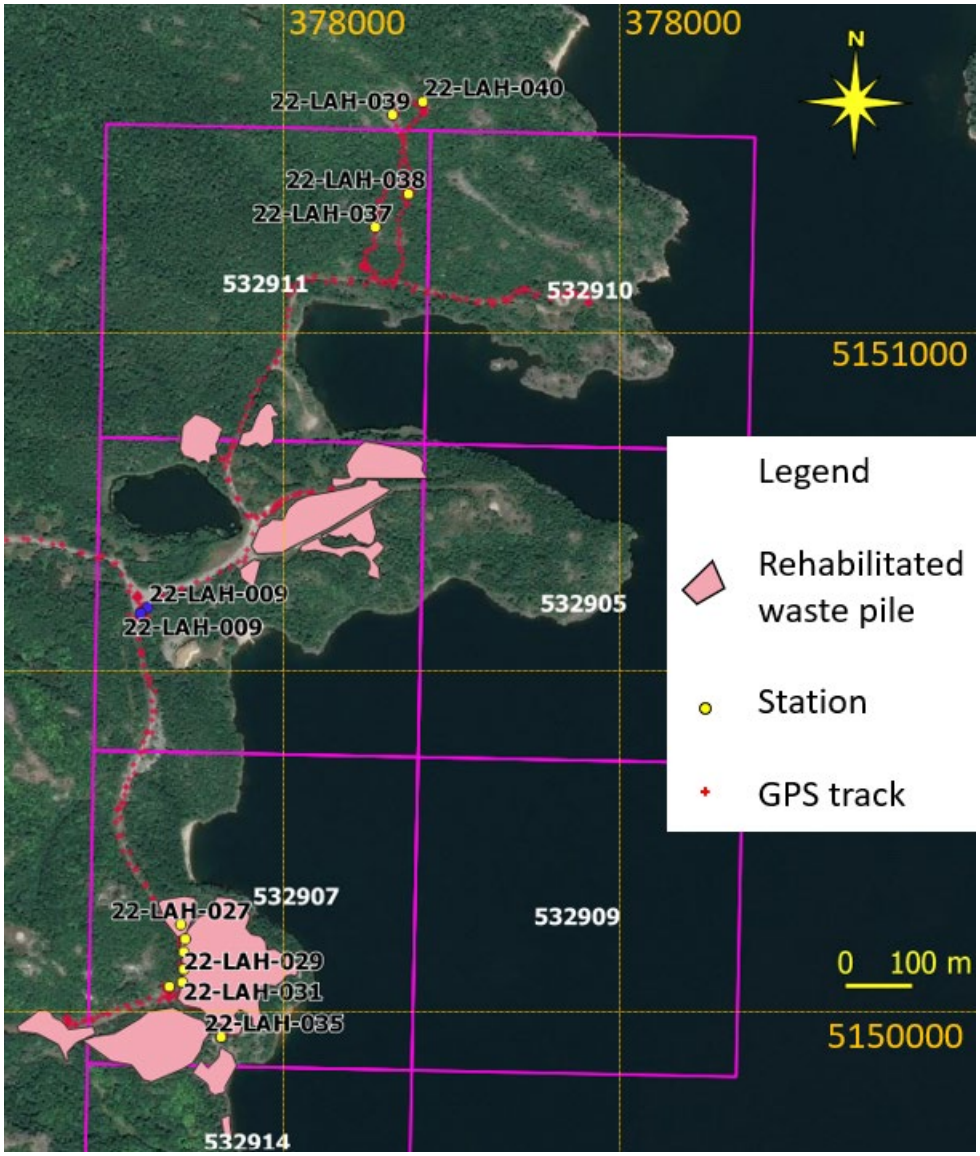


Figure 13: GPS tracks from August 4, 2022, stations, and rehabilitated waste rock piles. Note that the outcrop first described August 2 between stations labelled 22-LAH-009 was revisited - plotted with blue markers.

Gamma Ray Spectrometer measurements were taken on several of the outcrops visited on August 2 (in Assay mode). Particular attention was given to the outcrop at station 22-LAH-009. At this large outcrop, subhorizontal, slightly antiformal beds of different types of clastic and chemical sedimentary rocks are exposed. Each of 7 distinct beds were tested. The results are found in Table 4 and a photographic key to each bed is represented in Figure 14.

Table 4: Gamma Ray Spectrometer readings from distinct beds at station 22-LAH-009.

Photo_point	Lithology	K%_GRS	U_ppm_GRS	Th_ppm_GRS
1	grey, fine sandstone	1.8	3.6	16.9
2	grey, fine sandstone	2	7.8	10.2
3	grey, fine sandstone	2.4	4.5	11.5
4	grey, fine sandstone	2.5	3.6	13.5
5	cherty sediment	3.5	6.5	18.8
6	marl	3.2	5.7	17.1
7	grey, fine sandstone	2.4	5	14.6

Figure 14: Photos looking east showing beds measured with the Gamma Ray Spectrometer at station 22-LAH-009; left photo is of the northern end of the outcrop; the right photo is of the southern end of the outcrop where the uppermost stratigraphy was accessible.

Leaving the device on Survey mode, rare, exposed waste rock piles were scanned to expedite the discovery of anomalous rock (Figure 15). The spectrometer only signaled radiation over the trails with granule to pebble sized material over soil and vegetation and for some fragments of waste rock that were caged in by wire (Figure 16; station 22-LAH-033). Two samples were collected at station 22-LAH-035.

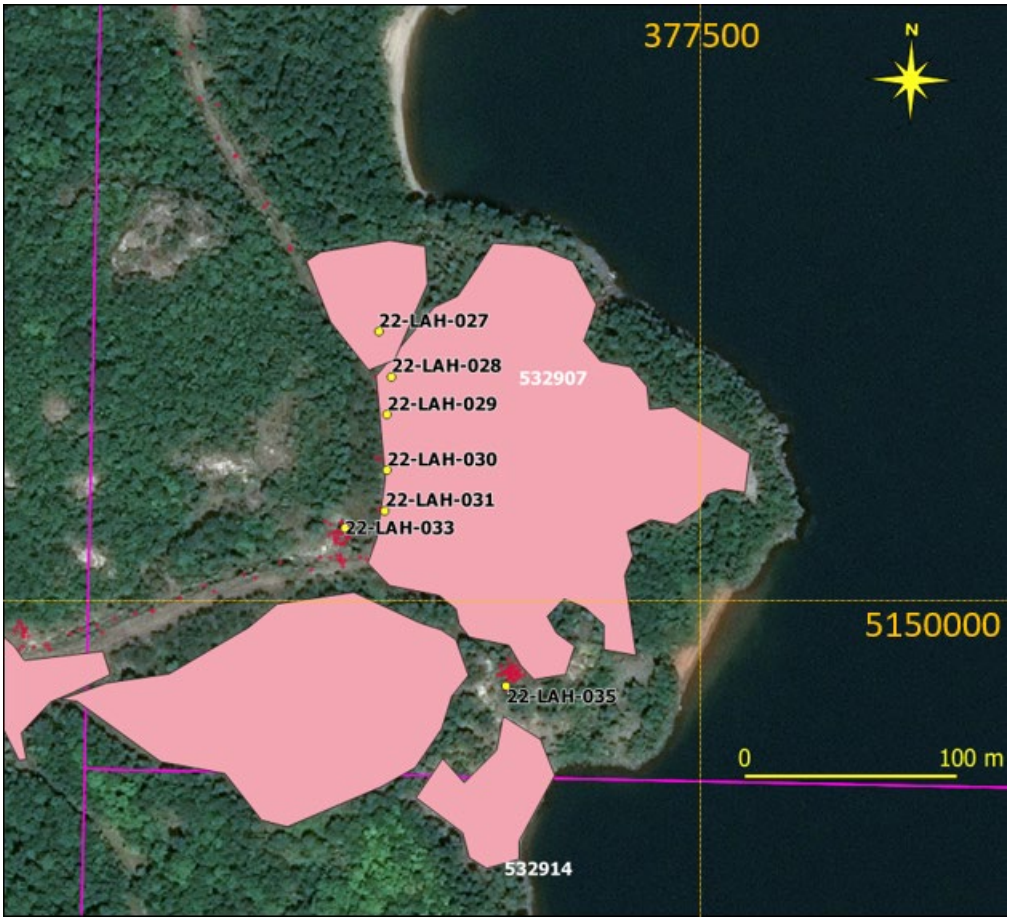


Figure 15: Detailed view of traverse made with Gamma Ray Spectrometer in Survey mode, August 4, 2022.

Figure 16: Radioactive fragments of waste rock confined with a wire mesh; station 22-LAH-033.

In the afternoon, the District Geologist, Barun Maity, and District Geological Assistant, Cyrus Adrianwalla, from the Sault Ste. Marie District Geologist Office (DGO) joined us in the field to see exposures on the property and offer their insights. As a group, we revisited the northern-most part of the Quirke Lake West Property and undertook an off-trail traverse to the north prospecting for possible exposures of the mineralization hosting stratigraphy (Figure 17). A further four outcrop areas were described, four Gamma Ray Spectrometer readings were measured, and one sample was taken in this short traverse. Sample 22-LAH-040 was collected approximately 40 m north of the property boundary. As such, the shipping and analytical costs of this sample are not included in the costs applied to this assessment.

The team from the Sault Ste. Marie DGO returned to Sault Ste. Marie with the Gamma Ray Spectrometer.

Brenda Hodgins and Lindsay Hall returned to the Dunlop Lake Lodge to prepare the samples for shipment to the ALS Laboratories in Vancouver.

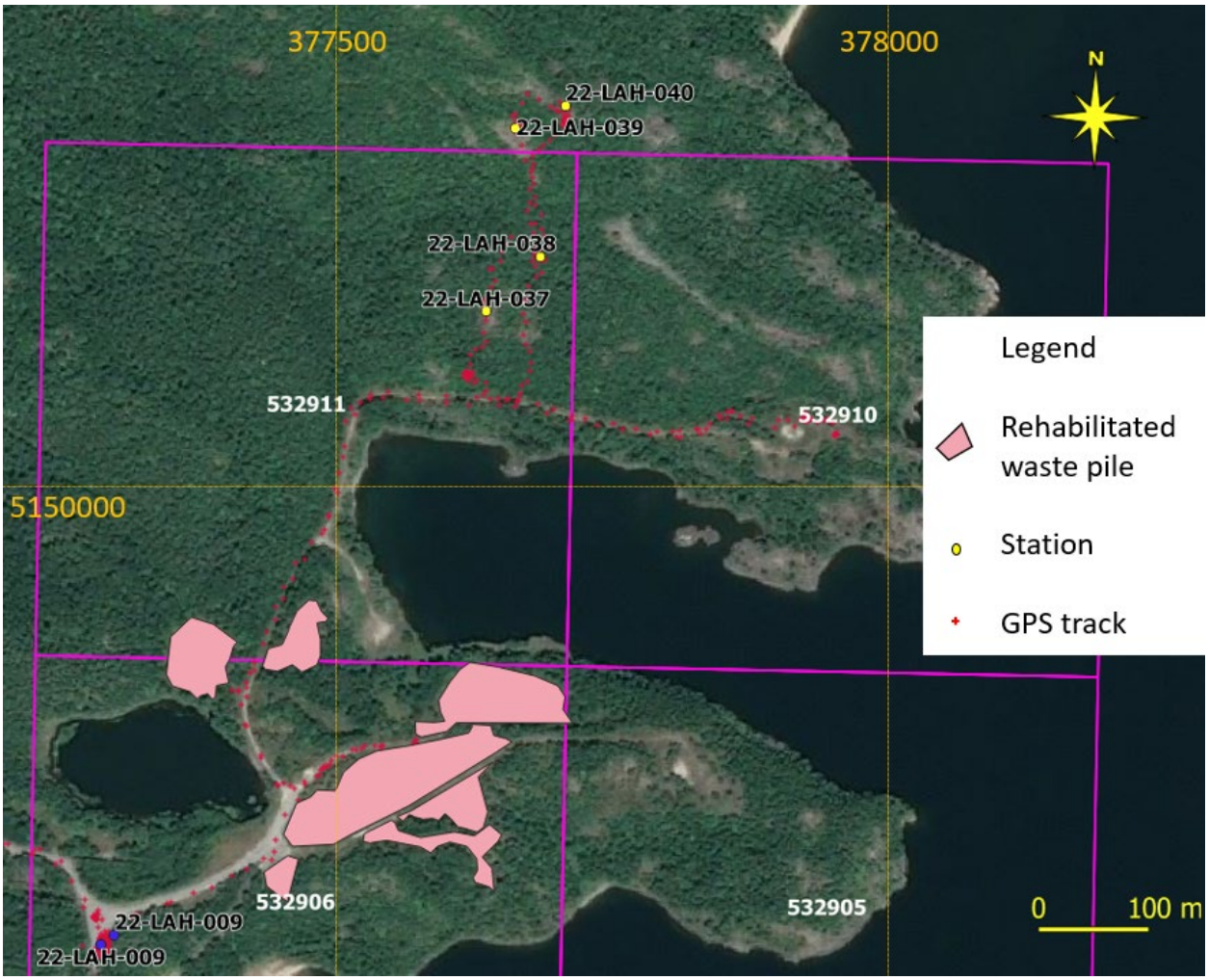


Figure 17: Detailed view of the traverse made in the company of the DGO staff on the afternoon of August 4, 2022.

August 5

Brenda Hodgins and Lindsay Hall completed preparations for the shipment, packed the equipment and drove to Elliot Lake. In Elliot Lake the 23 samples were shipped to ALS Laboratories in Vancouver. The rest of the day was occupied with the return drive to Shawville, Quebec.

January 10, 2023

Analytical results released to Radio Fuels by ALS Global and integrated into this Assessment File. As expected, the most anomalous results returned are associated with the pyrite-mineralized, quartz pebble conglomerate samples that were from cobble float interpreted herein as ore from the underground mine. Results are included as Appendix 3. U, Li and Ce are plotted in Figure 24, Figure 25, and Figure 26 respectively.

Recommendations for future work

Immediate resubmission of Sample 22_LAH_011 for reanalysis of Ce due to overlimit result.

Important considerations for this project area:

- The project has federal oversight (Atomic Energy) as well as falling under the Ontario provincial Mining Act.
- Three significant and extensive mines were located on the project. As a result, most of the data pertaining to these properties are not publicly available in Assessment Files, SEDAR, or other provincial government sources. To adequately research the properties an Access to Information request(s) must be filed.
- Consultation with both surface rights owners and the Atomic Energy of Canada assigned custodian for the former mines (Denison Environmental) must be undertaken prior to further field work including drilling.

Next steps for work on these properties include:

1. Establish an official communication link with Denison Environmental in Elliot Lake. According to the Ontario Mining Act, Radio Fuels has the right to access its properties without impediment. It is possible that, due to the involvement of the Federal Government regulatory body that employs Denison to monitor the former mine sites, there was some confusion regarding the rights of Radio Fuels to access the properties by the Denison management that refused us entry.
    a. Access to the properties through the gates for any future work is necessary. This is especially true for activities requiring heavy equipment.
    b. **This undertaking should be made by Radio Fuels officers or employees.**
2. Establish a good relationship with the surface rights owner who lives part time on the former Denison Mine site in the Quirke Lake West Property.
    a. This undertaking should be made by Radio Fuels officers or employees.
3. Undertake a comprehensive compilation of all data on the Denison, Spanish American and Panel mines. This will require that “Access to Information” (ATI) requests be filed with the government of Ontario. The data may be available in the Sault Ste. Marie District Geologist Office. The District Geologist, Barun Maity, was not sure on this count when asked. This will be a significant body of work. This will be acceptable for future assessment credit if point 6 (below) is also undertaken.
    a. Depending on the data availability, location and the data volume, this critical step could take up to a month (possibly longer) of dedicated work and may require temporary residence in Sault Ste. Marie or Sudbury.
    b. Manual organization and metadata extraction to characterize the resulting data from the ATI will be a first step. Costs would be dependent on the length of time, expenses, and employee costs.
        i. A minimum budget of $35 000 should be set aside for this step.
4. Scanning of hard copy data provided by the ATI using the extracted metadata.
    a. Professional scanning companies are available (i.e., Sierra Document Management). Costs for this work will be dependant on the volume and quality of the hard copy data.

        i. A minimum budget of $60 000 should be set aside for this step.
5. Data extraction should be undertaken using Optical Character Recognition (OCR) software wherever possible. This step will also be undertaken by specialists, potentially the same group as those who complete Point 4.
    a. A minimum budget of $30 000 should be budgeted for this step.
6. From the digital data acquired on the Denison, Spanish American and Panel mines (points 3, 4 and 5 above) 3D geological, structural and mineralization models should be created to better constrain what the sub-surface potential is. The preliminary work done on the properties reported herein and in the assessment files clearly demonstrates that uranium and rare earth element mineralization on these properties is hosted in rocks that are not exposed at surface, rather they are/were hosted in the underlying stratigraphy. To properly assess the potential and location of all buried mineralization, 3D geological models constrained by the historic mining data are required. This must be done prior to any attempts to drill. This will be a significant body of work. This work is acceptable for assessment credit. Depending upon the state of data returned from the Access to Information data compilation, scanning and extraction, this step could be extremely work intensive.
    a. Both the Spanish American and Denison mines will require at least a month of dedicated work by a skilled 3D geological modeller. The Panel Mine may require less time due to its shorter operational history and commensurately smaller footprint and data.
    b. A minimum of 100 days of work by a skilled modeller would be required to generate these three 3D models.
    c. At least $100 000 should be budgeted for this step.

A total budget of $225 000 should be set aside for the acquisition, scanning, extraction/digitization and 3D geologic modelling of all data that may be available through ATI. The total costs are impossible to predict due to the lack of insight into the data prior to the ATI request results.

Maps

Figure 18 shows locations of all samples collected and submitted for analysis; yellow triangles represent those applicable for assessment purposes, orange triangles represent those that are not applicable for assessment purposes. Appendix 2 provides details of the samples collected. Costs for 19 of the 23 analyses and 19/23 of the shipping bill are to be applied to this assessment.

Figure 19 shows the locations and relative values of uranium (U) in parts per million (ppm) measured with the Gamma Ray Spectrometer in Assay mode.

Figure 20 shows the locations and relative values of thorium (Th) in parts per million (ppm) measured with the Gamma Ray Spectrometer in Assay mode.

Figure 21 shows the locations and relative values of potassium (K) in parts per million (ppm) measured with the Gamma Ray Spectrometer in Assay mode.

Figure 22 shows the mapped lithologies at each outcrop described. The mapped occurrences of "Quartz pebble conglomerate" are all occurrences of cobble float that is interpreted as waste rock from underground mining.

Figure 22 shows the structural features measured where identified in the field.

Figure 23 shows the locations and U ppm values returned for all samples analysed by ALS Global.

Figure 24 shows the locations and Li ppm values returned for all samples analysed by ALS Global.

Figure 25 shows the locations and Ce ppm values returned for all samples analysed by ALS Global. Over-limit sample 22-LAH-011 is labelled with both sample number and an over-limit threshold (500 ppm) + 1 value of 501 ppm. Note that this is NOT the final value for the sample, but it there to indicate that the 500ppm threshold was exceeded and the sample must be analysed with a different technique to appropriately measure the cerium contained in it.

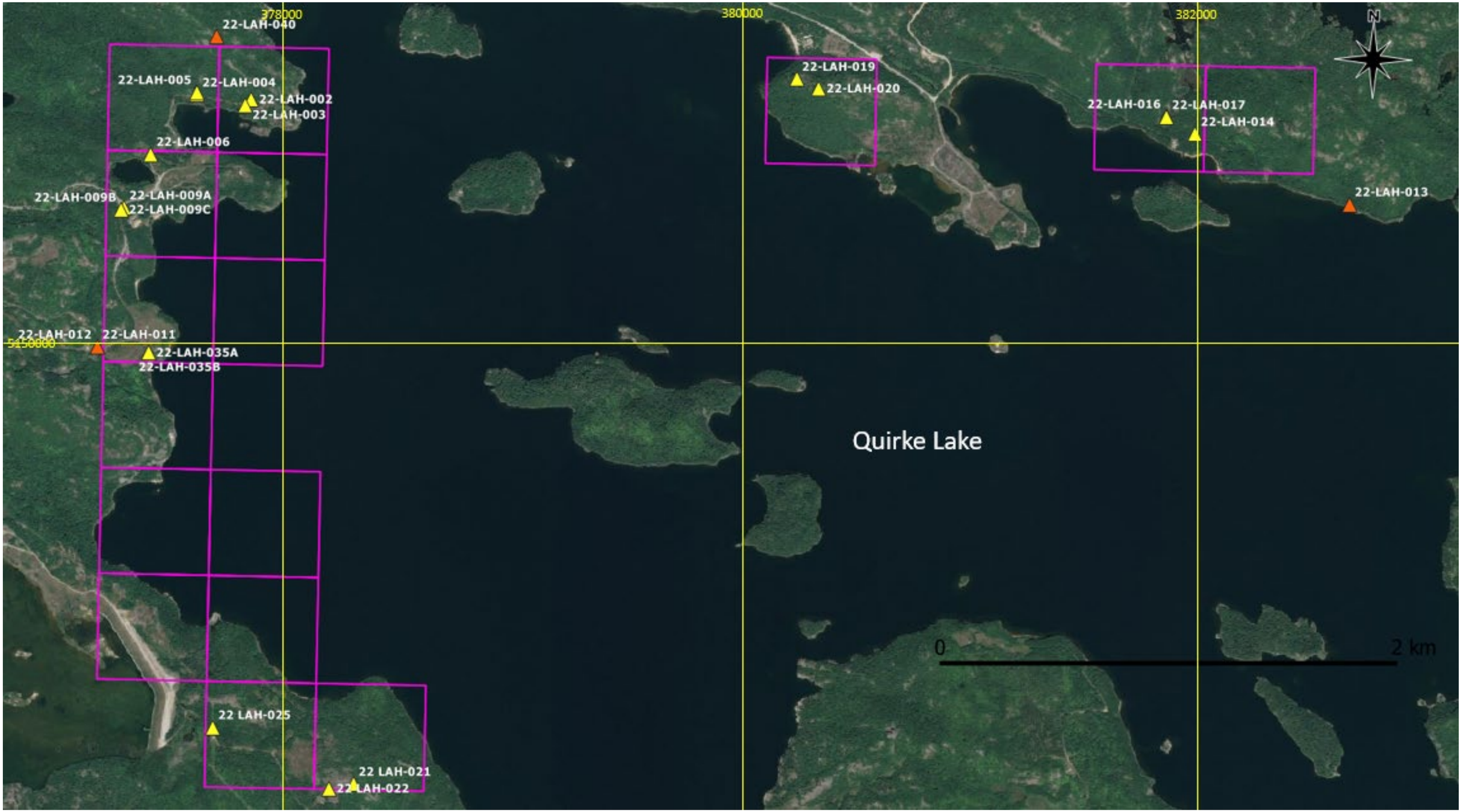


Figure 18: Locations of all samples collected and submitted for analysis. Yellow triangles represent samples that fall within the Quirke Lake properties boundaries; orange triangles represent samples that fall outside the Quirke Lake properties claim boundaries. NAD83 Zone 17.

