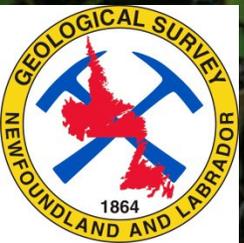


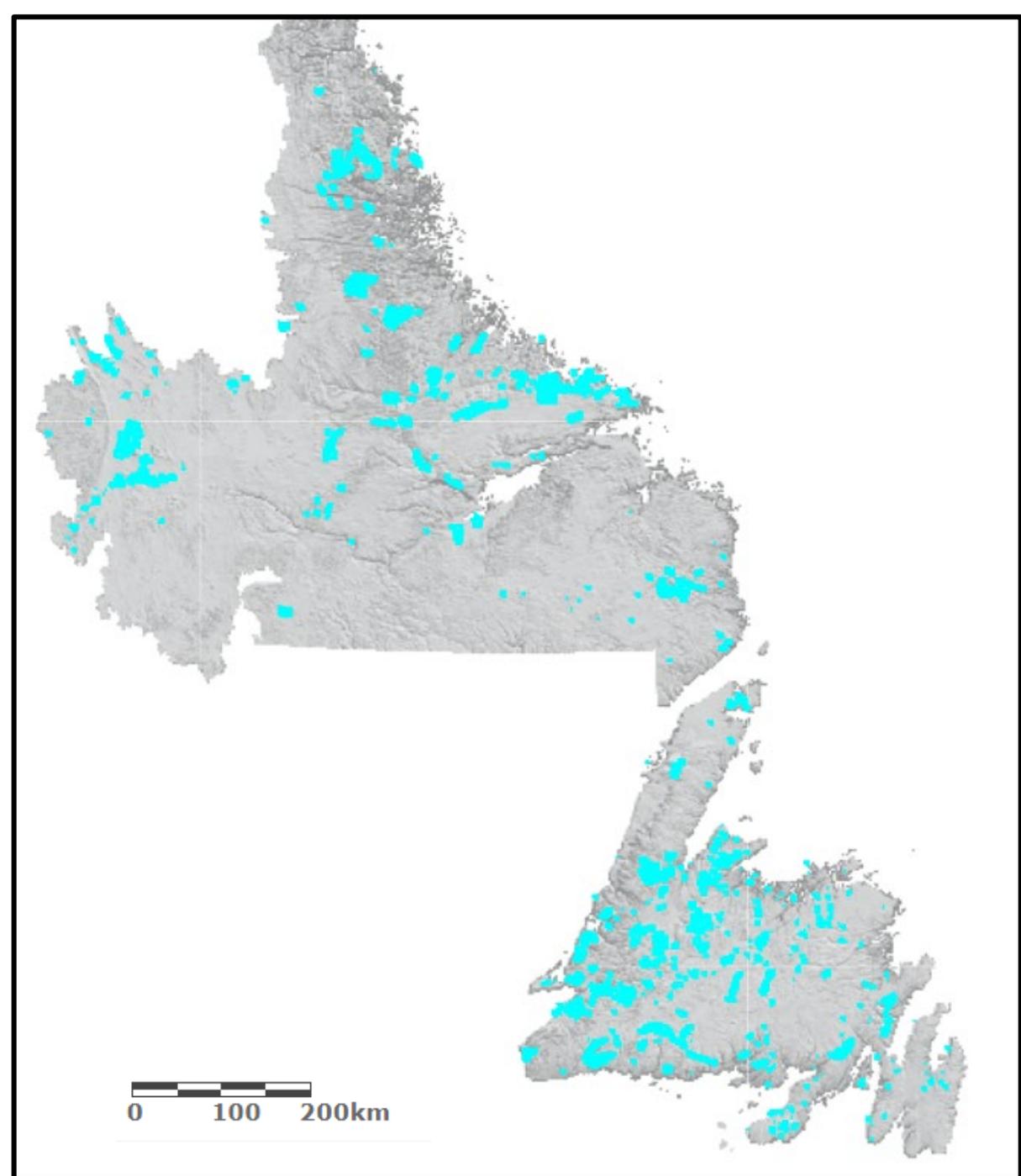
Handheld scintillometers: basic use, field applications and vectoring