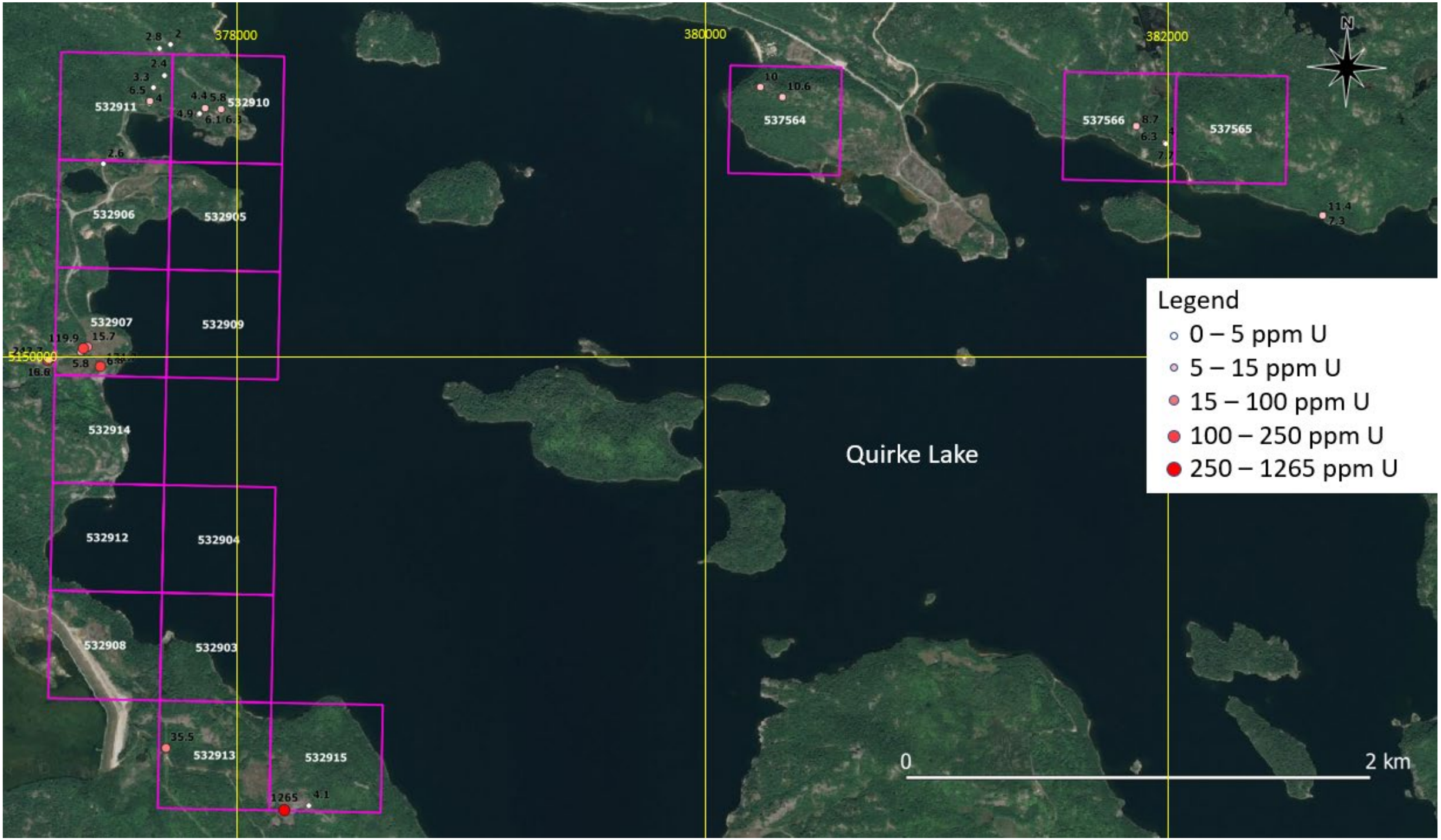


Figure 19: Locations and relative values of uranium (U) in parts per million (ppm) from the Gamma Ray Spectrometer in Assay mode. Measured values for U ppm plotted on map adjacent to the corresponding symbol. NAD 83, Zone 17.

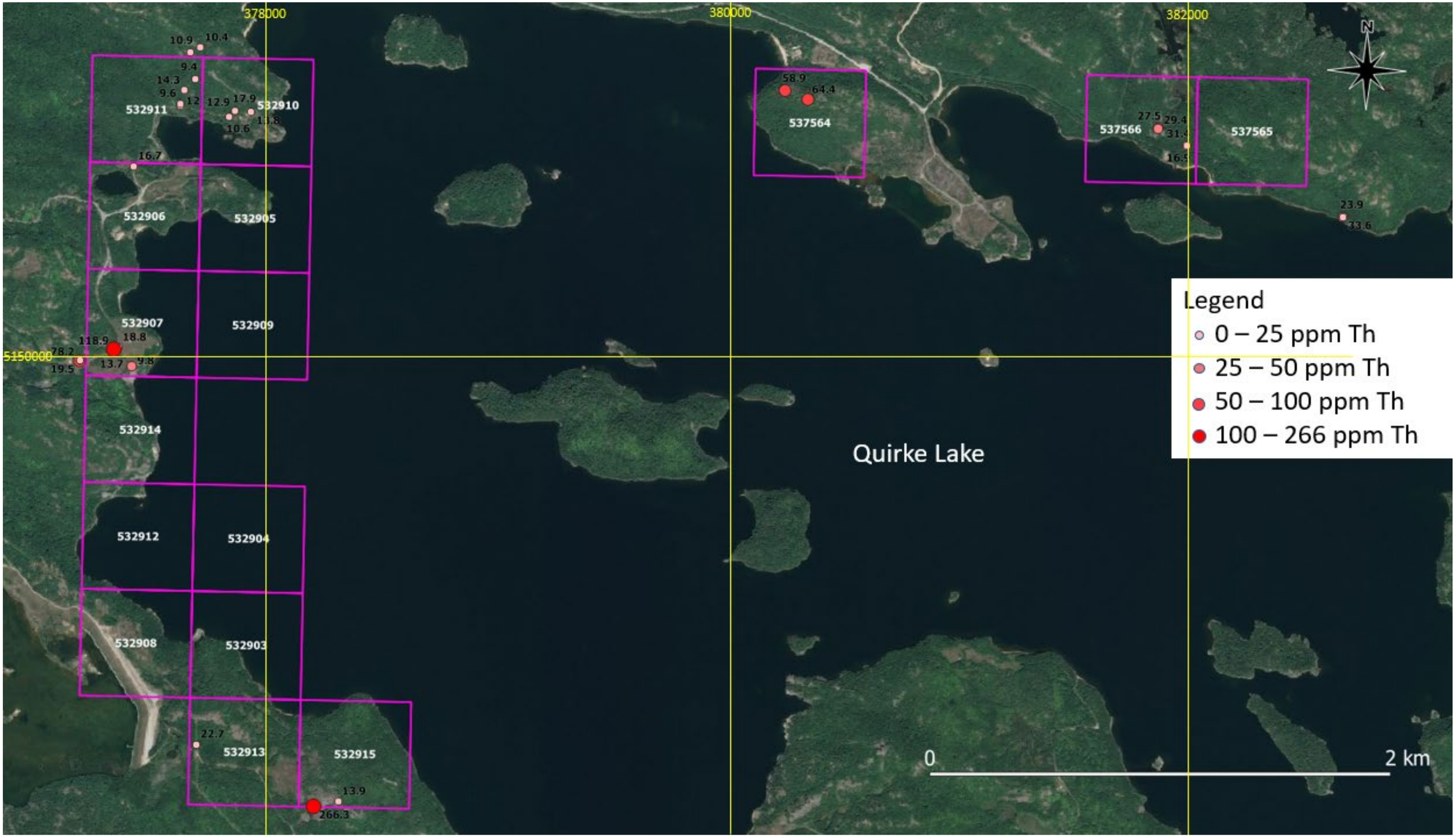


Figure 20: Locations and relative values of thorium (Th) in parts per million (ppm) from the Gamma Ray Spectrometer in Assay mode. Measured values for Th ppm plotted on map adjacent to the corresponding symbol. NAD 83, Zone 17.

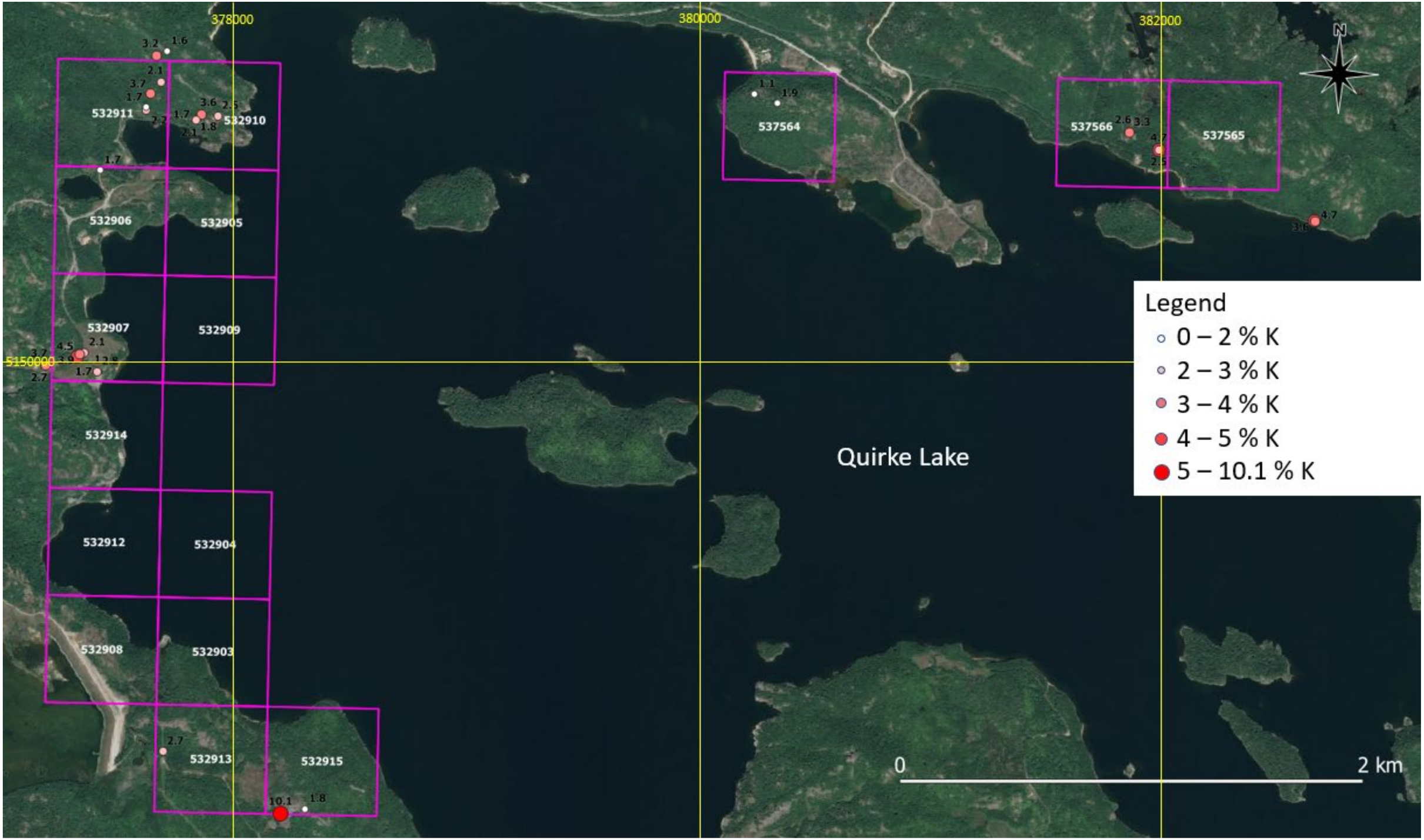


Figure 21: Locations and relative values of potassium (K) in percent (%) from the Gamma Ray Spectrometer in Assay mode. Measured values for K% indicated on map adjacent to the corresponding symbol. NAD 83, Zone 17.

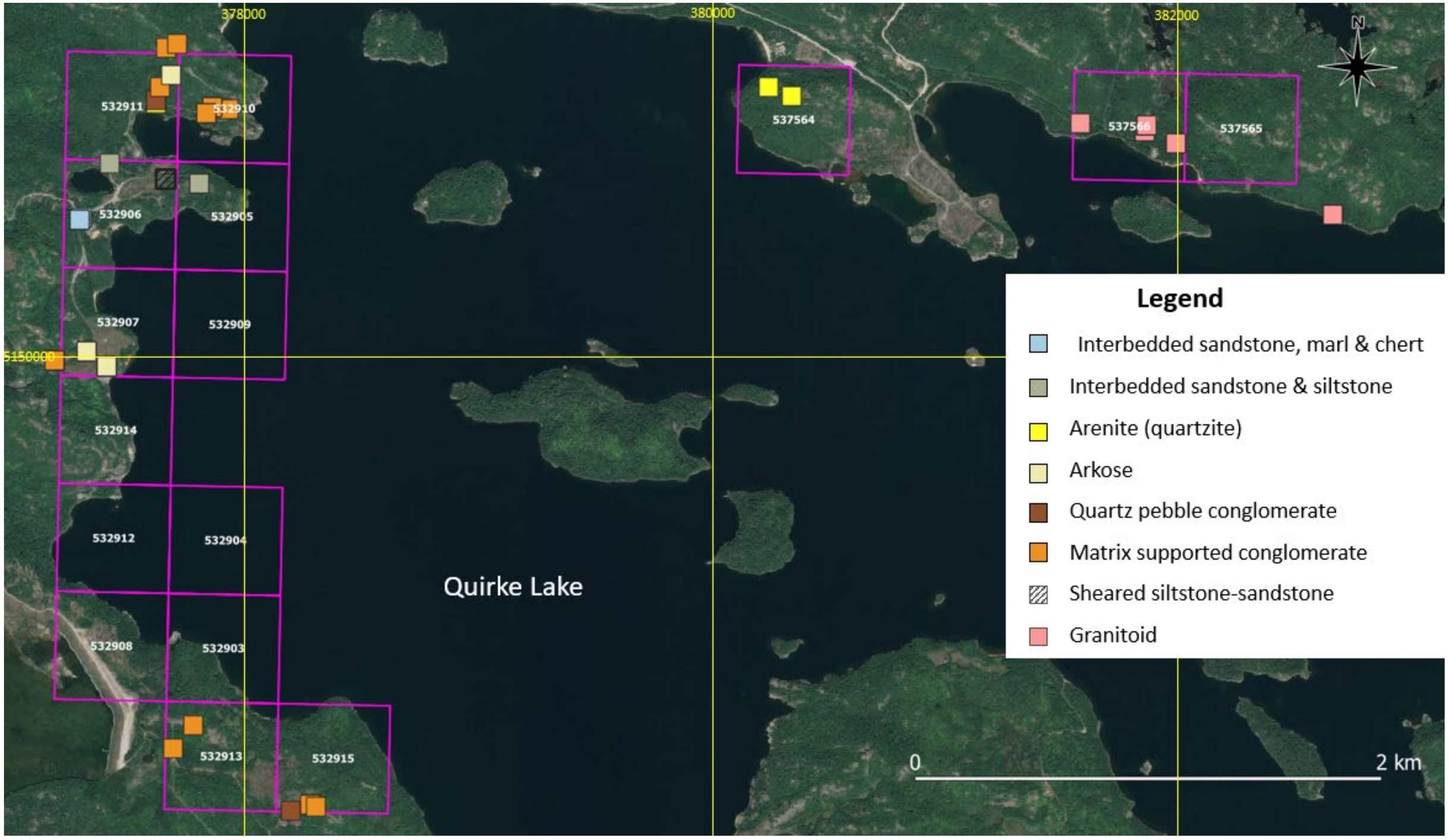


Figure 22: Simplified interpreted lithologies mapped at each station. All occurrences of "Quartz pebble conglomerate" are cobble float. NAD 83, Zone 17.

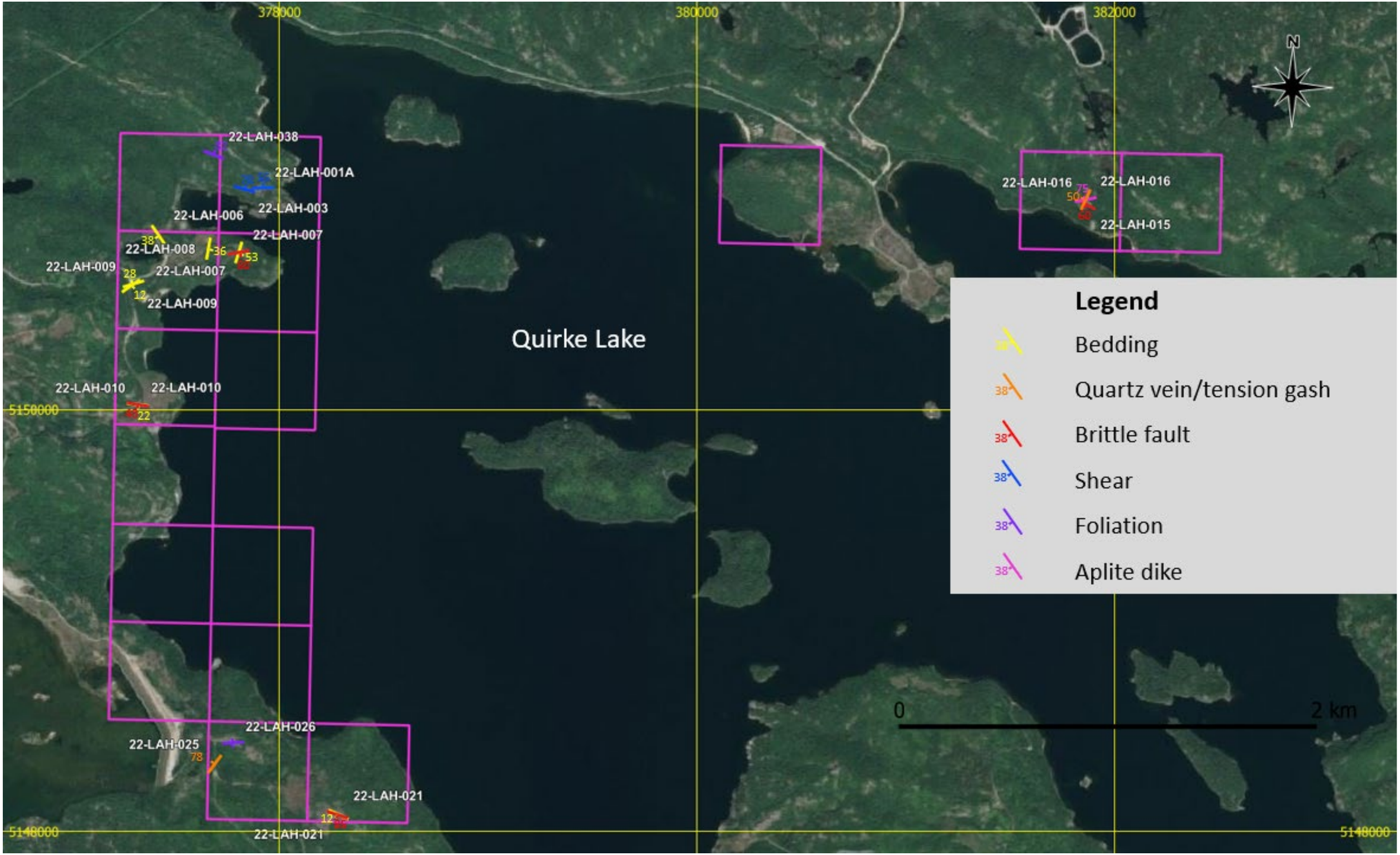


Figure 23: Structural measurements taken from outcrops on the Radio Fuels properties. NAD83, Zone 17.

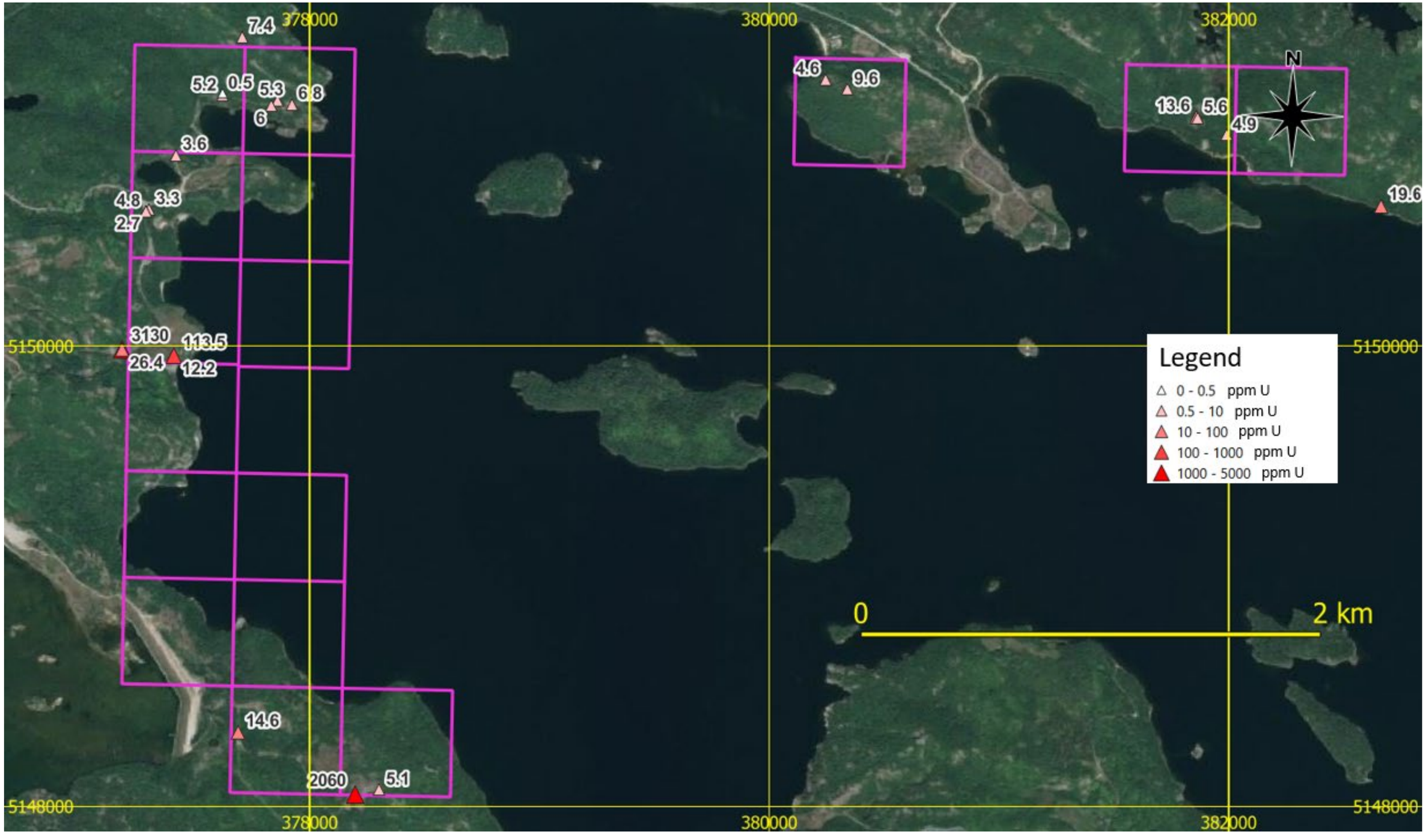


Figure 24: Uranium values returned (ppm) for samples submitted for analysis from the Radio Fuels properties. NAD83, Zone 17.

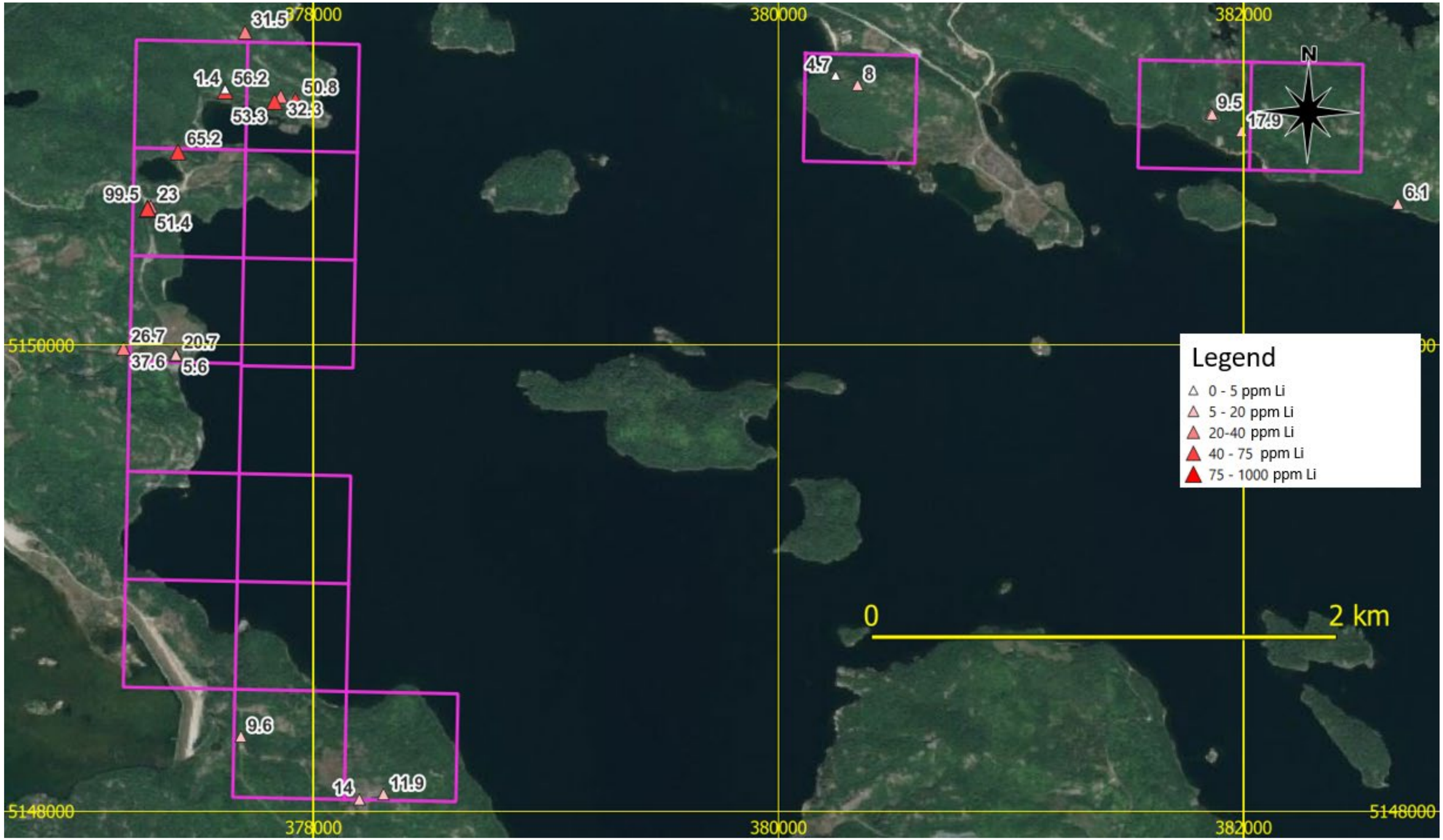


Figure 25: Lithium values returned (ppm) for samples submitted for analysis from the Radio Fuels properties. NAD83, Zone 17.

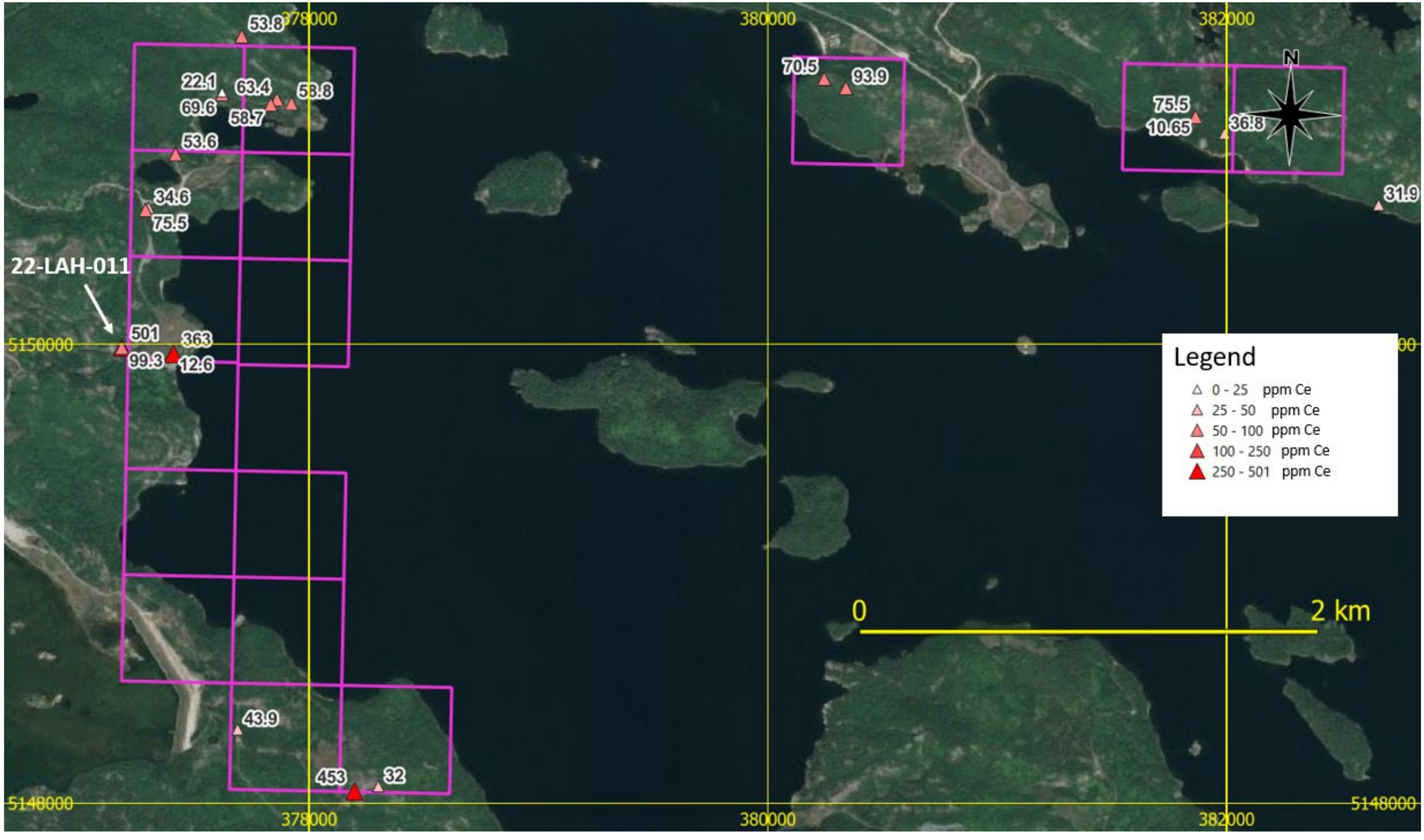


Figure 26: Cerium values returned (ppm) for samples submitted for analysis from the Radio Fuels properties. NAD83, Zone 17. Note that the labelled sample 22-LAH-011 returned an over-limit value that is labelled above as 501 ppm to indicate that it is over-limit.9i888888888888888888888888888

References

Ontario Geological Survey 2011. 1:250 000 scale bedrock geology of Ontario; Ontario Geological Survey, Miscellaneous Release–Data 126 - Revision 1.

Project costs:

Salary (Brenda Hodgins field work) 5 days at $750/day	$3750.00
Salary (Lindsay Hall field work) 5 days at $1250/day	$6250.00
Salary (Lindsay Hall research and report writing) 50 hours at $100/hour	$5000.00
Field accommodations (Dunlop Lake Lodge – 4 nights, 2 people)	$700.60
Vehicle mileage: 1358 km at $0.60/km	$814.80
Food ($50/day/person *per diem*) 5 days, 2 people	$500.00

Subtotal	**$17015.40**
- Amount to Quirke Lake Panel Property (1/4 field day + 1/3 of 2 travel days = .183 of subtotal)	$3113.82
- Amount to Quirke Lake North Property (1/4 field day + 1/3 of 2 travel days = .183 of subtotal)	$3113.82
- Amount to Quirke Lake West Property (2 1/2 field days + 1/3 of 2 travel days = .634 of subtotal)	$10787.76
Shipping costs (total $251.07, 23 samples shipped = $10.92/sample x 19 applicable samples)	**$207.41**
Portion to Quirke Lake Panel Property – 2 samples	$21.83
Portion to Quirke Lake North Property – 2 samples	$21.83
Portion to Quirke Lake West Property- 15 samples	$163.75
Analytical costs ($70.86 per sample), 19 samples	**$1346.29**
Portion to Quirke Lake Panel Property – 2 samples	$141.71
Portion to Quirke Lake North Property – 2 samples	$141.71
Portion to Quirke Lake West Property - 15 samples	$1062.86

Total costs applied to Quirke Lake Panel Property ($2752.82 + $21.83 + $129.80) $3277.36

Total costs applied to Quirke Lake North Property ($2752.82 + $21.83 + $129.80) $3277.36

Total costs applied to Quirke Lake West Property ($9509.76 + $163.75 + $973.50) $12014.37

RS-125/230

Super Spectrometer System

USER MANUAL

Version 3.0

Part Number P-1306

TABLE of CONTENTS

RS-125 Super-Spec
RS-230 BGO Super-Spec

User Manual

Rev 3.0 – Oct 2011

1 GENERAL

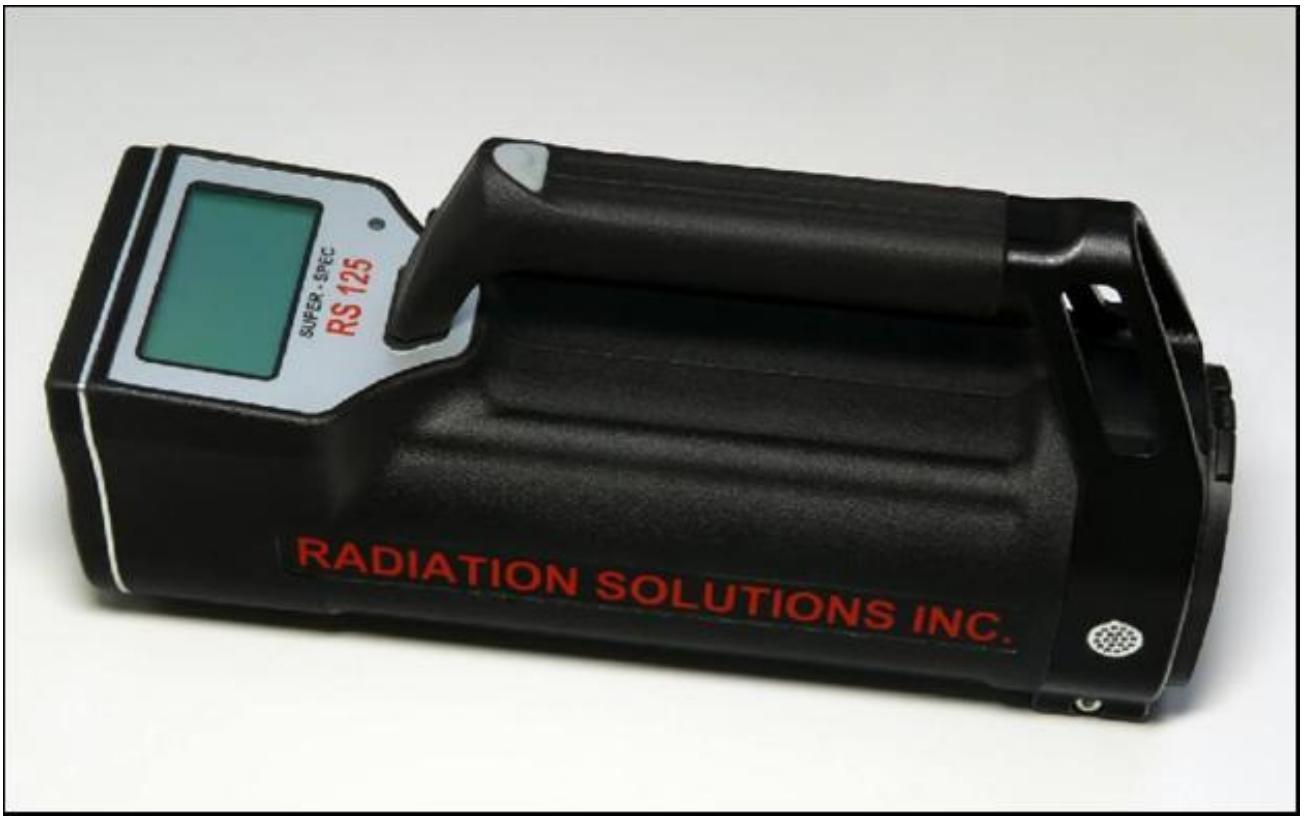
The new RS-125/230 Spectrometer is the state-of-the art in portable hand-held radiation spectrometer survey instrument for the Geophysical industry. It offers an integrated design with full weather protection, large detector, ease of use and the highest sensitivity in the market segment. This unit offers users a full Assay capability with internal data storage and PC data retrieval and display.

NOTE: the only difference between the 2 units covered in this manual are:

- RS-125 has a 6.3 cu ins Sodium-Iodide detector
- RS-230 has a 6.3 cu ins BGO detector that offers performance similar to a 21 cu in Sodium-Iodide detector
-

For simplicity the manual refers only to the RS-125 but system operation is identical for RS-230 instruments

Users are advised that the manual and software supplied with the instrument were current when manufactured however a program of continuous improvement means that many new features are added and old ones improved with time. **Users are advised to contact RSI directly for new releases including new manuals and software.**



1.1 MAIN FEATURES

- **RS-125 = 2x2" (6.3cu in**) Sodium-Iodide detector provides High sensitivity performance due to the large xtal. Energy response from 30 keV-3000keV.
- **RS-230 = 2x2" (6.3cu in**) BGO detector provides typically 3x equivalent performance over comparably sized Sodium-Iodide detectors.
- Full ASSAY capability with data in **%K and ppm U and Th.**
- **no radioactive sources required for proper operation**
- **USB** connection for data retrieval
- **Bluetooth** support for data transfer
- Large easy to read **5 digit display** updated at 1/sec – giving a wide dynamic range, no overflow, no range controls. Graphic display LCD with white backlight with automatic dimming - 128 x 64 pixels, 28 x 60mm size
- Simple **ONE BUTTON OPERATION** – no parameter setups required for normal operation
- Fast response, easy-to-hear **AUDIO** at 20/sec sampling making source location easier and eyes free
- **512K** memory standard on older units – **4M** standard on newer units (512K memory units can be upgraded if required)
- New design state-of-the art electronics with advanced CPU/spectrometer capability
- Special rugged design, robust aluminum casting construction with a heavy duty "**Rubberized**" outer coat which works as a shock absorber and provides thermal isolation.
- Outer coating gives a **good grip even when wet**, is simple to maintain and permits easy decontamination if required.
- Well balanced, easy to hold and designed for **one hand operation**
- **RUGGEDISED** integrated carrying handle
- **Full IP66 weatherproofing** – short term water immersion and fully dust protected
- **Rechargeable battery kit** supplied including NiMH battery pack module (4xAA) batteries, Universal Charger (110/220VAC) and a 12V cigarette lighter charge cable.
- Typical **8+ hour** battery life at 15^0 C on NiMH batteries
- Size 10.2" x 3.2" x 3.6" – 4.4lbs **with batteries** (259x81x91mm – 2Kgs : RS230=2.2Kgs)
- Operational Temperature range **-20 to 50 degrees** Celsius (display is the limit)
- Spare battery module for "**instant**" replacement
- **Protective boot** with carry straps (supplied standard with 2008 units but available as an option for older units)

N.B. see Section 5 for summary of new software system changes. Note that this manual incorporates all changes in the current release

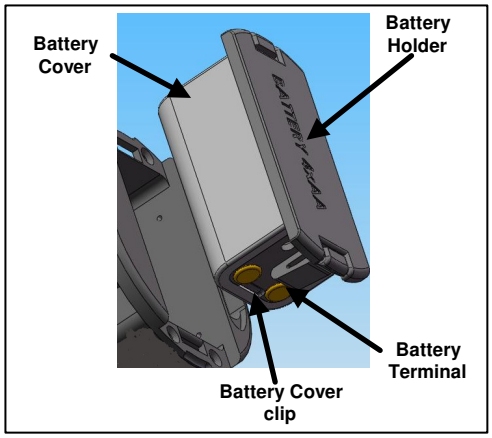
NOTE: USERS ARE REMINDED THAT THE RS-125, IN COMMON WITH OTHER SIMILAR INSTRUMENTS, USES A Sodium-Iodide CRYSTAL AS THE DETECTOR (the RS-230 uses a BGO detector). THESE CRYSTALS ARE FRAGILE AND EVEN THOUGH THE UNIT HAS BEEN RUGGEDISED FOR FIELD USE, GREAT CARE SHOULD BE TAKEN TO AVOID ABUSING THE INSTRUMENT AS THE VERY EXPENSIVE CRYSTAL IS NOT COVERED UNDER WARRANTY

2 SYSTEM OPERATION

2.1 BATTERIES

a) **LOAD BATTERIES in HOLDER** - the unit is shipped with the batteries separate. Remove the Battery Cover by depressing the Battery Cover Clip at each side. Load the 4 x AA cells with negative at the spring end. Slide the battery Cover back in place ensuring that the side guides are lined up – if all OK the Cover should fit smoothly on.

b) **LOAD BATTERIES in UNIT** – slide the Battery Holder into the base of the RS-125 with the battery Terminals on the side of the copper terminals in the unit. (if in incorrectly the unit will not power on). If all is OK the 2 side mounted clips should "click" into place to hold the Battery Pack solidly into the RS-125 unit.



THE RS-125/230 ARE SHIPPED WITH CHARGED BATTERIES. HOWEVER OVER A PERIOD OF TIME THESE BATTERIES WILL DISCHARGE SO USER ARE ADVISED TO FULLY CHARGE BATTERIES BEFORE USE (4hrs MINIMUM)

2.2 BUTTON

The RS-125 Super-Spec instrument has only ONE control that is the front panel PUSH-BUTTON referred to as **BUTTON**.

This Button is actually mounted on the face of the instrument but with the normal handle attached, connection to the Button is via a mechanical link from the Button on the handle. The Button has 3 primary actions:

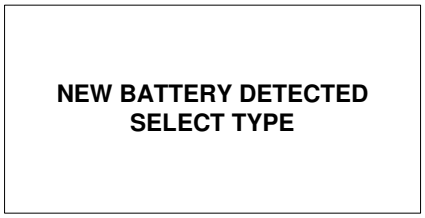
- **CLICK** – this is a short (less than 1 second button action)
- **LONG** – this a longer action typically 3 seconds with display feedback

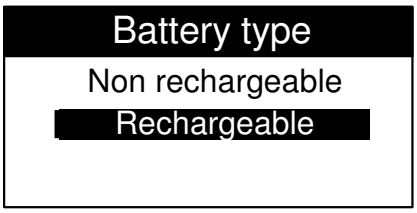
2.3 DISPLAY

The Display is a back lighted LCD display optimized for high contrast in outdoor conditions. Display Backlighting is required in low light conditions to make the display readable but this reduces battery life so to optimize battery life the backlighting automatically comes on ONLY when required. The Display is used for various functions and messages.

2.4 POWER ON after BATTERY CHANGE

Press the **BUTTON** until the unit beeps then release the **BUTTON**. The battery change label is shown for 2 seconds then changes to the next display which requires battery type selection.





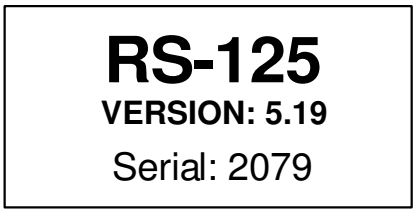
NOTE: The Battery Type selection is required to let the unit know which batteries are used. Battery discharge rates vary between battery type so that for Low Battery detection it is essential the unit knows the correct battery selection. Normally RECHARGEABLE batteries are the correct option for the RS-125 as this is what is supplied with the unit – but the user can select to suit their requirements

USERS SHOULD BE CAREFUL NOT TO LOAD non-RECHARGEABLE BATTERIES SUCH AS ALKALINE, INTO THE UNIT THEN CHARGING THEM. EVEN THOUGH THE UNIT HAS PROTECTION AGAINST THIS EVENTUALLY THE ALKALINE BATTERIES WILL LEAK AND DAMAGE THE INSTRUMENT

CLICK the **BUTTON** (short less than 1 second) to move between selections. Once the correct selection is highlighted hold the **Button** (LONG-CLICK) until the selection background changes – release the **Button** for the correct selection

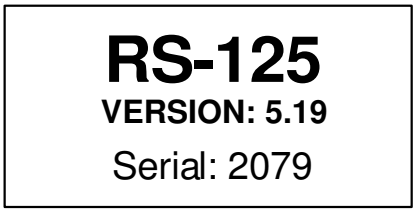
The next display is the start up display and shows for 3 seconds then changes to the **SURVEY** display (2.6 below).