towards areas of elevated radioactivity

Greg Sparkes
Mineral Deposits Section
Geological Survey of Newfoundland and Labrador
Department of Industry, Energy and Technology

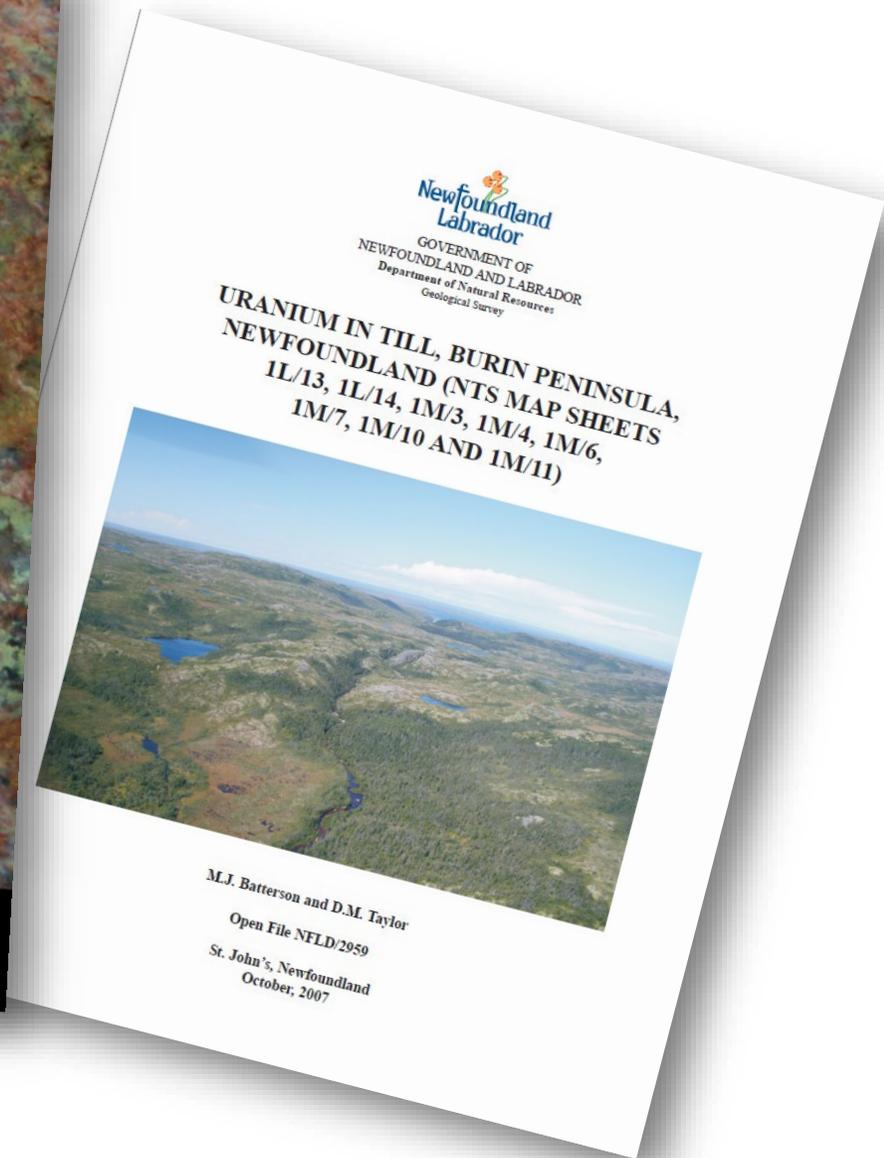
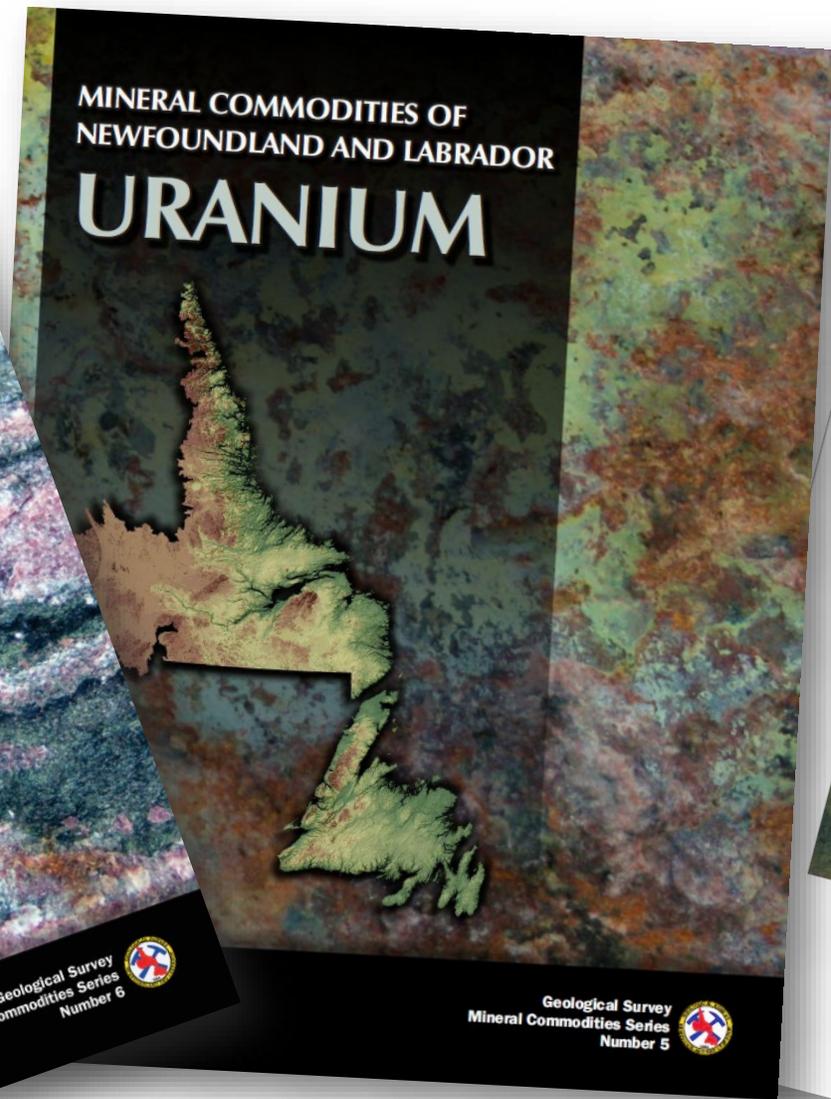
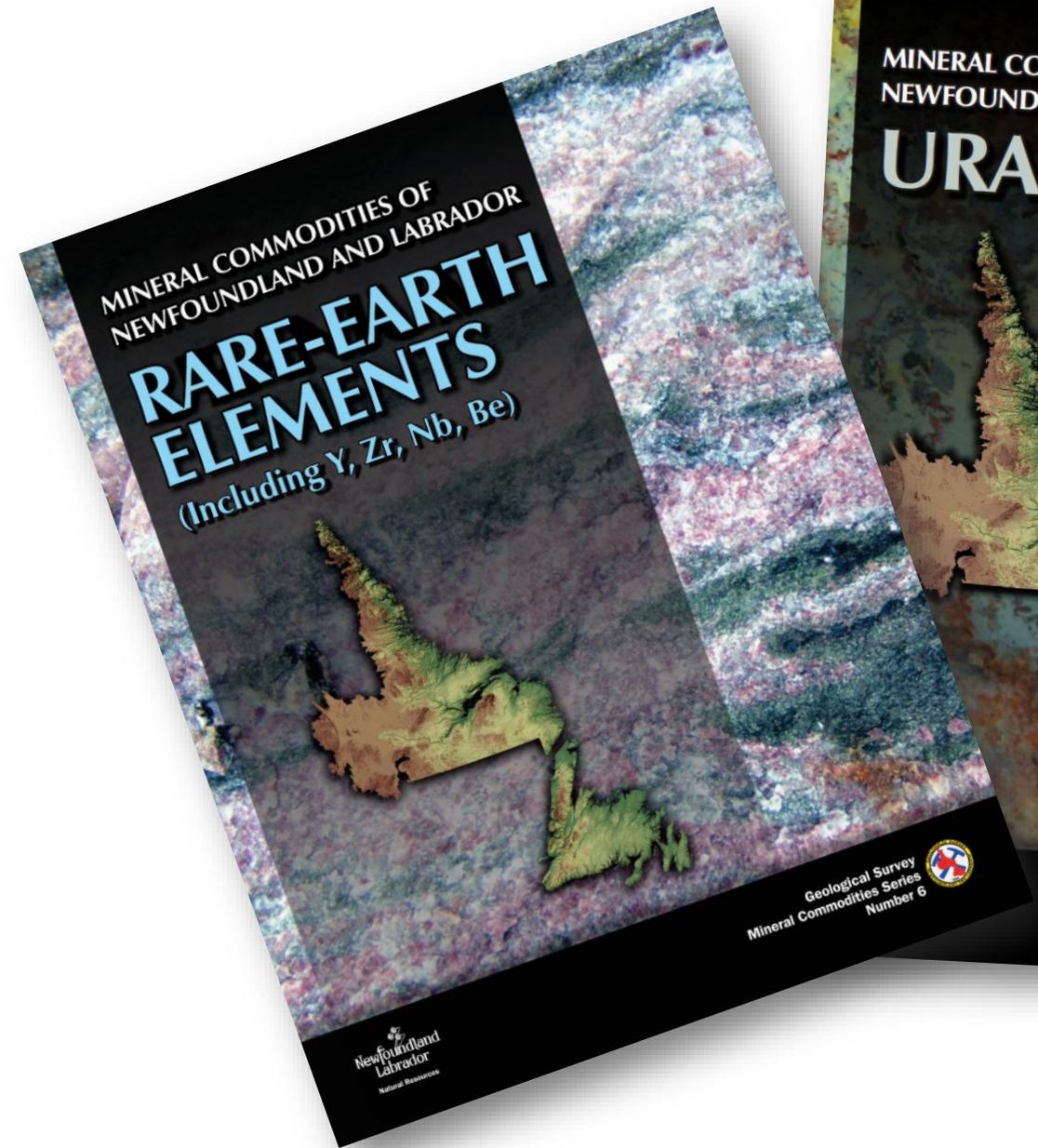