NOTE: the software version will be 5.79 in this case



2.5 POWER ON normal

Press the **BUTTON** until the unit beeps and the sign on display is seen, then release the **BUTTON**. After 3 seconds the sign on display changes to the SURVEY DISPLAY.



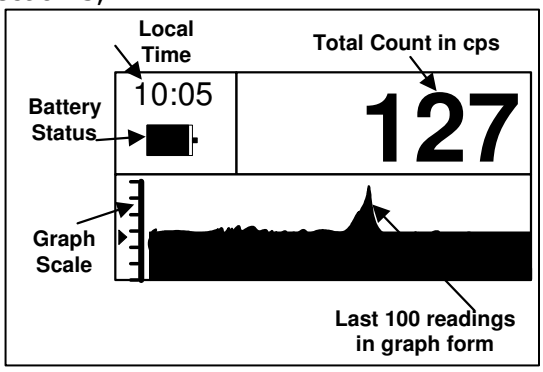
NOTE: The Version# is the installed software version of the unit. In any communication with RSI regarding system performance, it is very helpful to specify the SERIAL # and the SOFTWARE VERSION to enable better trouble shooting support

2.6 SURVEY DISPLAY

The Survey Display is segmented as shown in the figure.

Local Time: settable to Local Time in Parameter Setup – section 3,4

Battery Status: an Icon that shows current status of the battery



ALKALINE batteries 

RECHARGEABLE batteries 

Total Count: current radiation level in counts/second units

Graph: the last 100 readings are shown in graphical form. The right hand reading is the oldest and the left hand is the latest. This helps the user to look for small changes they might have missed

2.7 AUDIO

a) **INTERNAL** - the RS-125 has an audio speaker inside the unit. The audio system is activated when the radiation level gets above a certain internally computed Audio Threshold. Once the Audio Threshold is exceeded then the Audio INTENSITY will reflect the incoming count rate to provide a varying INTENSITY level that relates directly to count rate and therefore local radiation intensity.

In this manner a hands-free survey can be carried out that is usually highly recommended in many field situations where often the eyes are selecting the terrain so, without proper audio feedback, some significant count levels could be missed if the eyes are distracted. The Audio system can be fine-tuned in Parameter setup if required

b) BLUETOOTH AUDIO

Since the unit has Bluetooth (BT) connectivity, a new feature is the ability to use a BT earphone system for improved audio in very noisy areas (rivers, rain etc.) See section 3 below to activate the selected BT earphone system (the RS-125 assumes that VOLUME control is on the earphone as is normal on most units) – see section 4 for special parameter changes for Audio

2.8 STABILIZATION

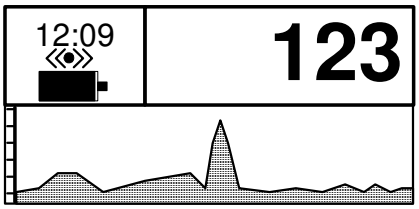
Spectrometer systems like the RS-125 use an integrated SPECTROMETER system to provide data for analysis of ASSAY results. The accuracy of these results is a function of many items but a very significant one is spectrometer stability. It is crucial that the system spectrometer maintains a stable operational mode independent of temperature etc. To provide accurate Assay data the spectrometer **must be stabilized** to also give data independent of local conditions that could affect the data.

To achieve this, the RS-125 has a **FULLY AUTOMATIC** spectrum stabilization system integrated inside the unit that uses the low radiation levels from surrounding geology to perform this analysis. In principle the system accumulates spectra **INTERNALLY** while the system is powered ON and once a high enough level has been achieved then a complex analysis takes place to determine the correct spectrum position. This analysis results in an error measurement that the system uses internally to correct these effects. Note that this process is completely independent of the user. Typical Automatic Stabilization takes 5-10 minutes depending on local conditions.

IF USERS EXPERIENCE STABILIZATION PROBLEMS PLEASE CONTACT
service@radiationsolutions.ca

Once the system is fully stabilized a new icon ((●))

appears on the display above the Battery icon to show the analysis is complete – see figure. The RS-125 can continue to be used in the SURVEY mode while this fully automatic process is carried out in the background



If the system is **NOT** stabilized and the user attempts an **Assay**, an error message appears and **the unit beeps 3 times**. **If the user ignores this warning, the Assay continues** – note that under these conditions the quality of the Assay data is questionable as system Stabilization is incorrect so the data could be roughly OK if stab is close but really bad data if Stab is significantly in error. The stab status is shown on the data retrieved to the PC for data verification

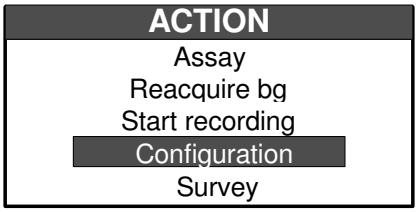
System NOT stabilised

Stabilization accumulation of data is NOT interrupted by the Assay process. In fact an auto correction is implemented so that if at the end of Assay a Gain correction is required, the system automatically computes the potential Gain error and corrects the data to minimize system errors.

In addition the unit beeps every time it stabilizes as a reminder to the user that all is well. This can be inhibited if judged to be a problem – contact RSI.

2.9 ACTION

The RS-125 only has one **BUTTON** as noted above. To achieve the required system functions **CLICK** (short) and a Menu appears. The user navigates up and down this menu using **CLICK** (short) and the highlighting moves with the selection. Once the selection is made, hold the **Button** until the background changes from Dark to Light (typically 2-3 secs) then release the Button to make the selection



Selections:

a) **Assay** – activates the ASSAY capability of the system (see section 2.10 below)

b) **Reacquire bg** – rests system background (see section 2.11 below)

c) **Start recording** – activates the RECORDING capability of the system (see section 2.12 below)

d) **Configuration** – permits parameter change (in older software parameter selection was accessed on power up but 519 has made setup easier) - see section 3 below

e) **Survey** – this selection returns to the previous SURVEY display with NO change in background setup levels

2.10 ASSAY

NOTE: THE DISPLAY MUST SHOW THE STAB ICON BEFORE THE ASSAY DATA IS VALID

System not stabilized

If ASSAY is attempted with incorrect Stabilization an error message will appear on the display and the unit will beep 5 times. Correct action is to press the button once to terminate the ASSAY and wait until the unit is stabilized (normally 2-5 mins max)

When the **ASSAY** selection is made the ASSAY mode starts and a new display is seen

ASSAY DATA	
Time	85/120s
Dose Rate	38.4nGy/h
K	1.1%
U	29.3ppm
Th	11.5ppm

Meas Time – when the sample starts, a preset Sample Time parameter shows the sample time on the right and on the left is a count up timer showing sample progress.

Once the first 30 secs sample point is reached an Assay result is shown. Each additional 30 secs the Assay data is recomputed and updated on the display.

For best accuracy the full count period should be permitted. However in very anomalous areas sample times as low as 60 seconds give very good data due to the large detector size. Guidelines are:

60 secs – anomalous area – low quality data is fine – fast sampling is required to get maximum data for an area in a short period of time

120 secs -DEFAULT VALUE – anomalous area – medium quality data is fine – fast sampling is required to get maximum data for an area in a short period of time

180 secs – medium anomalous area – good quality data is required

240 secs – medium to low anomalous area – high quality data is required

300-1800 secs – low anomalous area – maximum quality data is required

Note if the sample period is set ABOVE 999 secs then for display limitation reason, the "Meas time" is shown as a % of completion starting at 0.1%

FOR EASE OF USE THE SAMPLE PERIOD IS NORMALLY SET TO 120 secs AS THIS VALUE GIVES GOOD QUALITY DATA IN MOST CONDITIONS. See Section 3 and 4 to change to suit users requirements.

At the end of the preset Assay period the sample stops and the audio continuously beeps to advise user of the end of sample. The user takes the unit and presses the **Button** to stop the audio and inspect the display results. Note the display top label now shows "ASSAY RESULTS".

ASSAY RESULTS	
Time	120/120s
Dose rate	38.4nGy/h
K	1.1%
U	29.3ppm
Th	11.5ppm

Note that the **K** data is shown in **%** and the **U and Th** data in **ppm** (parts/million – N.B. ppm/10,000=%). The **Total Count** is usually shown in DOSE units (Sv/Gy, R) to give users an idea of the relevant Dose information and can be used as an overall indication of radiation intensity.

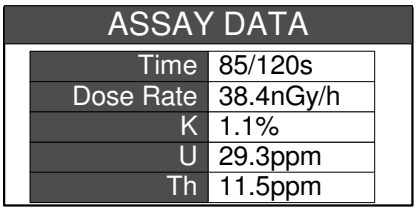
The user can then view/note these results then press the **BUTTON** again and the display shows

Assay #51
14/11/07 11:15:03

The user has approx. 3 secs to note the TIME or the Spectrum # to enable them to relate the stored data to the actual sample location when data is retrieved from the unit. Alternatively the user can note the **TIME** on the RS125 display **BEFORE** the sample is started as perhaps an easier way to record the data results relationship to sample location. The data is stored in system memory and can be retrieved later (see Section 4). NOTE: when the unit is initially setup the first spectrum is #0, after that they increment 1, 2, 3 etc. Even when data is erased this continues so if the last spectrum of the day was #46 then the first spectrum of the next day could be #47 the next #48 etc. This number continues to increment indefinitely so identical sample #'s cannot occur. This method of "universal spectrum numbering" helps in minimizing data confusion.

SHORTEN ASSAY PERIOD

At any time **AFTER THE FIRST 30 SECS** - the user can **stop** the Assay progress by a short **CLICK** of the Button – the display then shows the Assay Results with the time shown at whatever it stopped at. This is NOT recommended as the quality of the data depends a lot on the sample time.



Selecting a fixed sample time (usually 120 seconds) and ensuring all users wait for full sample completion, is a sensible way to maintain overall data quality

DATA MEMORY LIMITS: Refer to section 4 (MEMORY) to determine system memory limitations and selections. The user is recommended to download data each day to prevent data loss.

GPS with ASSAY

If a GPS unit is configured (linked) to the RS unit then GPS location data is recorded at the end of the Assay period. To conserve GPS battery power it is only necessary for the GPS to be powered ON for a short time during the Assay sample period. To assess this – at the start of Assay power the GPS to ON and there should be a flashing cross-hair below the battery icon. Once the GPS has a good lock on satellite data, the cross-hair goes steady. As soon as this steady-state is seen the GPS coordinated have been transmitted to the RS unit so the GPS can now be powered OFF. Of course the GPS can stay on at all times if battery conservation is not a problem

SPECIAL FUNCTIONS – see section 4.9.Measurement for special Assay actions

2.11 Reacquire bg

When in the SURVEY mode of operation, the AUDIO THRESHOLD is set using a preset parameter – usually 1 Sigma for Geophysical application. When the unit is powered on, after internal checks the first 3 x 1 second samples are averaged and the Audio Threshold computed from this average – then the Audio is enabled. If the count level exceeds this threshold the audio sounds as described above. However in many areas the local background changes and this causes threshold problems.

As an example if the local background level was 100 cps then at 1 Sigma the Audio Threshold = 110 cps (100 + 1 Sigma). So if the count rate goes above 110 cps the audio will sound. However if the local Background increases substantially to 300 cps then the audio will be on continuously and the audio will not seem as sensitive to small local changes. Similarly if the local Background goes down to 50 cps then the local radiation would have to increase very substantially before the audio sounds – thus effectively desensitizing the audio system

To overcome this "problem" AT ANY TIME the user can briefly touch the **BUTTON** and select the **Reacquire bg** selection. Then the system will return to the SURVEY display and the system will automatically recompute the Audio Threshold and the message "UPDATING BACKGROUND" will be seen on the display for the 3 seconds of the update. This means the user can "retune" the Audio Threshold at any time thus keeping the audio threshold optimized

2.12 Start RECORDING

The RS-125 now has a RECORDING capability that permits automatic recording of **TOTAL COUNT** data and/or **ASSAY RESULTS** into memory to permit line profiles etc. In addition an external **GPS** unit can be interfaced directly into the unit via the Bluetooth connection and the GPS data **integrated directly into the internally stored data memory**.

NOTE: **MEMORY** – system memory is allocated to suit users requirements. See section 4.9 for details and changes)

a) RECORDING WITH GPS

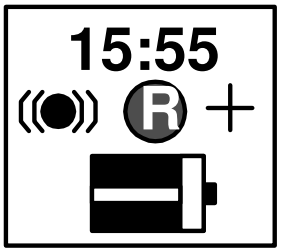
The system has been developed to work with the **GARMIN 10** GPS system which has Bluetooth capability and communicates data directly to the RS-125. However the GPS output data stream (GGA format) is common to all units so other GPS units should work fine **BUT THEY HAVE NOT BEEN TESTED AT THIS TIME**

GPS INITIALIZATION

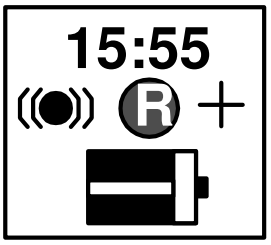
Setup the GPS recording link as described below in Section **3**. Once the GPS is activated (linked) to the RS-125, data recording can start.

From the Main Menu select "**Start recording**" and new icons appear on the display as shown in the figure.

The "**R**" symbol shows that recording is ON and the **cross-hairs** show the GPS connection. If the cross-hair symbol is flashing this means that the GPS has not found a good satellite lock so data recorded in the system for Lat/Long are ZERO. When the GPS acquires satellites the cross-hair is solid showing proper location data is being recorded



NOTE: when the GPS is activated it does nothing until the **START RECORDING** selection is made. Then the units starts to automatically acquire satellites to get a good lock. It is very common that it takes 5-10 minutes to get a good lock with as many satellites as are available (this is the equivalent of a cold start. Once it has found ALL the satellites available it only needs 3 to get a good position. This means that once it has got all the satellites available it can continue to give good data even in areas where many satellites are lost.



b) WITHOUT GPS

If no GPS is connected or activated Profile recording can still occur. From the Main Menu select "**Start recording**" and new icons appear on the display as shown in the figure. The "R" symbol shows that recording is ON and the flashing GPS cross-hairs still appears but may be ignored

2.12.1 DATA RECORDING GENERAL

The data recording action shown with the  symbol means that the selected data is being recorded.

Section 3.m below permits the user to select whether to record TOTAL COUNT data only, ASSAY RESULTS only or both.

a) TOTAL COUNT data only

Set parameters as required

RECORD TYPE = **Total only**

Total scan period = 1- 20 secs (e.g.1 sec)

MEMORY allocation as in section 4, selected to suit recording needs

When **START RECORDING** is selected then Total Count data is stored in memory at the selected rate (Total scan period) of 1 sample/sec (or as selected).

The data is stored in 30 sample data blocks. If an external GPS is integrated, the GPS data is stored every 30 samples – if no GPS is connected the GPS data is stored as zeros.

Some users want to record GPS data at a faster data rate. This can be done but some memory gets sacrificed – **see Appendix B**

When data recording is complete press the Button to see the menu and select **Recording OFF** to terminate recording

RS-Analyst is used to retrieve this profile data see section 4 for more details

b) ASSAY RESULTS data only

User must select:

RECORD TYPE = Assay only

Assay scan period = 30-1800 secs (e.g. 30 sec)

MEMORY allocation – as described in section 4.9

Parameter setup can be done manually as described in Section 3 below but it is much easier to do via PC connection as shown in section 4

When **START RECORDING** is selected then **Assay Results** only (no spectra) data is going into memory at the selected rate of 30 secs/sample.

The data is stored in a txt file, if an external GPS is integrated the GPS data is also stored – if no GPS is connected the GPS data is stored as zeros.

When data recording is complete press the Button to see the menu and select **Recording OFF** to terminate recording

RS-Analyst is used to retrieve this profile data as shown below in a space delimited file that can be read into Excel as required – see section 4 for more details

c) TOTAL + ASSAY data

In this case BOTH the Total Count + GPS data and the Assay Results + GPS data are stored in their appropriate memory locations and can be retrieved as described in section 4.

2.13 POWER OFF

To power OFF the unit, press and hold the **BUTTON** and the unit powers OFF. The display shows a countdown "**TURNING OFF 3**", "**TURNING OFF 2**", "**TURNING OFF 1**" then the unit finally powers off. Sometimes this countdown sequence can take a few seconds before initiating if the unit is "busy" but typically no more than 5 seconds before the countdown sequence starts. At anytime before power OFF, if the **BUTTON** is released the unit continues to function.

2.14 LOW BATTERY

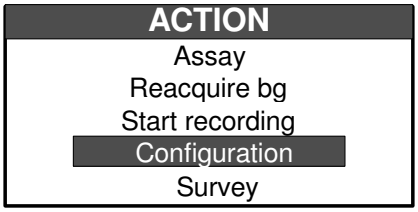
If the Batteries are getting low, an audio beep prompts the user to view the display. If the Battery icon shows very little battery left the battery pack should be changed. RSI recommends that a spare Battery Pack is carried at all times to prevent field problems as changing is a few seconds task with NO loss of stored data.

2 Battery modules are supplied with each unit

3 CONFIGURATION (MANUAL METHOD)

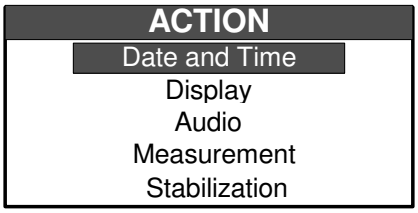
(Section 4 shows a much simpler way of parameter changes via the PC)

Select **CONFIGURATION** for the display reached by clicking BUTTON.



a. **CLICK** (short press of the BUTTON) to move down the menu. The screen highlights the selection. Move down the menu until the required parameter is reached then **LONG CLICK** (press BUTTON until the backlighting of the display changes from White figures on a Black background to the opposite) – then release the BUTTON to select this parameter

b. Once the parameter is selected use **CLICK** (short BUTTON) to move down the menu selection. Once the correct one is reached **LONG CLICK** (hold BUTTON until the background changes) then release the BUTTON to select.



PARAMETERS

a. **DATE and TIME**

i. **YEAR -** YEAR for the internal CLOCK. The display shows 2006, 2007, 2008 etc. **CLICK** to select the right YEAR then **LONG-CLICK** to set this selection

ii. **MONTH -** this sets the MONTH for the internal CLOCK. The display shows Apr, May, Jun etc. **CLICK** to select the right MONTH then **LONG-CLICK** to set this selection

iii. **DAY -** this sets the DAY (DATE) for the internal CLOCK. The display shows 1, 2, 3 ……31. **CLICK** to select the right DAY then **LONG-CLICK** to set this selection

iv. **HOUR** – this sets the HOUR for the internal CLOCK. The display shows 0,1,2,3…23. **CLICK** to select the right HOUR then **LONG-CLICK** to set this selection

v. **MINUTE** - this sets the MINUTES for the internal CLOCK. The display shows 0,1,2,3…59. **CLICK** to select the right MINUTE then **LONG-CLICK** to set this selection

vi. **GO BACK** – return to the higher menu

b. **DISPLAY**

i. **CONTRAST** sets the Display CONTRAST. Selections are -3, -2, -1, 0, 1, 2, 3. -3 to -1 lightens the display, +1 to +3 darkens it. Normally "0" is a good average selection. **CLICK** to select the right setting then **LONG-CLICK** to set this selection

ii. **BACKLIGHT** – this sets the Display BACKLIGHT.. Selections are AUTO, ON, OFF.

AUTO = the system automatically selects the required Backlighting using a light sensor to set the required level. This is the best selection but in dark shadow areas the Backlighting will come ON to make the display more visible. While often this is a required feature the downside of this is a significant reduction in battery life by typically 40% if the Backlighting is ON all the time

ON = overrides the light sensor and sets the Backlighting ON all the time
OFF = sets the Backlight permanently Off to conserve battery life.

iii. **GO BACK** – return to the higher menu

c. **AUDIO**

i. **VOLUME** - this enables or disables the audio survey system. Selections are ON, OFF
ON = Audio is enabled
OFF = Audio is disabled
For Geophysical applications set to **ON** as Audio Survey is an essential operational requirement, the OFF mode is used for special applications

ii. **FILTER LENGTH** – this sets the filtering parameters to optimize the audio system response for different applications. Selections are 1-10 and indicate the number of 50mS samples are averaged.
1 = shortest filter thus the fastest audio response
10 = longest filter giving the slowest response
SHORT filters give fast response but don't give such a "smooth" response to a slowly increasing field.
LONG filters give a very smooth "even" response for a slowly moving field but tend to minimize short term local effects

For most Geophysical applications a setting of "**9**" is appropriate

iii. **THRESHOLD** - this sets the Audio response threshold. Selections are 1x to 5x Sigma levels of the average of the first 3 samples. If 3 Sigma is selected then when the unit starts the local radiation BACKGROUND is averaged for a 3 second period (display shows **Updating Background**).

This local background average is then used to compute the selected 3 Sigma (3 Standard deviations) level and this is ADDED to the average background to set the AUDIO THRESHOLD. Each new radiation sample (at a 20/sec rate) are tested against this AUDIO THRESHOLD and if above it then the audio sounds.

As an example – a typical local background level could be 100 cps (counts/second). So a selection of 3 Sigma would set the Audio Threshold = 100 + 3 x Sq Rt of 100 = 100+30=130. So if the count level goes above 130cps the audio will sound.

Once the Audio Threshold is exceeded then the Audio INTENSITY will reflect the incoming count rate to provide a varying INTENSITY level that relates directly to count rate and therefore local radiation levels. In this manner a hands-free survey can be carried out that is usually highly recommended in many field situations where often the eyes are selecting the terrain, so without proper audio feedback some significant count levels could be missed if the eyes are distracted. For most GEOPHYSICAL applications, **a 1 Sigma level is recommended and this is the DEFAULT setting**. This means that occasionally the unit will "chirp" on local background but this is often comforting as a means of ensuring the unit is functioning.

In some other operational areas this random chirping can distract the user so for these SPECIAL applications a 3 Sigma level can be used

CLICK to select the right setting then **LONG-CLICK** to set this selection

iv. **GO BACK** – return to the higher menu

d. **MEASUREMENT**

i. **TOTAL SCAN PERIOD** – the user selects the SCAN data rate for Recording Total Count data – selections are 1-20 secs – **default = 1 sec**

ii. **TOTAL AVERAGING** – this sets the filtering of the display numeric data. Selections are 1,2,3,4,5 and these are Moving Average parameters

1 = NO filtering at all so numeric data is displayed as recorded – normally recommended for Geo users and the DEFAULT setting

3 = a 3 point filter so the numeric data displayed is a 3 point moving average updated at a 1/sec rate

5 = a 5 point moving average

In most Geophysical applications the user utilizes the AUDIO to find the approximate peak intensity location and the NUMERIC data to select the actual hot-spot. In this application a setting of "**1**" gives the fastest response but the other settings are available as required

iii. **ASSAY TIME –** the user selects the SCAN data rate for recording Assay Results data – selections are 30-1800 secs – **default = 30 sec**. Note that Assay auto scan **SPECTRA** are **NOT** stored in memory to conserve memory space however normal Assay still stores full spectral data.

iv. **OnFlyAssay Window** – sets the period in seconds that the On-the-fly Assay data is averaged for. Assay data below 20 secs is very noisy so normally this parameter should be set to a minimum of 30 (secs). Note that these data are computed as a running average on a 1/sec basis.

Thus when started, for the first 30 seconds no data is computed until this time period is achieved then a 30 second average is computed. This average is then updated at a 1/second rate and used as required

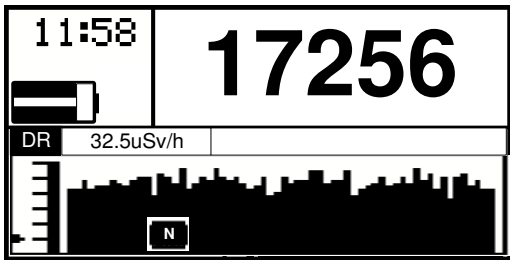
v. **OnFlyAssay storing** – sets the period in seconds at which the On-the-fly Assay results computed as noted in (iv) above are stored in data memory during recording.

vi. **Show OnFlyAssay** – sets the period in seconds at which the On-the-fly Assay results computed as noted in (iv) above are displayed

vii. **RECORD TYPE** – this selects the type of data recording method used when START RECORDING (SCAN mode) is selected. Also see MEMORY selection in Section 4.

- **Only total –** selection means that START RECORDING only stores TOTAL COUNT data and GPS
- **Only Assay -** selection means that START RECORDING only stores ASSAY RESULTS data and GPS
- **Total+Assay -** selection means that START RECORDING stores TOTAL COUNT + ASSAY RESULTS data and GPS

viii. **Show Dose** – this allows the user the ability to show the DOSE RATE on the front display. Note the Dose Rate is computed from KUT data results and is referred to as the GEOPHYSICAL ASSAY. Users should note that if (for example) an artificial isotope such as Cesium-137 is placed near the unit, the Count rate will change as the system sees the radiation but the Dose Rate will be essentially unaffected as Cs-137 is outside the KUT calculation matrix.



ix. **DOSE UNITS** – user can select R, Gy or Sv as required

x. **GO BACK** – return to the higher menu

e. STABILIZATION

i. **CS STABILIZATION** – permits the user to carry out stabilization using a Cesium-137 source. This is a special capability sometimes useful if the unit has serious troubles.
It requires the availability of a Cesium-137 typically 1-10uCi spaced a few inches away from the face of the unit (1uCi against the face, 5uCi 2" away, 10uCi – 6" away is recommended). Once the source is positioned, activate the selection and the unit will stabilize itself automatically on the Cesium source. When it says **COMPLETE**, remove the source and carry on as usual. The advantage of this capability is that Cesium-137 is a very defined source so if the unit's stabilization is completely lost, the **Cs stabilization** can often fully recover it. Huge improvements in 519 software makes this feature non essential but under special circumstances it is useful. Consult RSI before using this feature if unsure.

ii. **TEMP.RECOVERY** – under special circumstances an abrupt change of temperature can sometimes make the Gain adjustment step computed by the automatic system stabilization fail, this is especially true of the BGO detector in the RS-230. To help the system recover if a unit will NOT stabilize within 5 minutes – select this **Temp.recovery** option. The unit will then reload the original calibration data at the factory corrected to the local temperatures. After this action the unit should stabilize OK.

iii. **GO BACK** – return to the higher menu

f. ACCESSORIES

i. **BATTERY TYPE** – this sets the type of Battery used. Selections are "**Non rechargeable**" or "**Rechargeable**"

Non rechargeable = selects Alkaline non-Rechargeable batteries. It is highly recommended that if non-rechargeable batteries are used then ONLY ALKALINE batteries be chosen. Some non-Alkaline non-rechargeable batteries can leak and cause problems inside the instrument. If non-Alkaline are used then remove the battery clip after use to avoid this fairly common leak problem

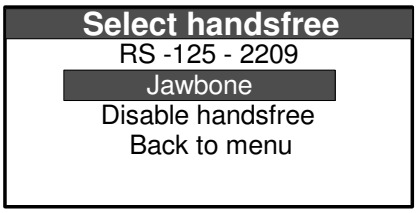
Rechargeable = the internal battery system will automatically select battery type so NiCd or NiMH batteries can be used. However NiMH batteries (2500 series) are highly recommended as NiCd batteries have significant operational limitations in prolonged use (also see Section 5)

ii. **GPS** - this selection is used to couple an external GPS to the system by Bluetooth (BT) link (currently only the GARMIN 10 is supported). The users manual of the GPS should be consulted too ensure that the unit batteries are charged. Once batteries are OK switch the units BT capability **ON**

Choose - **Select GPS** – display shows **"Looking for Handsfree devices"** then various messages and finally the "**Select GPS**" display is seen. Use the Button to cursor down to select "**Garmin GPS 10**", then LONG Button down until the reverse video changes to select the device. Message says "**Connecting to device**" and then finally "**GPS connected**" then the display goes back to the main menu. Exit the menu to go back to the Survey screen.

iii. **HANDSFREE** - this selection is used to connect the RS-125 to an external BT earphone system. In the example below a JAWBONE system is described but most BT compatible earphone are supported. The users manual of the earphone should be consulted too ensure that the unit batteries are charged. Once batteries are OK switch the units BT capability **ON**

Choose - **Select HF** – display shows **"Looking for Handsfree devices"** then various messages and finally the "**Select Handsfree**" display is seen as in figure. Use the Button to cursor down to select "**Jawbone**", then LONG Button down until the reverse video changes to select the device.



Message says "**Connecting to device**" and then finally "**Handsfree connected**" then the display goes back to the main menu. Exit the menu to go back to the Survey screen, enable the BT device and a special icon should be seen on the tope left of the display below the clock

Now if the unit internal audio activates to show the presence of radiation the earphone audio mirrors this data. Note that the earphones own audio level control is used to control volume.

iv. **GO BACK** – return to the higher menu

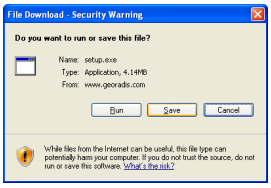
4 PC CONNECTIONS

NOTE: The PC data retrieval and display program supplied to support the RS-xxx portable instruments is being frequently updated to add user required features. With each unit, RSI supplies software on a CD. The latest software, firmware and documentation version is available at the following link:
http://www.radiationsolutions.ca/sw/Handhelds/RS125-230.zip

Note that new versions of RSAnalyst may NOT be compatible with older software but the Analyst PC Software update process also permits updates of the firmware inside the RS-125/230 as required. So the rule is if you want to update – then update **BOTH** the RSAnalyst and the unit's internal FIRMWARE as detailed below

NOTE: the RS-125/230 instruments are a joint development of RSI and our sister company GEORADIS so some software screens may be labeled GEORADIS as required

4.1 PC SOFTWARE



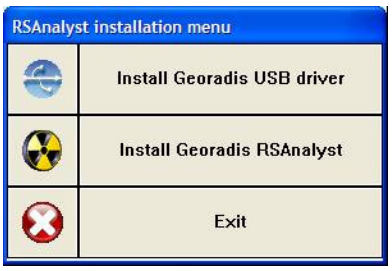
Setup a new sub-directory on the users PC – named as required - (e.g. **RSI).** Click on the link noted above or load it into your Internet browser and click **GO**. Choose **SAVE** then select the correct sub-directory to download the software to (e.g. RSI). Then open this file and **UNZIP** it as required.

4.2 INSTALL PC RSAnalyst

NOTE: This software has been designed to run on all current Microsoft OS systems. The software has been successfully installed and heavily tested on a variety of computers including Win2000, WinXP, WinXP Professional and Vista. A Minority of users have seen some installation problems depending on computer setup configurations. If these problems persist contact RSI for support.

Use Windows Explorer to look at the sub-directory where the downloaded file exists (e.g. **RSI**) – locate the file named **INSTALL.EXE**. Double click this file then select **RUN**.

When this screen is seen – click **"Install Georadis RSAnalyst"**



Follow prompts to complete installation

N.B. Users requiring USB connection (as opposed to Bluetooth) should then go back to the selection menu and select **"Install Georadis USB driver"**

When this is complete select **EXIT** to terminate the process

Then **FINISH** to complete the final installation.

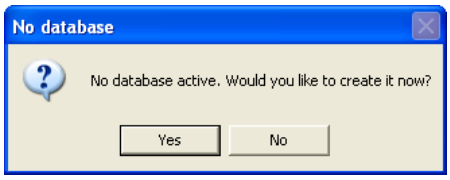
The process is now complete and a new icon is located on the Windows Desktop

ONCE THE NEW RS-ANALYST IS INSTALLED - USERS ARE STRONGLY ADVISED TO UPGRADE THE SYSTEM FIRMWARE TO IMPLEMENT BUG FIXES AND NEW FEATURES (see 4.9.4 below). HOWEVER WHEN THIS IS DONE ALL DATA IN THE UNIT IS ERASED! USERS SHOULD RETRIEVE STORED DATA FROM THE UNIT BEFORE UPGRADING.

4.3 STARTUP

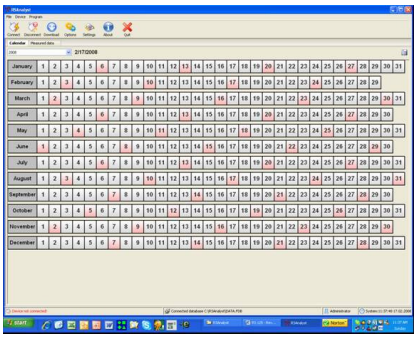
The system stores all data in a Firebird database and this must be created.

Double-click the **RS-Analyst** icon on the desktop. This message is seen – click **YES**, choose the sub-directory (e.g. **RSAnalyst** and choose a database name (e.g. **Data**).



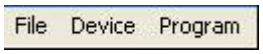
A Firebird formatted data base will be set up named **DATA** on the RSAnalyst sub-directory and all data will be stored there until a different database is created

The final display should show as in the figure.



Note the database name at lower right:

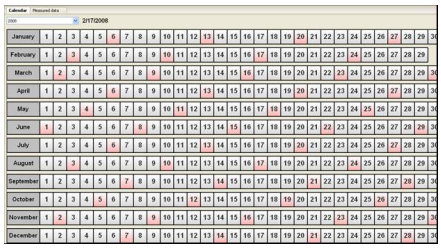
This main display has many selections :



permits selection of various functions – see 4.4

b) icons for special functions – see below

c) a calendar for data location – see below



4.4 FILE menu

FILE

– **CREATE** local data base – select this to create a new Database stored in a required location with a selected name as required

- **SELECT** local database – permits users to select a local data base that already exists and add data to it

Note that a single database can support many RS-125 or RS-230 units with data selection using the unit's serial number.

Device and **Program** select functions described in the ICON description below

4.5 CONNECTION

Connection the RS-125/230 unit to the system can be by local **USB** connection or via **Bluetooth(BT)**

a) via USB - connect the supplied USB cable which plugs into the unit below the rubber flap at the end

With the RS unit powered ON and the RS-Analyst display showing on the PC
Click this icon 

to establish a connection

The unit's serial number will be shown in a data box (e.g. **2025**) – click **OK**

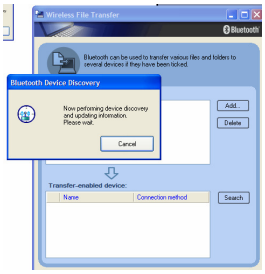
Bottom left on the PC screen should say **"Connected device #2025"** and on the RS unit should see a USB icon

The unit is now fully connected

b) via BLUETOOTH

NOTE: All except the early RS units have BT capability – however in the early units the software did not support this BT technology. In the latest software 5.xx this BT is fully supported. Users are advised that if they need BT capability, then install the new v5xx software included in the download package using the USB connectivity THEN test the BT to be sure all is OK. Contact RSI if problems

Typically data transfer is 3x faster using USB connections

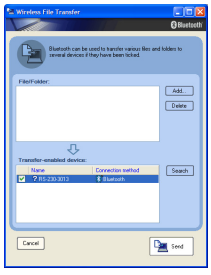


The following is a typical Windows setup. Users setup maybe slightly different depending on Operating System but in principle the connection linkage is similar.

Power ON the RS-125/230 and place within 1m of the PC used

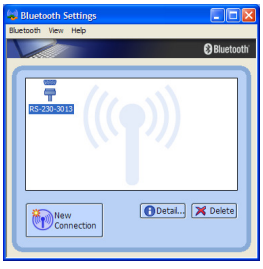
On the PC select **START – All Programs – Bluetooth – Wireless Data Transfer**

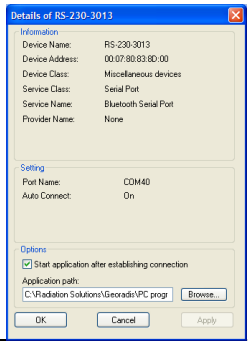
This display appears as the unit searches for BT devices nearby



This display shows the unit has been found.
Click the box (green check sign in the picture)

Close this window (**red X** at top right of the box)
At the bottom right tray the BT sign will be seen
– right click on this and select **Bluetooth settings** .





A new display is seen click **DETAILS** (sometimes a BT Password is asked for – if required enter **0 0 0 0**)

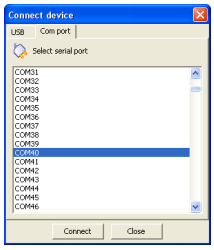
Inspect the second display for
PORT NAME – in this case **COM40**

In RS-Analyst – click 

then **Com Por**t on the pop up box

Select **COM40** and click **CONNECT**

Bottom left on the PC screen should say **"Connected device #1234"** and on the RS unit should show the BT icon. **The unit is now fully connected**



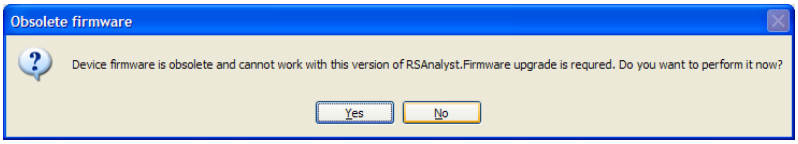
NOTE: this setup is retained in the PC so next time connection is made it is not necessary to relink the BT just use the COM port# previously defined

4.6 DOWNLOAD data

Click this icon to start data transfer from the RS unit into the PC database – final message is **"Downloaded ### records"** – click **OK**

4.6.1 DOWNLOAD selection = wrong FIRMWARE

Some older units with non v5.xx s/w need upgrading before Analyst can be used as data formats are very different. If this is the case the following message box appears



USERS ARE ADVISED TO UPGRADE THE SYSTEM FIRMWARE TO IMPLEMENT BUG FIXES AND NEW FEATURES. HOWEVER WHEN THIS IS DONE ALL DATA IN THE UNIT IS ERASED! USERS SHOULD RETRIEVE STORED DATA BEFORE UPGRADING. USERS WITH 117F SOFTWARE PLEASE CONTACT RSI BEFORE UPGRADING

Select **YES** – then procedure is the same as described in NEW SOFTWARE in section 4.9

4.7 DATA DISPLAY

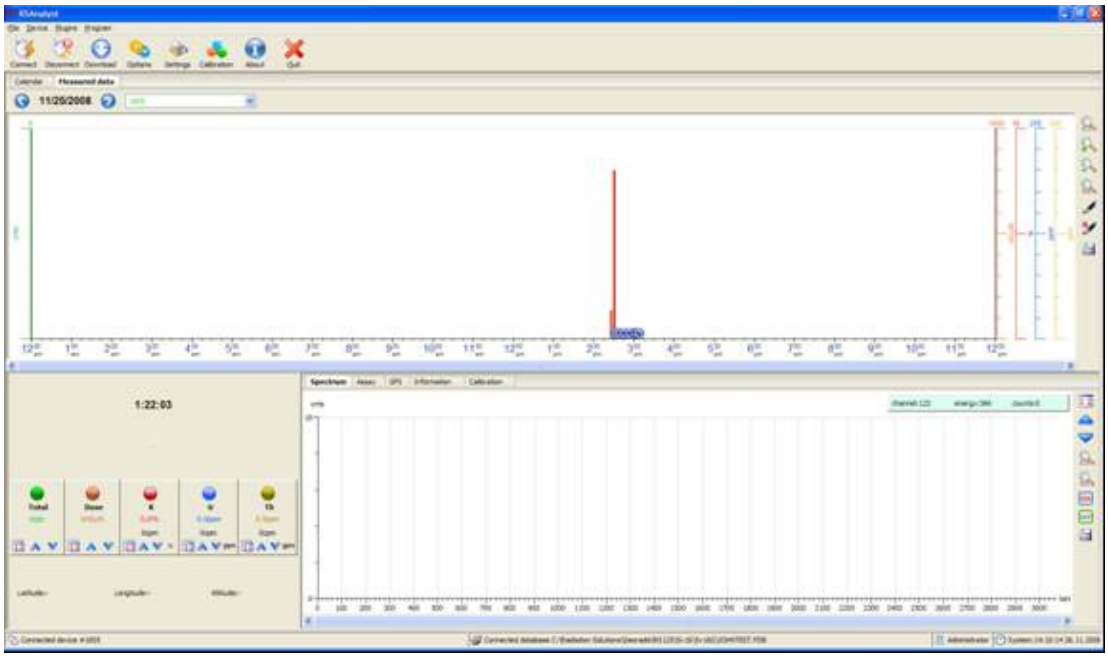
The main Data Display is a calendar format (**Jan-Mar 2008** section shown above).

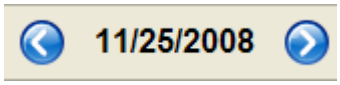
Data is shown on this calendar with colored icons and positioning the cursor over one date block shows the serial # of the data available (example above shows ser # **2210** and **3045).** The database can store data from an essentially unlimited # of RS instruments but for ease of use the data is distributed by DATE to make access easier.

Double-click any **DATE** selection and the data page moves to the **MEASURED DATA** page

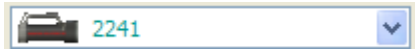
4.7.1 MEASURED DATA PAGE

This complex display is explained as follows:



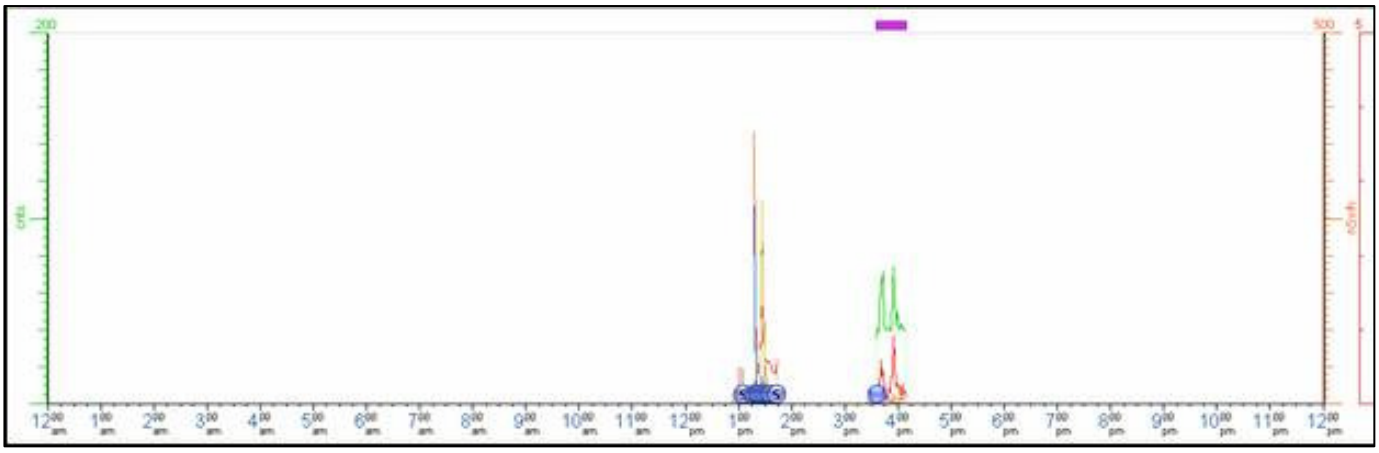


this shows the date of the data selection and the arrows permit moving up down the calendar as required



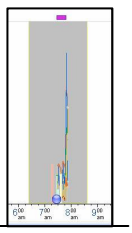
permits selection of the instrument serial number of interest (as noted previously the database can store data from many instruments – however for simplicity many users open different databases for each instrument to prevent data confusion

The next data block shown below shows the selected DATE full 24hr display on which the data is shown at the time it was accumulated

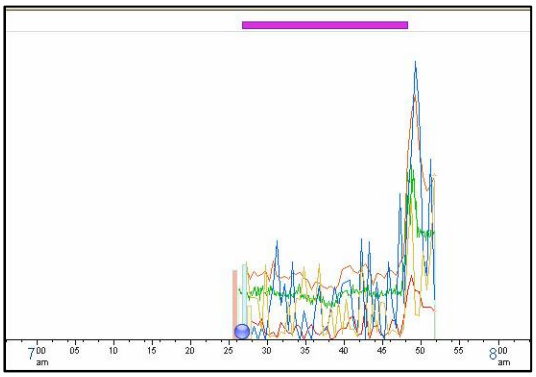


This data for demo purposes shows a mix of data – some ASSAY and some SCAN data as any type of data may be recorded in the instrument and thus be in the database.

this icon is used to **ZOOM** the data display. To zoom data – select this icon first – then use the mouse and left button to select a section of the data – the selection is shown in GREY as in the figure.



Release the left button and the data is now **ZOOMED** as shown. This process can be repeated until the data is in a convenient view size



these icons can be used to zoom manually

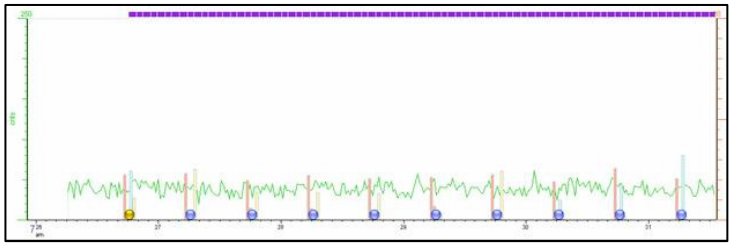
this icon zooms fully OUT to show all the data and permit zoom selection as required

These data were taken with the RS unit set to record TOTAL count at 1/sec and ASSAY data at 1/30 secs. The display is formatted to view the data separately to avoid confusion.