Commodities of Interest:

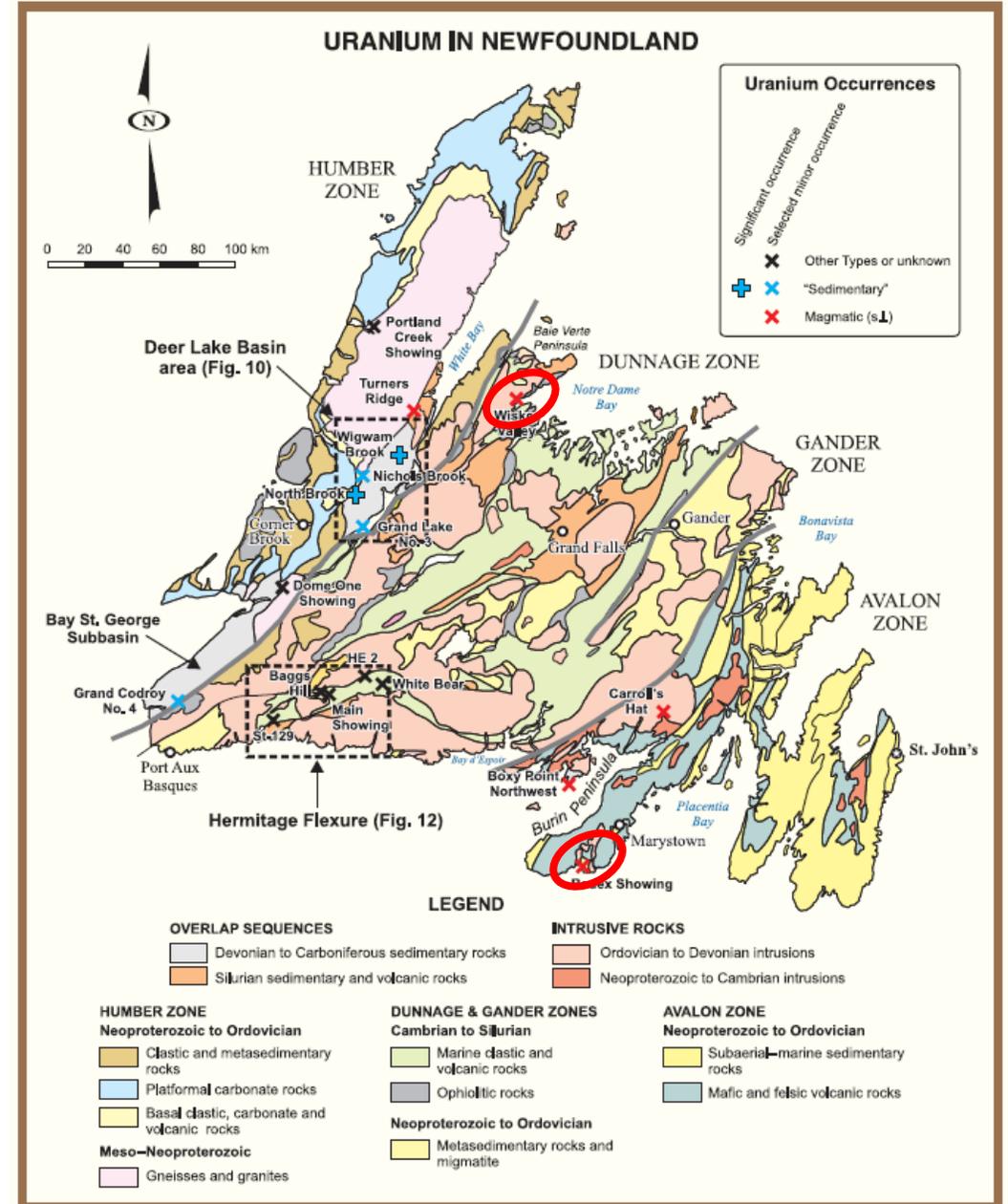
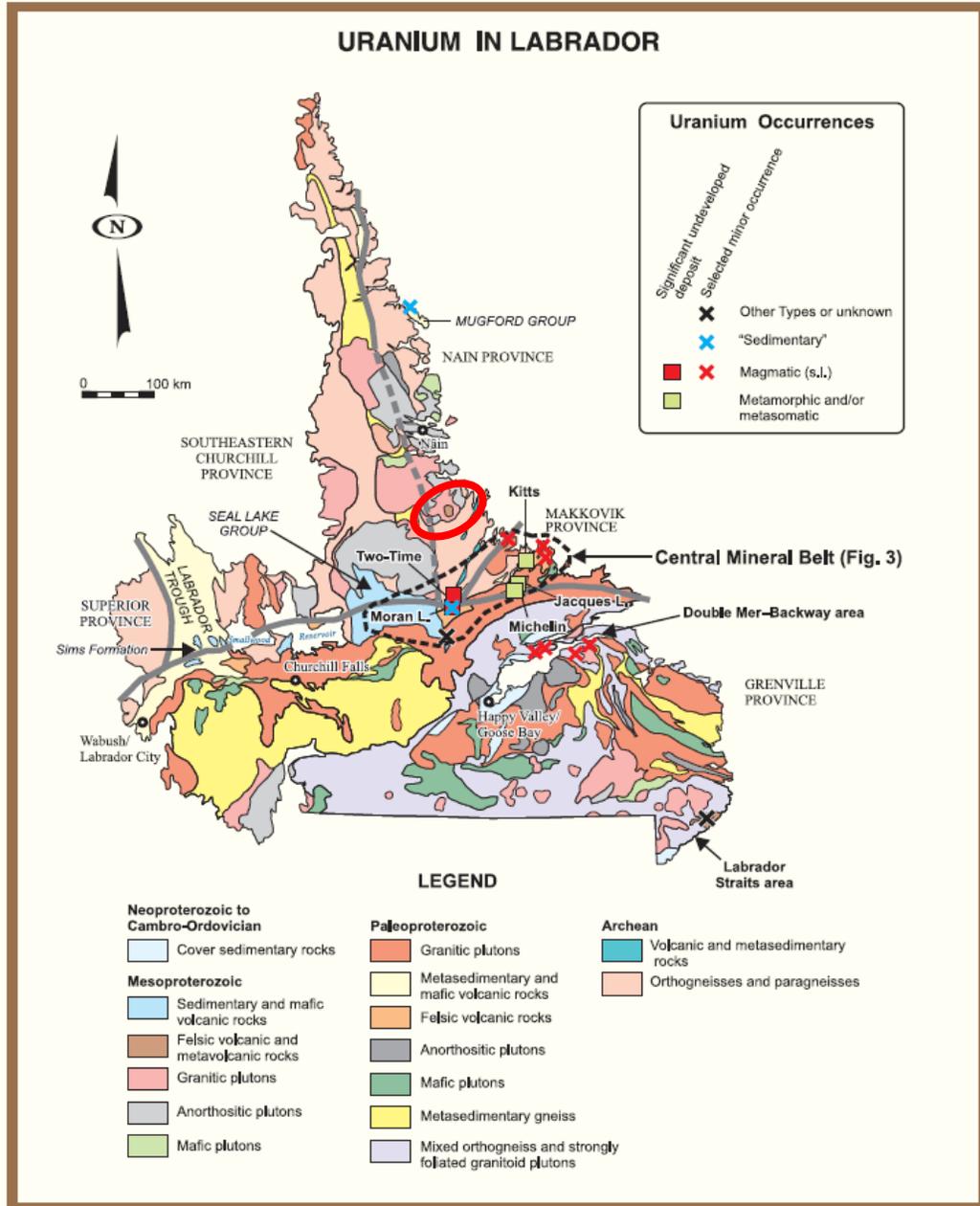
- Increased interest in uranium and rare-earth elements along with other critical minerals.
- Prospecting for these targeted minerals is aided by the use of scintillometers in the field.