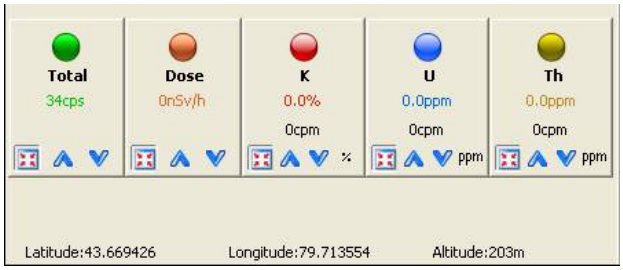
ASSAY SCAN data at selected SCAN rate (typically 30 secs)

In the above example the left side of the display shows some vertical histogram data with a blue ball – this is the **ASSAY** data. To see it use the ZOOM capability and highlight only this section of the data and zoom it to see a display like below

This display shows the individual 30 sec data for K, U and Th in a histogram format with the GREEN line being the Total Count data. The bottom left data block shows the color scheme – **RED = K** etc. Position the cursor over any histogram selection and the lower left data block shows the numeric results. Also the PURPLE line above shows that GPS data was taken so the cursor selection also shows GPS coordinates

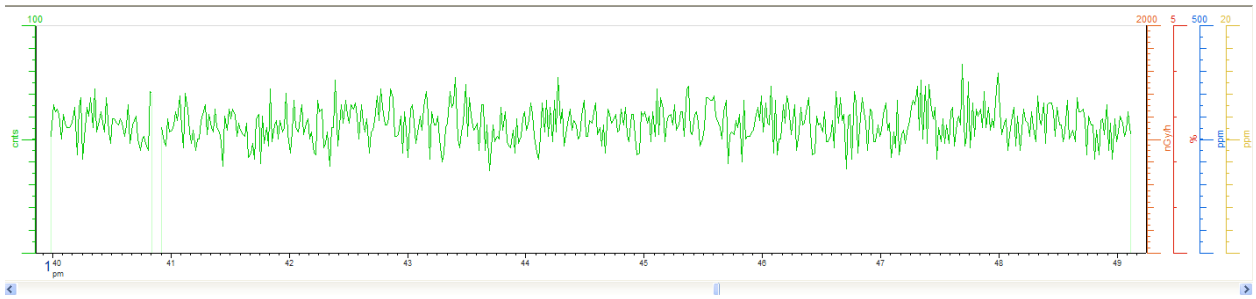


Once again moving the cursor along the data permits numeric and GPS data to be seen in the lower left data box



SURVEY DATA at selected rate (typically 1/sec) -

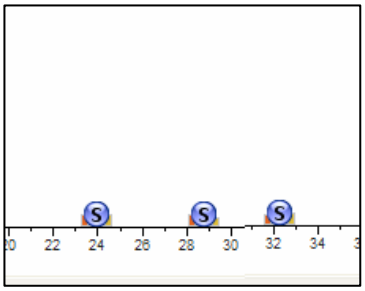
If the whole data set is zoomed then the ASSAY data is suppressed and the raw Total Count data is seen as a graph – see figure below.



"NORMAL" ASSAY DATA

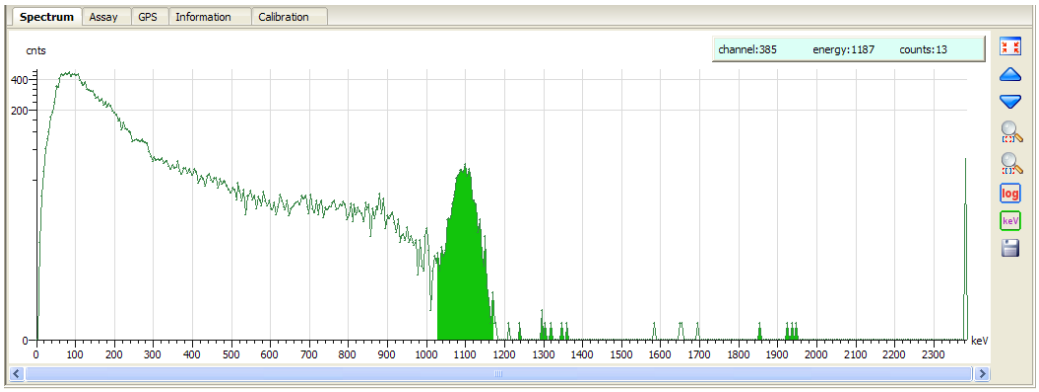
The data stored by the user with the ASSAY selection (typically 120 secs) is also viewable on these displays. The example below is such a data set.

The data marked as **"S"** are the individual stored ASSAY results. Click on any "**S**" to see the data.



SPECTRUM DISPLAY

Click on any of the spectral data (denoted by an "**S**") and the full 1024 channel spectrum is seen. The cursor can be used to see Channel #, keV and cts for any channel in the spectrum. The spectrum can also be vertically scaled using the buttons and a LOG button permits easier viewing of higher energy low count rate events

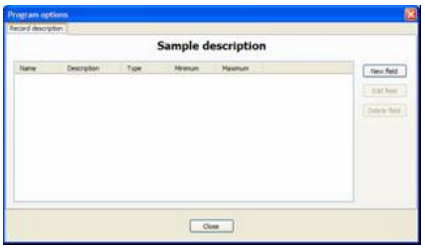


This display has 5 tabs:

SPECTRUM – spectral display of the selected point
ASSAY – Assay data of the selected point
GPS – GPS data of the selected point
INFORMATION – gives additional data
CALIBRATION – gives the full cal matrix of the selected data point

ADDING COMMENTS/NOTES

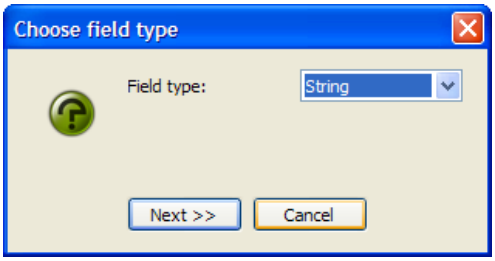
A special feature of RSAnalyst is the ability top mark data on the display to add comments related to the data



ADD COMMENTS FIELD

Select the COMMENTS icon and a new data box appears

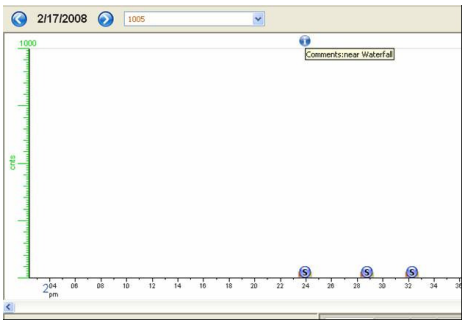
Select **NEW FIELD** – then choose FIELD TYPE on this data box. Select **STRING** as this gives a large space for comments – then **NEXT**

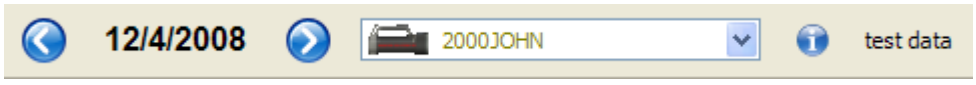


Then enter in a **FIELD NAME** (e.g. Comments) then a **Field Description** (e.g. Comments) and click **ADD FIELD**

Now this Comments ability is added, to insert data click the left pen icon (ADD – the one with a red mark is REMOVE). The position the cursor at the data point of interest and click it. Immediately data box will appear and the user can add comments (e.g. near Waterfall)

Comments are seen as shown:



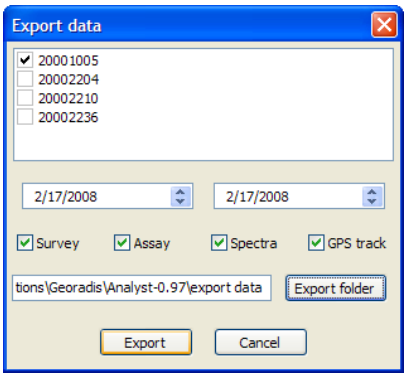


If the blue **i** is clicked, then users can enter info in the Comment field created above (e.g. **test data**) and this will appear next to the **i** button to permit users to label the data

4.8 DATA EXPORT

All recorded/displayed data can be output as txt files.

Selects the EXPORT data process. The data box shows all Serial Numbers of data in the database – select as required.



User can select various data output:

SURVEY – retrieves the SURVEY scan data in a txt file
ASSAY - retrieves the SURVEY scan data in a txt file
SPECTRA – retrieves all stored spectra in full 1024 channel data format as a txt file
GPS TRACK – retrieves GPS data as a txt file

Most users should select ALL options just to be sure.

EXPORT FOLDER – user can select the sub directory where the data is exported to

Select **EXPORT** – and all data files are transferred to the selected directories where they can be viewed as required (Excel Text data import etc.). The data is exported with embedded headers labeling data columns.

Typical export data into Excel

Use Delimited by semi-colon to properly separate data columns, see examples below

a) ASSAY data

ID	Date	Time	Temperature	Stabilized	Total[ppm]	Total[cpm]	K[ppm]	K[cpm]	U[ppm]	U[cpm]	Th[ppm]	Th[cpm]	Dose	Dose units	Latitude	Longitude	Altitude
100	2/22/2008	14:56:33	22	1	33.7	283.8	0.15	17.3	0.8	7.6	2.69	5.2	13.49	nGy/h	43.636	-79.67861	192
101	2/22/2008	14:57:04	22.1	1	38.7	325.5	0.56	34	0	3.5	3.96	7.3	17.96	nGy/h	43.636268	-79.680163	198
102	2/22/2008	14:57:33	22.1	1	29.3	246.2	0.22	21.4	0.09	7.6	5.02	9.4	16.89	nGy/h	43.636425	-79.679847	203
103	2/22/2008	14:58:03	22.1	1	35.2	296.3	0.68	36	0	0	5.21	9.4	22.9	nGy/h	43.636427	-79.67984	200
104	2/22/2008	14:58:33	22.1	1	35.7	300.5	0.3	27.7	1.56	9.7	1.46	3.1	16.3	nGy/h	43.636423	-79.67984	201
105	2/22/2008	14:59:03	22.1	1	31.3	262.9	0.33	17.3	0	0	0.56	1	5.77	nGy/h	43.636418	-79.679832	193
106	2/22/2008	14:59:33	22.1	1	30	252.4	0.13	21.4	2.43	11.8	0.24	1	15.54	nGy/h	43.636413	-79.67982	191
107	2/22/2008	15:00:03	22.1	1	33.3	279.6	0.41	23.5	0.18	1.4	0	0	6.37	nGy/h	43.636403	-79.679815	191
108	2/22/2008	15:00:33	22.1	1	35.7	300.5	0.13	6.8	0	0	1.73	3.1	6.32	nGy/h	43.636398	-79.679812	191
109	2/22/2008	15:01:03	22.3	1	29	244.1	0.17	11	0	1.4	1.69	3.1	6.83	nGy/h	43.636393	-79.679808	195
110	2/22/2008	15:01:33	22.3	1	27.8	233.6	0.31	23.5	0.63	5.6	1.57	3.1	11.75	nGy/h	43.636393	-79.679808	196
111	2/22/2008	15:02:03	22.3	1	29.8	250.3	0.48	29.8	0.11	3.5	1.63	3.1	11.27	nGy/h	43.636397	-79.679808	192
112	2/22/2008	15:02:32	22.3	1	32	269.1	0	6.8	1.07	5.6	0.42	1	6.94	nGy/h	43.636398	-79.679808	192

b) SURVEY

	Date	Time	Temp	Smp	rate	s1	2	3	4	5	26	27	28	29	S30	Lat	Long	Alt
45	2/12/2008	15:36:12	19.2	30	1	35	44	46	41	40	41	44	47	45	34	43.622975	79.669925	190
46	2/12/2008	15:36:41	19.4	30	1	37	36	38	37	41	34	37	51	44	37	43.624885	79.672477	189
47	2/12/2008	15:37:11	19.4	30	1	38	44	38	46	35	36	25	33	42	39	43.626872	79.675147	191
48	2/12/2008	15:37:41	19.6	30	1	55	34	34	34	24	46	41	45	29	31	43.628152	79.677157	197
49	2/12/2008	15:38:11	19.8	30	1	34	36	37	42	40	28	36	37	45	41	43.627118	79.67879	192
50	2/12/2008	15:38:41	20	30	1	49	45	49	49	44	44	40	42	42	41	43.626533	79.67953	192
51	2/12/2008	15:39:11	20	30	1	33	39	49	49	39	65	47	51	63	56	43.626643	79.67979	193
52	2/12/2008	15:39:41	20.2	30	1	69	72	55	74	62	69	80	64	68	56	43.629507	79.681785	194
53	2/12/2008	15:40:11	20.2	30	1	69	57	50	58	61	51	70	53	64	73	43.632143	79.678108	198
54	2/12/2008	15:40:41	20.4	30	1	62	64	64	69	65	86	80	80	67	66	43.634382	79.672393	196
55	2/12/2008	15:41:11	20.4	30	1	69	69	57	71	70	64	61	72	68	72	43.636583	79.665713	193

In the above example, the data have been exported from RSAnalyst and imported into Excel. Some columns have been deleted from the data set to make the figure above clearer.

Note that the GPS location data shown after sample #30 is the position of Sample #1.

c) SPECTRA

The Assay data spectra file is stored in memory as an *.spc file and the example shows one such file imported into Excel. Data assignment as follows:

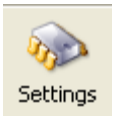
data 1 = LiveTime in mSec
data 2 = Clock Time (mSec) = (set time - # secs x 39mSec)
data 3 = spectral chn 1
data 1026 = spectral channel 1023 = Cosmic channel
data 1027 = Linearization coefficients

114725	LiveTime
114960	Clock Time
0	chn 1
1	chn 2
0	chn 3
0	....
2	....
0	....
103	chn 1023
7.47 1.880176 2.970002 0.000140	chn 1024

d) DATA-Serial#.kml

This data file contains only the GPS coordinate data and is intended for direct import into GOOGLE EARTH. Once imported the track position can be seen with Google's GIS terrain overlays and is useful to confirm and inspect survey location

4.9 SETTINGS

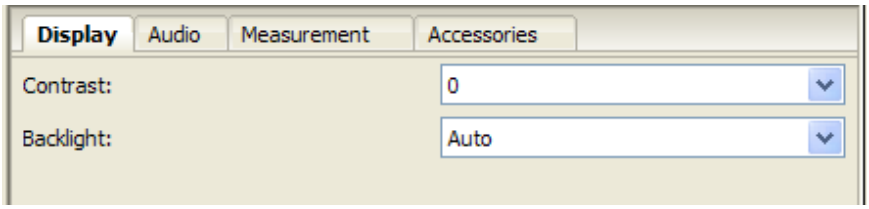


this icon allows various user functions by Tab selection

4.9.1 DEVICE SETTINGS - TAB

There are four sub-directories for parameter selection

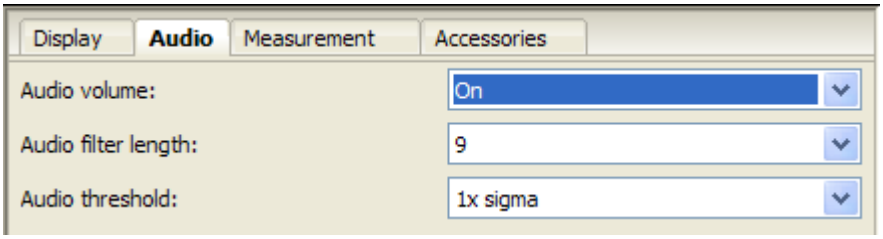
a) DISPLAY -



Contrast = adjusts display contrast – range +3 > -3 - normally **0**

Backlight = backlight options – selection – ON, OFF, AUTO - normally **Auto**

b) AUDIO

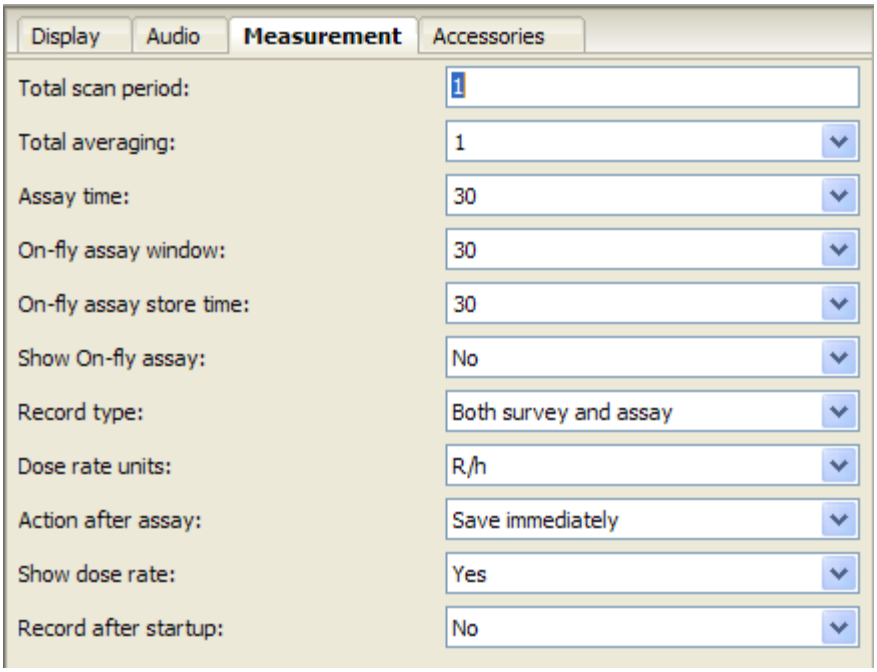


Audio volume = selections ON, OFF - usually **ON** (permits muting if required)

Audio filter length = permits audio response adjustments by filtering changes – for Geophysics usually **9**

Audio threshold = selections x1 to x6 sigma – for Geophysics usually **1x sigma**

c) MEASUREMENT



Total scan period – the sample period (minimum 1 sec) for K/U/T/Total data to be stored on the RECORDING (SCAN) mode described above – usually **1 sec** for fast surveys or **2-5 secs** for slower traverses

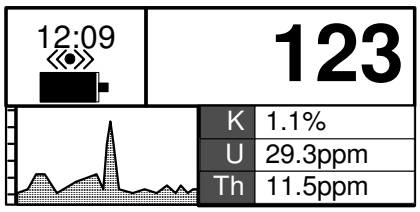
Total averaging = permits the front panel instrument display to use running averaging to "smooth" data viewing – for Geophysics usually **1**

Assay time = sets the time period used when an ASSAY is taken - selection 30-1,800 secs - **120** secs is a sensible selection under most conditions

On-fly assay window = the sample period (30 - 300 secs) for Assay data to be computed on the RECORDING (SCAN) mode described above – usually **30 secs.** This is really a moving average period updated at 1/sec

On-fly assay store time = the sample period (10 - 300 secs) for Assay data to be stored on the RECORDING (SCAN) mode described above – usually **30 secs** but some users want faster data storage so this parameter can be set to 10 secs if required

Show on fly assay – YES or NO. If **YES** is selected then during recording the main data display screen changes to show real-time Assay on the fly.



Record type = permits data selected in RECORDING (SCAN) mode - selections:

- **only SURVEY** – only Total Count at the selected rate
- **only ASSAY** – only Assay data at the selected rate
- **both SURVEY and ASSAY** – both data sets at the selected rates

NOTE: ensure MEMORY selection is adjusted correctly to permit the required amount of data recording space – see section 4.9

Dose rate units = selects the Dose units used in the "Total" display on the units display during Assay. Selections are :

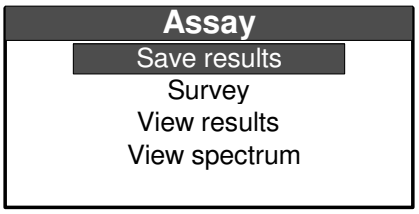
- R – Exposure Rte
- Gy – Absorbed Dose
- Sv – Dose Equivalent

Action after assay – permits the user to add special functions as noted below:

Save immediately – normal action as described in section 2.10 above – after the Assay is complete; the user inspects the data then presses BUTTON to save the data in memory and return to SURVEY mode

Show menu – some sophisticated users want to inspect the Assay spectra. If "Show Menu" is selected then at the end of the Assay period the unit beeps and the results are shown.

If the **BUTTON** is now pressed a new menu is shown



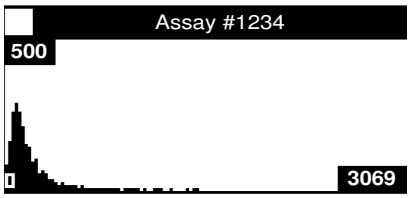
Selections are:

Save results – this saves the data into memory as described in section 2.10 above

Survey – this cancels the Assay data, doers NOT record them in memory and returns to the Survey mode

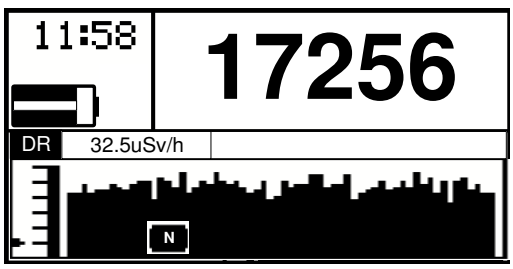
View results – returns the display to the same display that occurred at the end of Assay so the Assay results can be inspected again

View spectrum – this selection gives the user a graphical display of the 1024 channel spectrum with the Vertical scale shown in cps on the Y-axis and the Energy Level in keV shown on the X-axis



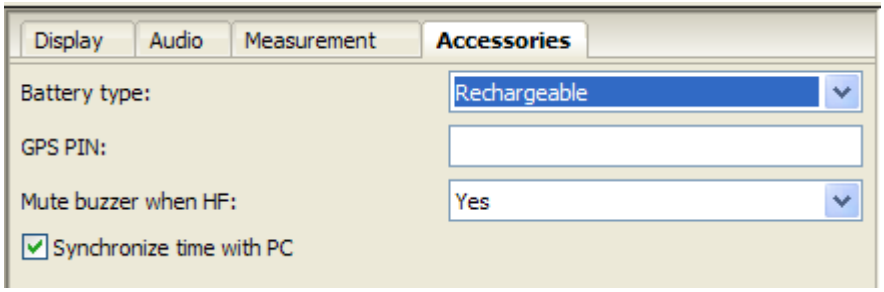
Pressing BUTTON again gives a split display view of the spectrum accumulated in memory. The upper display shows the full 1024 chn spectrum with the current selection (1/8th of the full spectrum so = 128 channels) highlighted, the lower display shows this selected 128 channel section of the spectrum expanded over a larger X-axis to make viewing easier. Repeated Clicks selects the next 1/8th section of the spectrum until the whole 1024 spectrum has been covered. Then these actions are repeated. Long Click to exit to the previous menu

Show Dose Rate – selections are **YES** or **NO -** this allows the user the ability to show the DOSE RATE on the front display. Note the Dose Rate is computed from KUT data results and is referred to as the GEOPHYSICAL ASSAY. Users should note that if (for example) an artificial isotope such as Cesium-137 is placed near the unit, the Count rate will change as the system sees the radiation but the Dose Rate will be essentially unaffected as Cs-137 is outside the KUT calculation matrix.



Record after startup – normally set NO. If YES then when the unit is powered ON, it immediately enters the Scan mode (same as selecting Start Recording from the main unit's menu)

d) **Accessories**



Battery type = none-rechargeable or rechargeable - usually **rechargeable**

GPS pin – some GPS units require a PIN number for handshaking

Mute buzzer when HF – if selected the Audio buzzer in the instrument is muted when the BT Headphone is selected

Synchronize = if this box is checked then the PC will sync the time of the RS unit to the current setting on the PC

PARAMETER CHANGE

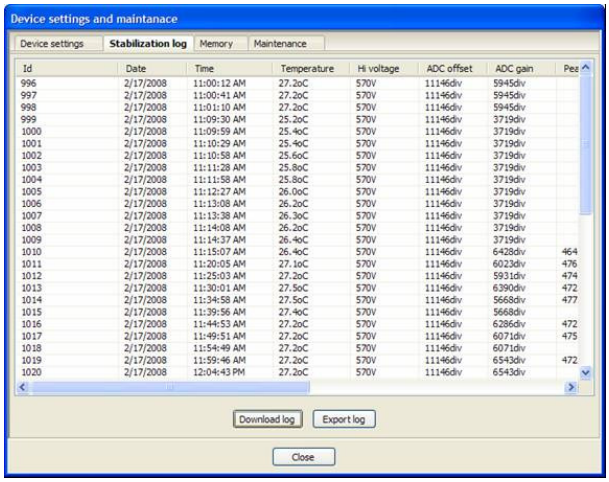
Under special conditions some internal parameters of the unit may need to be adjusted. If this is required RSI will send the user a special file with these parameter changes embedded. To load this file click the **LOAD FROM FILE** button then selecting the appropriate file and follow the prompts.

In addition users can save a copy of the parameter file or read in a new one with special parameter settings as required.

Press **Write to device** to load these settings into the unit
(also see 4.9.4 below)

4.9.2 STABILIZATION LOG

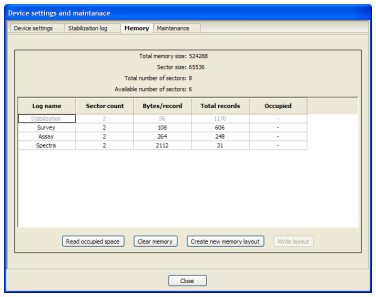
This tab selection permits users to access the internal Stabilization records of the unit. If the unit is acting incorrectly it is possible that the stabilization is causing problems. This selection permits the Stab Log to be downloaded and viewed (**Download Log**) or more useful is (**Export Log**) which outputs the data into a text file which can be exported and then emailed to RSI for analysis



4.9.3 MEMORY

The RS series of units were initially released with **512K** of memory but all 2008 units are shipped with **2Mb** of memory. Older units can be upgraded to **2Mb** if required at a nominal fee.

In v5.xx s/w the available memory can be allocated to the various functions and this is done inside RSAnalyst.



NOTE: the memory can be re-allocated at any time but this re-allocation ERASES ALL DATA IN MEMORY so users should download any data before allocation is attempted

READ OCCUPIED SPACE – shows how much memory is currently in use

CLEAR MEMORY – this command is used to clear data memory once data has been transferred to the PC – **most users transfer data daily then clear the memory to minimize data confusion and in low memory units .**

CREATE NEW MEMORY LAYOUT – this command allows the users to set the memory to suit their application – refer to the tables below for information to enable correct selection – when this selection is made the unit automatically checks memory size and advises users of the number of sectors available to allocate

OLDER UNITS with 512KB data = 6 sectors

		MEMORY ALLOCATION				
512K	**User set Sectors**	**Total # of records**	**# samples/ record**	**total # samples**	**Sample rate secs**	**Data storage Hrs**
SCAN - TOTAL	2	630	30	18,900	1	5.3
SCAN - ASSAY	2	248	1	248	30	2.1
ASSAY-spectrum	2	31	1	31	*	*
SCAN - TOTAL	6	3150	30	94,500	1	26.3
SCAN - ASSAY	0	0	1	0	30	0.0
ASSAY-spectrum	0	0	1	0	*	*
SCAN - TOTAL	0	0	30	0	1	0.0
SCAN - ASSAY	6	1241	1	1,241	30	10.3
ASSAY-spectrum	0	0	1	0	*	*
SCAN - TOTAL	0	0	30	0	1	0.0
SCAN - ASSAY	0	0	1	0	30	0.0
ASSAY-spectrum	6	155	1	155	*	*

The user can allocate memory in blocks so user can select 0,2,3,4,5 or 6 sectors. The table below shows memory allocation and shows what data storage is available so the user can change the sectors to suit the application

Note that in all memory selections, 1 sector in each selection is reserved for data buffering. So if you choose 4 sectors, you really only get data storage in 3. This is taken into account when the unit displays how much data can be stored and is only relevant if users are attempting to calculate the memory space

NOTE: the memory can be re-allocated at any time but this re-allocation ERASES ALL DATA IN MEMORY so users should download any data before allocation is attempted

NOTE:

Scan-Total – is in 30 sample data blocks whereas the SCAN-Assay is 1 sample/block. The above table shows these details and also shows how much data storage is available (in hrs) for the various combinations.

The **ASSAY-spectrum** of course has no time limit period as this is FULL SPECTRUM recording + ASSAY results at a data rate determined by the users manual sampling habits

Current units have 4MB memory = 58 sectors

4MB memory details

4Mb	User set Sectors - max 58	Total # of records	# samples/ record	total # samples	Sample rate secs	Data storage Hrs
SCAN - TOTAL	20	11529	30	345,870	1	96.1
SCAN - ASSAY	20	4716	1	4,716	30	39.3
ASSAY-spectrum	18	527	1	527	*	*

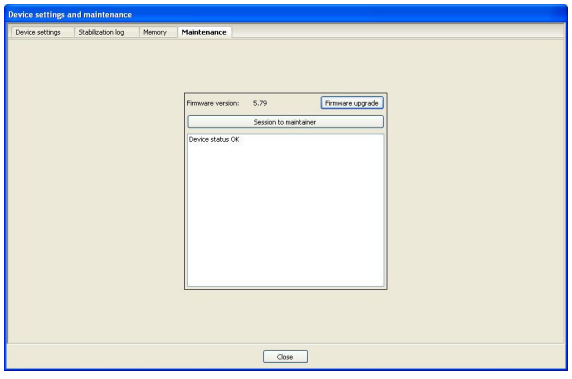
4.9.4 MAINTENANCE

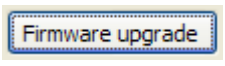
This tab selects various maintenance features

Firmware version – this shows the current software version.

Firmware upgrade – this process permits users to **UPGRADE** software to the latest version. **NOTE: The UPGRADE process ERASES data in memory so current data should be downloaded before doing an upgrade.**

NOTE: FOR ALL SYSTEM FIRMWARE UPGRADES ENSURE THE UNIT IS POWERED OFF AS SOME EARLIER VERSIONS OF SOFTWARE CAUSE UPLOAD PROBLEMS IF POWER IS ON. BEFORE STARTING A FIRMWARE UPGRADE, ENSURE THAT THE RS INSTRUMENT IS CONNECTED TO THE CHARGER AS IF BATTERY LEVELS ARE TOO LOW, UNDER SOME CONDITIONS THE FIRMWARE UPGRADE PROCESS CAN CRASH THE MEMORY AND UNIT MUST BE RETURNED TO THE FACTORY TO RECOVER





Ensure that the unit is connected via USB then click this button to start the process

In this screen select **"Specify firmware file manually". NEVER USE THE INTERNET LINK**

Follow prompts and select the ***.gfw** file included in the upgrade package found

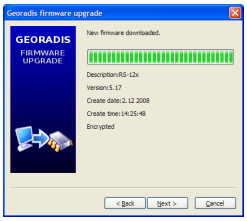
in the folder unzipped earlier (refer to section 4.1)

Ensure that the batteries are charged up and/or the Charger is plugged in as if the power dips during the upgrade process the memory could crash and the unit would then be unusable and must be returned to the factory

Then click "NEXT" to start the process.
The firmware is then uploaded into the unit via USB and this takes approximately 5 minutes

Once the process is complete a new screen appears.

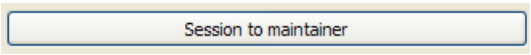
The user selects "**FINISH**" and the new firmware is "flashed" into the memory of the unit and replaces the old firmware. If all is OK the unit disconnects itself from the PC and restarts – users hears a beep.



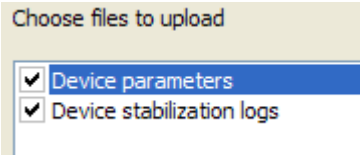
Unplug the USB port – power the unit OFF. Then power ON and verify that the latest software version has been loaded

SERVICE AIDS

For Maintenance support some special features have been added to the RSAnalyst software but they require the system to be connected to a PC that is connected to the Internet to function as designed.



If Maintenance is required, connect the unit via USB then click this button



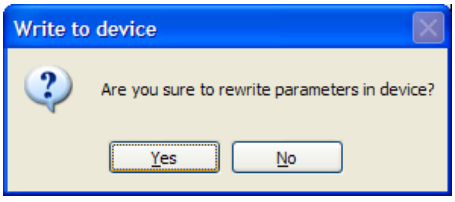
User selects a checked box (or cancels all and **OK** to go back)

****

Device parameters:

If user is experiencing problems with the unit they should discuss this with RSI (by email (at **service@radiationsolutiosn.ca**). RSI may ask the user to send the PARAMETER file to RSI as parameter setting errors can cause problems. In this case check the "**Device parameters**" box only and then click **OK**.

The program then extracts the parameter file from the unit and sends it to RSI
When RSI receives this file they inspect it and if changes are required RSI modifies this parameter file and notifies the user by email



The user then connects the unit to the PC and the PC to the Internet and selects the "**Device parameters**" check box then **OK**. This time the system logs onto the RSI site, searches for the new parameter file (by unit serial number) and automatically downloads the special customer file that RSI has loaded there after asking if OK to rewrite as in the figure.

Using these methods, RSI can make it very easy to help the user fine tune their units to resolve specific problems

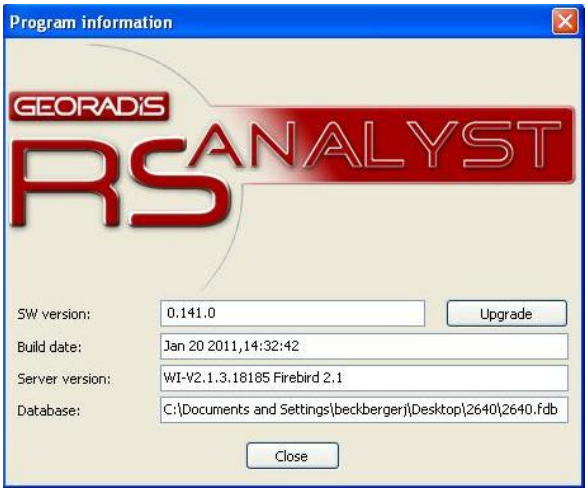
Device stabilization logs:

If user is experiencing problems with the unit's Stabilization performance they should advise RSI by email (at **service@radiationsolutiosn.ca**). When convenient connect the unit to the PC via USB and connect to the Internet. Then click "**Session to maintainer**" and select the "**Device stabilization logs**" then **OK**. The software will then automatically extract all relevant Stabilization data from the system and send it to thee RSI FTP site where RSI Service can access it. RSI Service will then analyze and communicate as required to resolve the issues.

Error details – the final data display on the maintenance page is the error status. The RS unit has various internal errors that are messaged on the display of the unit as a **!** below the clock display. Currently the only way to understand what this message is, is to connect to the PC and view this screen display. If errors occur, inspect this screen then contact RSI for resolution and advice.

4.10 ABOUT

From time to time updates are available for the RSAnalyst program. If the user wants to upgrade the software please contact RSI. There is an automatic upgrade via the Internet available using the **UPGRADE** button **but this may upgrade undocumented features so is not recommended unless advised by RSI.**



Appendix A: **RECHARGEABLE BATTERY SET FOR RS-120/125/230**

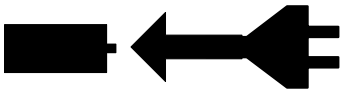
This set comprises 3 items:

- 4 x NiMH AA batteries (2500mA)
- 115V AC line adapter (or International 115/220V)
- Vehicle charging cable

PROCEDURE:

a) **Batteries** - The user should mount the 4 batteries in the RS unit as described in section 2.1 above

For AC operation – connect the supplied line cord to the DC input connector of the RS unit (hidden under the waterproof tab on the bottom of the unit). The display shows this icon/message to show that charging is taking place:


CHARGING

Once connected to the AC line the unit should take typically 4 HOURS (at 20^0 C) to reach full charge – longer at colder temperatures. Leaving the unit connected to the AC line overnight is OK but don't leave it connected for an indefinite period (more than 24 hrs) or potential battery damage could occur.

If the icon labeled POWER SUPPLY appears this means that the **wrong batteries are selected**. Power off the unit, remove and replug in the battery holder then on power on, select **RECHARGEABLE** batteries


POWER SUPPLY

NOTE: the batteries supplied with the RS-125 unit are NiMH rechargeable batteries. It is best to "condition" these batteries when first used to ensure a good battery life. The ideal form of conditioning is:

- fully charge the batteries in the unit – minimum of 4 hrs
- completely discharge the unit – 10 hours
- fully charge the batteries a second time – minimum of 4 hrs
- completely discharge the unit a second time – 10 hours
- fully charge the batteries a third time – minimum of 4 hrs
- completely discharge the unit a third time– 10 hours

Now the batteries should give their optimum life. Try to ensure at <u>least</u> 2 charge/discharge cycles

c) **DC operation** - If an AC source is not available the supplied VEHICLE charging cable can be used - this requires access to a 12V (max 20V) battery. Connect the supplied Vehicle Charging Cable to the DC input connector of the RS unit (hidden under the waterproof tab on the bottom of the unit). Connect the Cigarette lighter plug on the cable to the appropriate Vehicle connection – RS display should show the "**CHARGING**" message as noted above. Typically 4 HOURS (at 20^0 C) to reach full charge – longer at colder temperatures. NB Ensure that the Vehicle connection is powered on (red LED on the connector) as some units power OFF when the ignition key is switched off (check that the unit is displaying the "**CHARGING**" label as shown above even when ignition is OFF).

NOTE: Starting a vehicle can cause many bad voltage transients on the power line that can damage sensitive electronic equipment. For this reason users are advised to unplug the charger during vehicle starting.

APPENDIX B: ASSAY ANALYSIS – COMMENTS RE PRECISION

General

The RS-125 Portable Gamma Spectrometer units have an integrated 6.3 cu ins Sodium-Iodide detector for Gamma Ray detection. This very large sensor coupled with the 1024 channel spectrometer capability of the unit permit high levels of sensitivity for Geophysical prospecting.

However like all instruments, measurement accuracy is dependent on a variety of factors. This note briefly explains the basic errors related to instrument measurement and computes approximate system Precision capabilities.

Errors

There are various primary sources of error.

a) STATISTICAL – if we assume the calibration parameters are 100% correct then the accuracy of a reading is strictly related to the statistical noise of the counting, so if we count long enough we can reach any degree of precision and accuracy.

b) CALIBRATION - there are some level of errors when the unit is calibrated, so the measured calibration matrix is offset relative to the correct matrix. This will result in a systematic small error component that effects the accuracy. For levels below approximately the pad concentrations of 8% K, 50ppm U, and 140ppm Th – with an Assay Time of 2 min, this systematic error is small compared to the statistical error and can be ignored. At higher levels or if the counting time is extended (4 minutes at 4%K, 25 ppm U, 70 ppm Th) this error will get comparable to the statistical error and keep increasing faster than the statistical error.

c) GEOMETRY - the other factor that should be considered is the geometry. The assumption in computing the assay results inside the unit is that the detector is looking at a semi-infinite half space of uniform material. In more practical terms this means the instrument is averaging a circular area approximately 3 feet diameter. Thus if the rocks inside this 3ft zone are fully homogenous, then the Assay results from the instrument will approximate that of Chemical assay – however in the field this assumption is difficult to ensure so in most cases the Assay are an excellent INDICATION of the level of actual chemical assay results.

d) COUNTING TIME – the length of the sample (Assay) time is a function of the user's requirements. In the past, 300 secs (5 mins) was used as the standard to suit all field conditions as this gave good results in even low level areas. However much exploration now takes place in relatively high grade areas where this long assay period is not necessary and for many users this 5 min period was considered excessive. For this reason the RS-125 is factory set at 120 secs (but changeable by the user to suit their field requirements). When the sample starts, a preset Sample Time parameter shows the sample time on the right and on the left is a count up timer showing sample progress. Once the first 30 secs sample is reached an Assay result is shown. Each additional 30 secs the Assay data is recomputed and updated on the display.
For best accuracy the full count period should be permitted. However in very anomalous areas sample times as low as 60 seconds give very good data due to the large detector size.

Guidelines are :

60 secs – anomalous area – low quality data is fine – fast sampling is required to get maximum data for an area in a short period of time

120 secs – anomalous area – medium quality data is fine – fast sampling is required to get maximum data for an area in a short period of time

180 secs – medium anomalous area – good quality data is required

240 secs – medium to low anomalous area – high quality data is required

300 secs – low anomalous area – maximum quality data is required

IN THE ANALYSIS BELOW 120 secs ASSAY PERIOD IS ASSUMED

The table below shows the estimated error bars at the 1 Sigma level, so +/- 1 sigma is a good estimate of data precision but only errors (a) are included in this assessment.

a) RS-125 DATA

K %	1 sigma K%	1 sigma U ppm	1 sigma Th ppm
0	0.000	0.000	0.000
0.1	0.030	0.041	0.006
1	0.096	0.130	0.019
5	0.214	0.291	0.042
10	0.303	0.412	0.060
U ppm	**1 sigma K%**	**1 sigma U ppm**	**1 sigma Th ppm**
0	0.000	0.000	0.000
1	0.043	0.307	0.027
10	0.135	0.970	0.087
100	0.427	3.067	0.274
1000	1.349	9.698	0.866
10,000	4.27	30.67	2.74
Th ppm	**1 sigma K%**	**1 sigma U ppm**	**1 sigma Th ppm**
0	0.000	0.000	0.000
1	0.023	0.237	0.539
10	0.072	0.750	1.705
100	0.228	2.373	5.391
1000	0.721	7.504	17.047
10,000	2.28	23.7	53.9

NOTE: the above data have been computed taking into account the errors described. However as described above the final absolute precision levels are a factor of many of the errors described, some of which are hard to quantify for the reasons noted. For this reason the quoted error levels should be used in a relative rather than an absolute manner to ensure technical accuracy.

ZERO RESULTS

Under certain conditions some Assay results go to zero. This is caused by statistical noise errors interfering with the matrix calculation of Assay computation. Using the statistical noise calculations above, as an example if you have a 120 sec sample and a 100ppm Thorium sample with 10ppm Uranium, then the assy result for +/-1SD will be Th=100+/-5.5ppm and U=10+/- 3.3ppm thus in some samples **U could = 0.00**. This "noise" error can be minimized by taking very long Assay samples which reduces the scatter.

CROSS INTERFERENCE - for varying concentrations of e.g. Potassium there are error components for not only K but also U, Th etc. If you have a mix of K, U, Th - the combined errors can be found by taking the square root of the sum of the square of errors. If for example you have 1% K, 10 ppm U, and 10 ppm Th the combined K error is SQRT(0.096*0.096 + 0.135*0.135 + 0.072+0.072) = 0.18.

b) RS-230 DATA

The RS-230 data is approximately 2x better than the RS-125 data noted above due to the BGO detector technology

REFERENCE

The above data is based on Calibration data derived from RSI Calibration Pads. These pads are technically defined in the 1991 Geological Survey of Canada paper #90-23 titled "**Transportable Calibration Pads for Ground and Airborne Gamma-Ray Spectrometers**" by Grasty, Holman and Blanchard. This paper fully describes the manufacture and the assay testing of the material to verify the pad calibration results. Window widths of ROIs and cal standards were defined to IAEA standards as required.

APPENDIX C: FAST GPS SAMPLING ON TOTAL COUNT DATA

Some users want to record GPS data at a faster rate when recording Total Count data. Version 519 permits this but there are some compromises.

In the normal software, Total Count scan data is recorded in data blocks of 30 samples, after which GPS is recorded. This memory block size is not practical to change however users can adapt the scan rate to get faster GPS data.

To do this users should load a special parameter file named "**GPSfastscan.txt**" that should be supplied with the new software but can be obtained from RSI as required. This txt file looks like this:

Params.survey_rec_len = 30

Change the number as required for example to **15**, then store the file (only use Notepad or WordPad – don't use WORD as it adds formatting characters that will cause file loading problems) Then load the file into the unit using the method detailed in section 4.9.1 under **PARAMETER CHANGE**.

In the above example if Total Scan Period = 1 and the above file sets "Survey_rec_len" = 15 – then when RECORDING is started, the Total Count data is recorded at a 1/sec rate for 15 samples then the GPS is recorded and the recording repeated.

Note that in this case the allotted memory determined during memory partitioning is actually half of what is indicated because memory is allocated for 30 samples of data and only 15 are being recorded. However the new units with 4MB of memory have 58 sectors for allocation (see 4.9.3 above) so memory capacity should not be a problem.