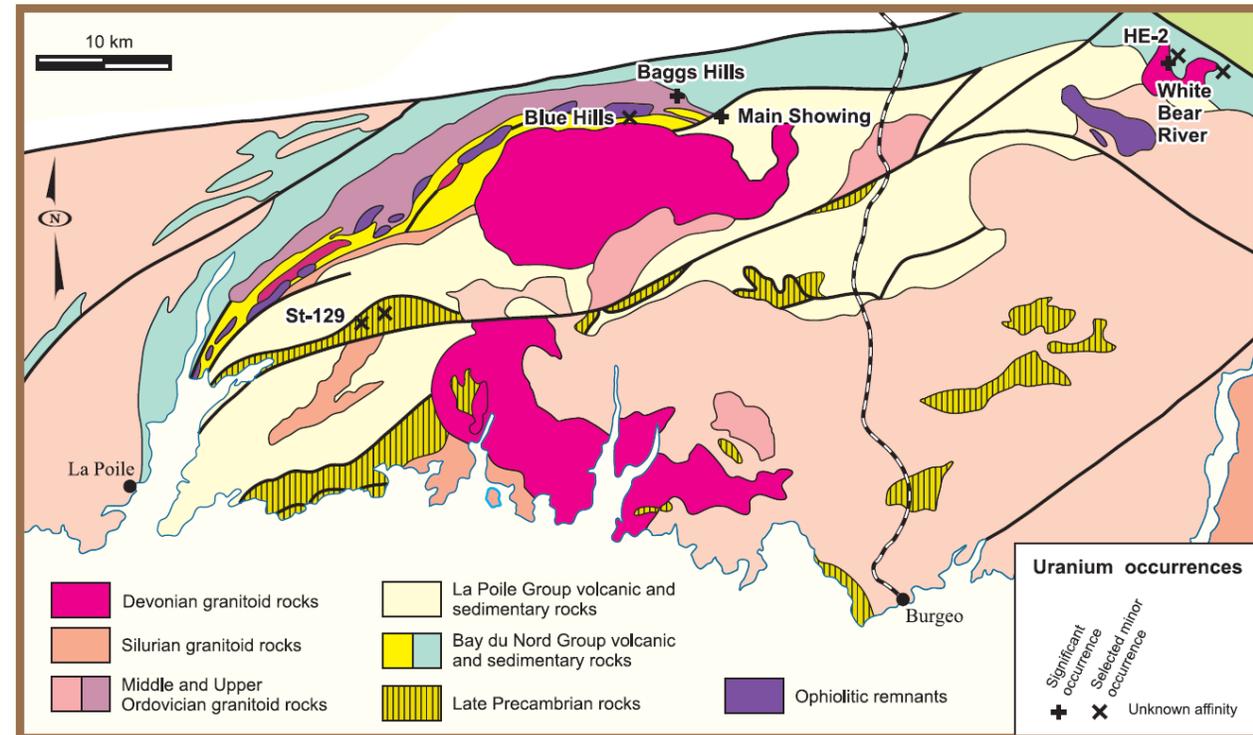
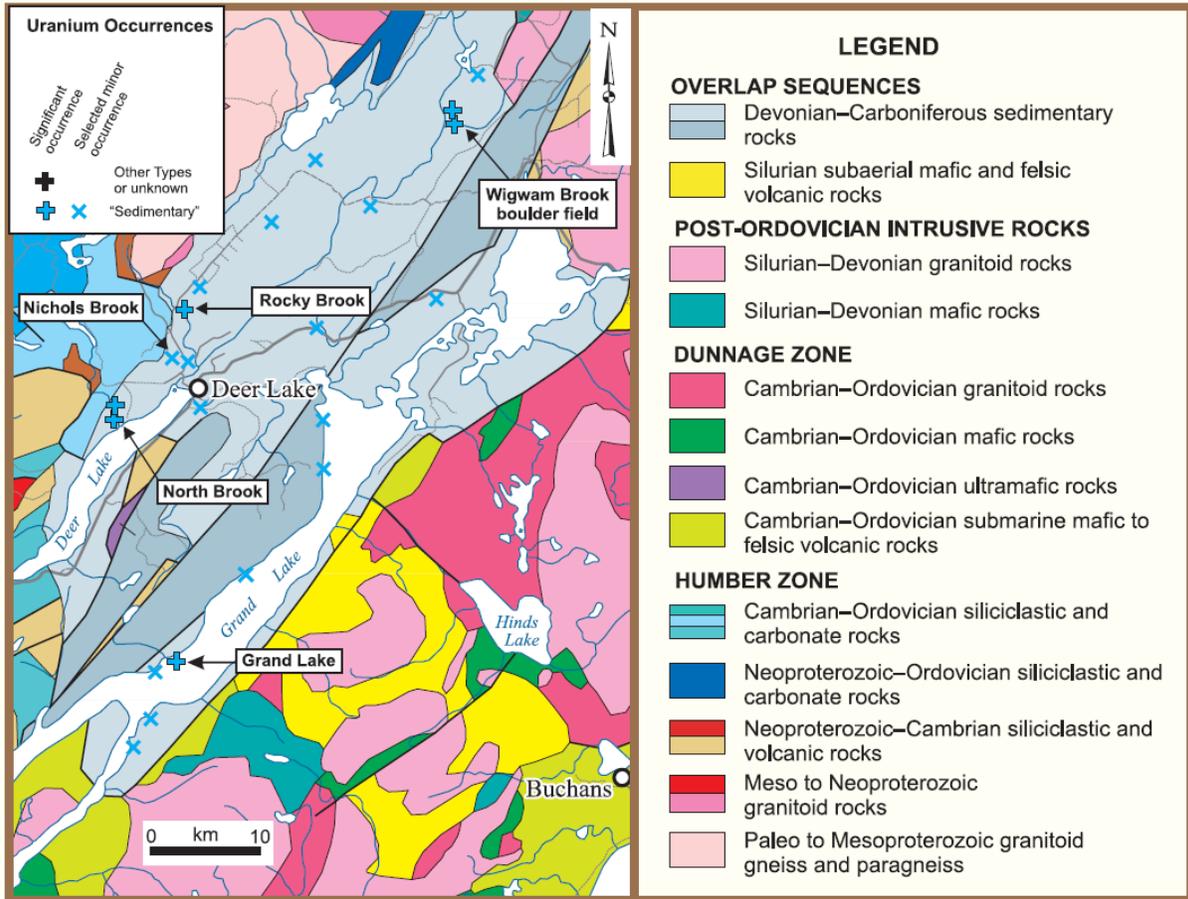
Area Selection:



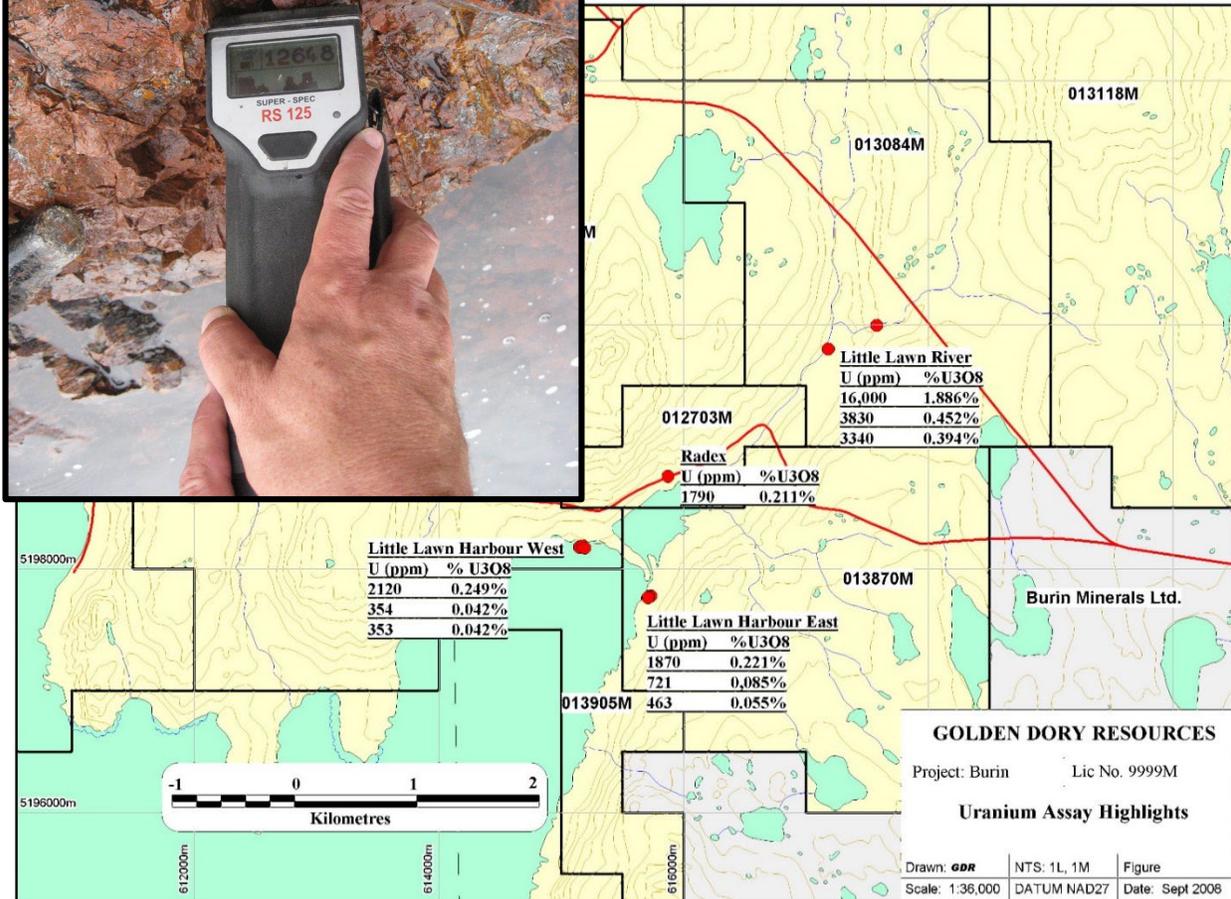
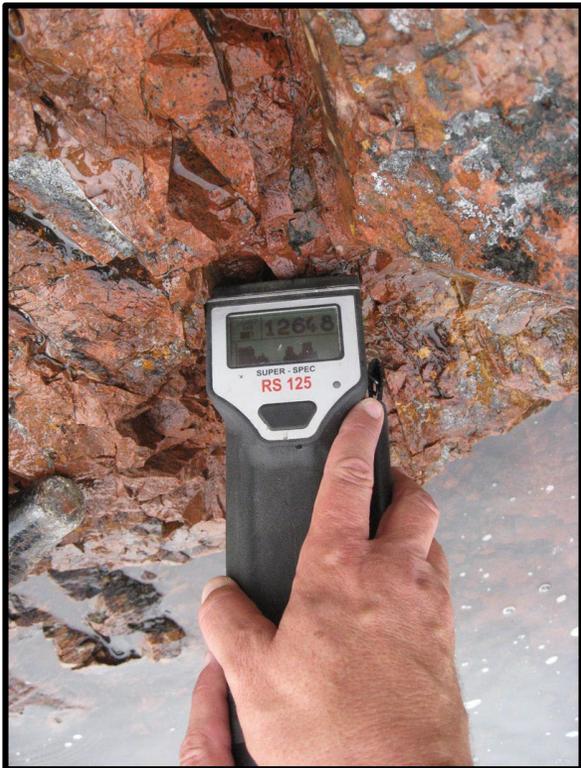