APPENDIX D: - RSI CONTACT INFORMATION:

In the event of problems please contact RSI by phone, fax or email as follows:

Radiation Solutions Inc
386 Watline Ave
Mississauga
Ontario, Canada
L4Z 1X2

Tel: [1] 905 –890-1111
Fax: [1] 905-890-1964
email: service@radiationsolutions.ca

PRODUCT STATEMENT
The RS-125 is a joint venture between RADIATION SOLUTIONS INC a Mississauga (Toronto) based geophysical equipment manufacturer and GEORADIS a Czech Republic based design company who were previously part of Exploranium but are now an independent private company

Station	WPT	Easting	Northing	Elev	Feature	Lithology	Structure_type	Strike	Dip	Plunge	Trend	Sample	Sample_ source	Photo	Description	outcrop vs sample GRS	GRS_K %	GRS_U ppm	GRS_Th ppm
C-Pipe	E C Pipe	377911	5151048	358	AMIS - cemented pipe	NA								1					
22-LAH-001A	E1A	377922	5151050	360	whale-backed outcrop W of E C Pipe	Pebble conglomerate in clean, dark grey, sandy matrix	C-surface	89	55			22-LAH-001	outcrop	5	Matrix supported, pebble conglomerate in clean, dark grey, sandy matrix; patchy rustiness particularly highlighted in fabrics, but also present adjacent to pits in the rock (weathered sulphides); sheared with interpreted C-surface and more subtle but more penetrative S-surface (perhaps dextral?); distinctive round, black quartz grains (as well as more abundant grey/white/clear quartz grains) relatively abundant in matrix; revisited with GRS.	sample	1.9	6.6	16.2
22-LAH-001A	E1A	377922	5151050	360	whale-backed outcrop W of E C Pipe	Pebble conglomerate in clean, dark grey, sandy matrix	C-surface	89	55				outcrop	5	Matrix supported, pebble conglomerate in clean, dark grey, sandy matrix; patchy rustiness particularly highlighted in fabrics, but also present adjacent to pits in the rock (weathered sulphides); sheared with interpreted C-surface and more subtle but more penetrative S-surface (perhaps dextral?); distinctive round, black quartz grains (as well as more abundant grey/white/clear quartz grains) relatively abundant in matrix; revisited with GRS.	outcrop	3.4	3.6	18.5
22-LAH-001A	E 1A	377922	5151050	360	whale-backed outcrop W of E C Pipe	Pebble conglomerate in clean, dark grey, sandy matrix	S-surface	78	72			22-LAH-001	outcrop	5	Matrix supported, pebble conglomerate in clean, dark grey, sandy matrix; patchy rustiness particularly highlighted in fabrics, but also present adjacent to pits in the rock (weathered sulphides); sheared with interpreted C-surface and more subtle but more penetrative S-surface (perhaps dextral?); distinctive round, black quartz grains (as well as more abundant grey/white/clear quartz grains) relatively abundant in matrix; revisited with GRS.	sample	1.9	6.6	16.2
22-LAH-001B	E 1B	377927	5151064	358	vertical outcrop N of EC Pipe	Pebble conglomerate in clean, dark grey, sandy matrix								1	Matrix supported, pebble conglomerate in clean, dark grey, sandy matrix; patchy rustiness particularly highlighted in fabrics, but also present adjacent to pits in the rock (weathered sulphides); distinctive round, black quartz grains (as well as more abundant grey/white/clear quartz grains) relatively abundant in matrix; revisited with GRS.	outcrop	2.5	6.3	13.8
22-LAH-002	E 2	377859	5151069	361	20m long, vertical, roadside outcrop	Pebble conglomerate in clean, dark grey, sandy matrix						22-LAH-002	outcrop	1	Matrix supported, pebble conglomerate in clean, dark grey, sandy matrix; primarily felsic intrusive pebbles (angular to sub-rounded), no marked fabric; revisited with GRS	sample	1.8	4.4	12.9
22-LAH-002	E 2	377859	5151069	361	20m long, vertical, roadside outcrop	Pebble conglomerate in clean, dark grey, sandy matrix								1	Matrix supported, pebble conglomerate in clean, dark grey, sandy matrix; primarily felsic intrusive pebbles (angular to sub-rounded), no marked fabric; revisited with GRS	outcrop	3.6	5.8	17.9

Station	WPT	Easting	Northing	Elev	Feature	Lithology	Structure_type	Strike	Dip	Plunge	Trend	Sample	Sample_ source	Photo	Description	outcrop vs sample GRS	GRS_K %	GRS_U ppm	GRS_Th ppm
22-LAH-003	E 3	377832	5151044	353	road side vertical outcrop	Pebble conglomerate, with rare cobbles	shear surface	105	78			22-LAH-003	outcrop	1	Matrix supported, pebble and rare cobble conglomerate in clean, dark grey, sandy matrix; primarily felsic intrusive pebbles (some bearing surprizingly abundant pyrite! 1%), dark quartz grains in matrix more dark grey than black here, moderately developed fabric; revisited with GRS.	sample	1.7	6.1	10.6
22-LAH-003	E 3	377832	5151044	353	road side vertical outcrop	Pebble conglomerate, with rare cobbles	shear surface	105	78					1	Matrix supported, pebble and rare cobble conglomerate in clean, dark grey, sandy matrix; primarily felsic intrusive pebbles (some bearing surprizingly abundant pyrite! 1%), dark quartz grains in matrix more dark grey than black here, moderately developed fabric; revisited with GRS.	outcrop	2.1	4.9	15.4
22-LAH-004	E trench	377620	5151089	377	2.5 m long,<1m wide, <0.5m deep trench with loose rocks surrounding	Quartz-rich sandstone/quartzite						22-LAH-004	loose from trench	2	Quartzite with abundant, black, round quartz, some mafic pebbles, 1% pyrite (+/- chalco?) in blebs	sample	2.2	4	12
22-LAH-005	E 5	377620	5151100	363	loose close to trench	Quartz pebble conglomerate						22-LAH-005	loose from trench	1	Pebble supported, with primarily round, white quartz pebble, a small angular jasper granule noted; matrix is clean white quartzite. No sulphides apparent. Adjacent outcrop is grey (buff weathering) quartzite with black and clear/white quartz grains; weak fabric; lichen obscures whether there is a pebble conglomerate interbed	sample	1.7	6.5	9.6
Pit	E Pit	377610	5151104	364	1m diameter, shallow										whole area is overgrown loose material this area was worked.				
Trench	E Tr 2	377595	5151101	360	4m long oriented ESE-WNW										whole area is overgrown loose material this area was worked.				
Adit	E Adit	377524	5150903	346	AMIS point									1	rounded boulders sealed the adit entrance, wpt from photo vantage				
					AMIS waste dump point									2	photos of planted and regreened waste pile. One photo with hammer, one with flat green space				
22-LAH-006	E 6	377419	5150829	362	long low outcrop with small running stream between it and the road and <1 m thick layer of waste material covering it	bedded siltstone-sandstone	bedding	145	38			22-LAH-006		1	Varved fine grained clastic seds of alternating cream/bone, fine grained quartzite and dark green siltstone. Relatively well developed fabric that changes orientation in the different bed types (steeper through the fine sand, shallower through the darker siltstone.	sample	1.7	2.6	16.7
Shaft	E shaft	377647	5150801	357	AMIS point cement capped shaft, quite large									1	AMIS point cement capped shaft, quite large; hammer for scale in photo				
22-LAH-007	E 7	377805	5150744	378	Curve of vertical outcrop around E Sh 2	bedded siltstone-sandstone	bedding	197	53					2	Beds thicker than outcrop 6 with coarser creamy beds 8-15cm thick. Wpt at brittle shear, bedding is shallower within fault				
22-LAH-007	E 7	377805	5150744	378	Curve of vertical outcrop around E Sh 2	bedded siltstone-sandstone	fault	80	80					2	Beds thicker than outcrop 6 with coarser creamy beds 8-15cm thick. Wpt at brittle shear, bedding is shallower within fault				
22-LAH-008	E 8	377660	5150762	371	long tall trail-side outcrop wpt at W end	sheared bedded siltstone-sandstone	bedding	190	36					?	well-bedded unit similar to outcrops 6 & 7, relatively sheared on outcrop face				

Station	WPT	Easting	Northing	Elev	Feature	Lithology	Structure_type	Strike	Dip	Plunge	Trend	Sample	Sample_ source	Photo	Description	outcrop vs sample GRS	GRS_K %	GRS_U ppm	GRS_Th ppm
22-LAH-009	E 9	377301	5150595	375	at Y in roads, 2.5m outcrop that curves 15m along intersection	interbedded clastic, calc-silicate and thin chemical sedimentary rocks	bedding	254	28			22-LAH-009A	outcrop	many	interbedded clastic, calc-silicate and thin chemical sedimentary rocks, bedding ranges from 1 cm (chert) to up to 70cm (typical fine grained arkose); carbonaceous sediments orange coloured and negatively weathering; evidence of soft-sediment deformation (flames, rip-ups and chaotic folding in 'marl' and chert horizons), tops up. Outcrop shows overall anticline form. Measurements from wpts 9 and 9B show different bed facing directions.	see worksheet 22LAH009_GRS			
22-LAH-009	E 9B	377289	5150586	389	at Y in roads, 2.5m outcrop that curves 15m along intersection	interbedded clastic, calc-silicate and thin chemical sedimentary rocks	bedding	55	12			22-LAH-009B	outcrop	many	interbedded clastic, calc-silicate and thin chemical sedimentary rocks, bedding ranges from 1 cm (chert) to up to 70cm (typical fine grained arkose); carbonaceous sediments orange coloured and negatively weathering; evidence of soft-sediment deformation (flames, rip-ups and chaotic folding in 'marl' and chert horizons), tops up. Outcrop shows overall anticline form. Measurements from wpts 9 and 9B show different bed facing directions.	see worksheet 22LAH009_GRS			
22-LAH-009	E 9B	377289	5150586	389	at Y in roads, 2.5m outcrop that curves 15m along intersection	interbedded clastic, calc-silicate and thin chemical sedimentary rocks	bedding	55	12			22-LAH-009C	outcrop	many	interbedded clastic, calc-silicate and thin chemical sedimentary rocks, bedding ranges from 1 cm (chert) to up to 70cm (typical fine grained arkose); carbonaceous sediments orange coloured and negatively weathering; evidence of soft-sediment deformation (flames, rip-ups and chaotic folding in 'marl' and chert horizons), tops up. Outcrop shows overall anticline form. Measurements from wpts 9 and 9B show different bed facing directions.	see worksheet 22LAH009_GRS			
Denison Two Shaf	E Den Two	377407	5150074	376	Large cement cap with vent pipe									1	Wpt from NE corner, photo with hammer for scale				
22-LAH-010	E10	377322	5150023	378	8m high 12m long cliff outcrop	light grey arkose	bedding	96	22					4	massive, light grey arkose/quartzite, lower part of the outcrop shows no evident bedding, cryptic bedding higher; none of the small ridge of waste material in the shaddow of the outrock look local. Returned with GRS - no anomalous material in this pile. Most of the waste rock seems to be in massive, revegetated mesas (meadows) - photo 2; revisited and additional structural measurements taken, GRS reading taken	outcrop	4.5	5.8	13.7
22-LAH-010	E10	377322	5150023	378	8m high 12m long cliff outcrop	light grey arkose	brittle fault	99	48					4	massive, light grey arkose/quartzite, lower part of the outcrop shows no evident bedding, cryptic bedding higher; none of the small ridge of waste material in the shaddow of the outrock look local. Returned with GRS - no anomalous material in this pile. Most of the waste rock seems to be in massive, revegetated mesas (meadows) - photo 2; revisited and additional structural measurements taken, GRS reading taken				

Station	WPT	Easting	Northing	Elev	Feature	Lithology	Structure_type	Strike	Dip	Plunge	Trend	Sample	Sample_ source	Photo	Description	outcrop vs sample GRS	GRS_K %	GRS_U ppm	GRS_Th ppm
22-LAH-010	E10	377322	5150023	378	8m high 12m long cliff outcrop	light grey arkose	slickensides			47	175			4	massive, light grey arkose/quartzite, lower part of the outcrop shows no evident bedding, cryptic bedding higher; none of the small ridge of waste material in the shaddow of the outrock look local. Returned with GRS - no anomalous material in this pile. Most of the waste rock seems to be in massive, revegetated mesas (meadows) - photo 2; revisited and additional structural measurements taken, GRS reading taken				
22-LAH-011	E11	377183	5149986	384	stripped outcrop with gossan and float	matrix supported conglomerate						22-LAH-011	float	2	Irregularly bedded, matrix-supported conglomerate with sandy matrix, pebbles, cobbles, and boulders. Rusty patches associated with more quartz rich bed, but rustiness is associated with a quartz vein that cuts the bedrock fabric. Some rusty float is pyritiferous quartz-pebble conglomerate - probably not locally derived.	sample	2.7	243.7	78.2
22-LAH-012	E11	377183	5149986	384	stripped outcrop with gossan and float	matrix supported conglomerate						22-LAH-012	outcrop	1	Irregularly bedded, matrix-supported conglomerate with sandy matrix, pebbles, cobbles, and boulders. Rusty patches associated with more quartz rich bed, but rustiness is associated with a quartz vein that cuts the bedrock fabric. Some rusty float is pyritiferous quartz-pebble conglomerate - probably not locally derived. Outcrop revisited with GRS.	sample	1.7	9.8	8.6
22-LAH-012	E11	377183	5149986	384	stripped outcrop with gossan and float	matrix supported conglomerate									Irregularly bedded, matrix-supported conglomerate with sandy matrix, pebbles, cobbles, and boulders. Rusty patches associated with more quartz rich bed, but rustiness is associated with a quartz vein that cuts the bedrock fabric. Some rusty float is pyritiferous quartz-pebble conglomerate - probably not locally derived. Outcrop revisited with GRS.	outcrop (gossan)	1.9	12.2	19.5
22-LAH-012	E11	377183	5149986	384	stripped outcrop with gossan and float	matrix supported conglomerate									Irregularly bedded, matrix-supported conglomerate with sandy matrix, pebbles, cobbles, and boulders. Rusty patches associated with more quartz rich bed, but rustiness is associated with a quartz vein that cuts the bedrock fabric. Some rusty float is pyritiferous quartz-pebble conglomerate - probably not locally derived. Outcrop revisited with GRS.	outcrop	3.7	6.6	10.2
22-LAH-013	E13	382663	5150609	357	steep outcrop above Quirke Lake	granite								3	Salmon pink kspar-quartz dominated granitoid with limited accessories. Fractures with dark grey possible Fe/Me oxides	outcrop	4.7	11.4	33.6
22-LAH-013	E13	382663	5150609	357	steep outcrop above Quirke Lake	granite						22-LAH-013	outcrop	3	Salmon pink kspar-quartz dominated granitoid with limited accessories. Fractures with dark grey possible Fe/Me oxides	sample	3.6	7.3	23.9
22-LAH-014	E14	381989	5150917	359	knobs of outcrops above track	granite								1	Medium-coarse granitoid, abundant grey quartz and creamy yellow feldspars no sulfides, abundant Mn oxides that are fracture controlled. No fabric	outcrop	4.7	7.7	31.4

Station	WPT	Easting	Northing	Elev	Feature	Lithology	Structure_type	Strike	Dip	Plunge	Trend	Sample	Sample_ source	Photo	Description	outcrop vs sample GRS	GRS_K %	GRS_U ppm	GRS_Th ppm
22-LAH-014	E14	381989	5150917	359	knobs of outcrops above track	granite						22-LAH-014	outcrop	1	Medium-coarse granitoid, abundant grey quartz and creamy yellow feldspars no sulfides, abundant Mn oxides that are fracture controlled. No fabric	sample	2.5	4	16.9
22-LAH-015	E15	381855	5150968	355	Large expanse of outcrop N of trail	granite								1	pink, v. coarse grained granitoid				
22-LAH-015	E Fault	381862	5150973	355	Large expanse of outcrop N of trail	granite	fault	118	60					1	pink, v. coarse grained granitoid, very narrow aplite (2-3cm) at wpt, incised zone is likely brittle fault, S side paler and finer grained (similar to 22LAH-014)				
22-LAH-016	E16	381862	5150994	357	Large outcrop	granite	aplite dike	259	75			22-LAH-016	outcrop	1	pink, v. coarse grained, quartz-rich (>40%) granitoid, salmon pink K-spar; few accessories; aplite dike (15cm wide) with coarse grey quartz core; quartz tension gashes	outcrop - on aplite	2.6	8.7	27.5
22-LAH-016	E16	381862	5150994	357	Large outcrop	granite	Tension gash	205	50					1	pink, v. coarse grained, quartz-rich (>40%) granitoid, salmon pink K-spar; few accessories; aplite dike (15cm wide) with coarse grey quartz core; quartz tension gashes				
22-LAH-017	E17	381863	5150991	359	Large outcrop, near aplite of 16	granite						22-LAH-017	outcrop	1	coarse, k-spar-quartz and limited dark accessory mineral; Kspars very dark salmon pink, quite angular; sample to compare with adjacent aplite	outcrop	3.3	6.3	29.4
22-LAH-018	E18	381579	5151001	359	Large roadside outcrop	granite								1	white-grey weathering, medium grained, quartz-rich granitoidd				
22-LAH-019	none	380244	5151158	398	Large hill capped with abundant outcrop	quartzite						22-LAH-019	outcrop	3	creamy-green; very coarse quartzite to quartz granule-bearing fine conglomerate with some v. fine granitoid granules/sand grains; 10m further NW some indication of bedding, with coarser granitic grain bearing beds and iner cleaner quartzite - bedding irregular	outcrop	1.1	10	58.9
22-LAH-020	E 20	380342	5151116	401	Large hill capped with abundant outcrop	quartzite						22-LAH-020	outcrop	1	coarse grained quartzite, rare other graines and rare small quartz pebbles; rare, small trace pyrite; cryptic bedding too unreliable to measure, but impression of bedding forming the NE facing surfaces.	outcrop	1.9	10.6	64.4
22-LAH-021	E 21	378283	5148081	409	huge stripping near property boundary, wpt near topo top	matrix supported conglomerate	bedding	114	12					8	looks like glacio-lacustrine/glacio-fluvial sediments; greenish fines - matrix supported; mostly granitic boulders, cobbles and pebbles; boulders with concentric depression rings (dropstones?); main W-facing (?) slope approximates S0				
22-LAH-021	E 21B	378278	5148080	413	huge stripping near property boundary, wpt near topo top	matrix supported conglomerate	brittle fault	108	85					2	looks like glacio-lacustrine/glacio-fluvial sediments; greenish fines - matrix supported; mostly granitic boulders, cobbles and pebbles; boulders with concentric depression rings (dropstones?); main W-facing (?) slope approximates S0				
22-LAH-021	E 21C	378304	5148072	413	huge stripping near property boundary, wpt near topo top	matrix supported conglomerate						22 LAH-021	outcrop	1	looks like glacio-lacustrine/glacio-fluvial sediments; greenish fines - matrix supported; mostly granitic boulders, cobbles and pebbles; boulders with concentric depression rings (dropstones?); main W-facing (?) slope approximates S1	sample	1.8	4.1	13.9

Station	WPT	Easting	Northing	Elev	Feature	Lithology	Structure_type	Strike	Dip	Plunge	Trend	Sample	Sample_ source	Photo	Description	outcrop vs sample GRS	GRS_K %	GRS_U ppm	GRS_Th ppm
22-LAH-022	E 22	378198	5148052	400	several pieces of gossanous float on same stripping as 22-LAH-021	quartz-pebble conglomerate						22 LAH-022	float	2	quartz-pebble conglomerate with abundant (semi-massive) pyrite in groundmass	boulder	10.1	1265	266.3
22-LAH-023	E 23	378105	5148178	386	rehabilitated waste									1	example of rehabilitated waste site				
22-LAH-024	E 24	378149	5148280	376	vent shaft?									1	vent shaft?				
22-LAH-025	E 25	377690	5148320	390	small outcrop under powerline	matrix supported conglomerate	quartz vein	217	78			22 LAH-025	outcrop	1	grey-green, matrix supported conglomerate with positive weathering granitic cobbles, no obvious quartz pebbles	outcrop	2.7	35.5	22.7
22-LAH-026	E 26	377779	5148421	391	long, E-W trending outcrop	matrix supported conglomerate	foliation	267	90					1	grey-green, matrix supported conglomerate as at 21 and 25, relatively well-developed foliation, dip unclear				
22-LAH-027	E 27	377349	5150126	386	elongate waste-rock pile									1	Scanned waste pile with GRS, nothing anomalous				
22-LAH-028	E 28	377355	5150105	369	elongate waste-rock pile									2	Scanned waste pile with GRS, nothing anomalous; variety of lithologies, photo with finger of quartz-rich cobble				
22-LAH-029	E 29	377353	5150087	375	elongate waste-rock pile									2	Scanned waste pile with GRS, nothing anomalous; only response from GRS comes from gravels of the path (2nd photo)				
22-LAH-030	E 30	377353	5150061	373	elongate waste-rock pile									1	Scanned waste pile with GRS, nothing anomalous				
22-LAH-031	E 31	377352	5150042	374	rusty float (waste rock)									1	Scanning gave no squeel indicating anomaly, point reading taken	cobble	2.1	15.7	18.8
	287	377331	5150037	381															
22-LAH-033	E 33	377333	5150034	379	caged rock stablizing rock wall									3	3 of boulders in the cage squeeled with the GRS; only one was physically accessible to take a direct measurement	cobble	3.9	119.9	118.9
22-LAH-035	E 36	377409	5149960	373	Cement pillar; view of exposed waste at lakeside; Outcrop	arkose								4+	outcrop with massive grey arkose/quartzite, by steep drop to beach with waste rock; materials at the base of the outcrop squeel loudly though under vegetative cover	outcrop	1.7	6	9.8
22-LAH-035	E 36	377409	5149960	373	Cement pillar; view of exposed waste at lakeside; Outcrop	arkose						22-LAH-035A	outcrop	4+	outcrop with massive grey arkose/quartzite, by steep drop to beach with waste rock; materials at the base of the outcrop squeel loudly though under vegetative cover	sample	1	6.8	8.8
22-LAH-035	E 36	377409	5149960	373	Cement pillar; view of exposed waste at lakeside; Outcrop	arkose						22-LAH-035B	float	4+	outcrop with massive grey arkose/quartzite, by steep drop to beach with waste rock; materials at the base of the outcrop squeel loudly though under vegetative cover	float sample	2.8	171.7	34.2
22-LAH-037	E 37	377636	5151157	376	Large expanse of outcrop N of trail	conglomerate (Bruce)									Matrix supported, pebble conglomerate in clean, dark grey, sandy matrix; patchy rustiness particularly highlighted in fabrics, but also present adjacent to pits in the rock (weathered sulphides); distinctive round, black quartz grains (as well as more abundant grey/white/clear quartz grains) relatively abundant in matrix;	outcrop	3.7	3.3	14.3
22-LAH-038	E 38	377685	5151207	378	small outcrop in the woods	arkose	foliation	111	82					1	grey arkose/quartzite bearing euhedral pyrite and black round quartz eyes	outcrop	2.1	2.4	9.4
22-LAH-039	E 39	377663	5151323	408	large outcrop area, wpt from the N/top end	conglomerate (Bruce)								1	matrix supported conglomerate with primarily granitic cobbles/pebbles, and sand-fine matrix	outcrop	3.2	2.8	10.9
22-LAH-040	E 40	377708	5151343	402	large expanse of outcrop	conglomerate (Bruce)						22-LAH-040	outcrop	1	matrix supported conglomerate with primarily granitic cobbles/pebbles, and sand-fine matrix	outcrop	1.6	2	10.4