Area Selection:



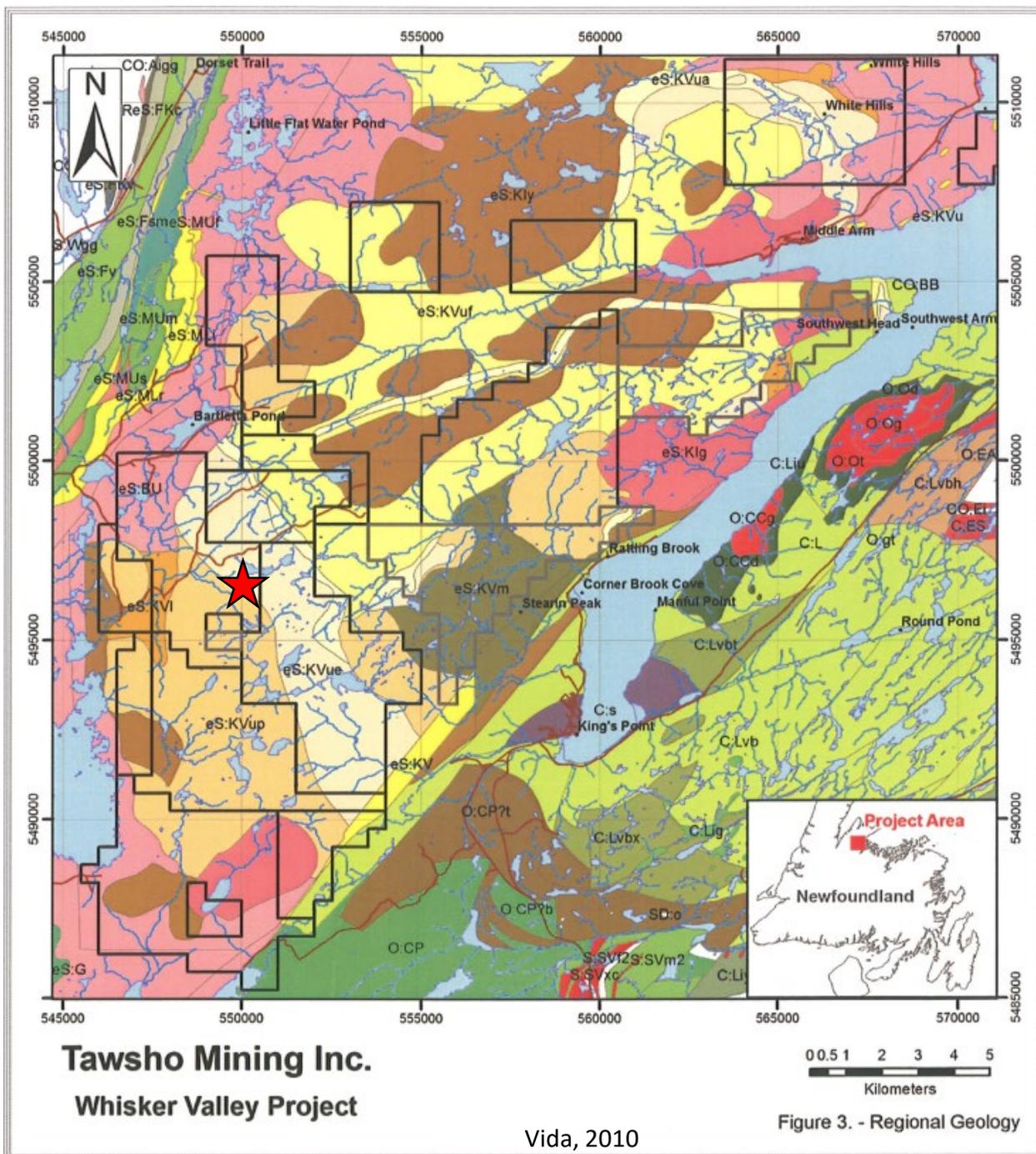
Area Selection:



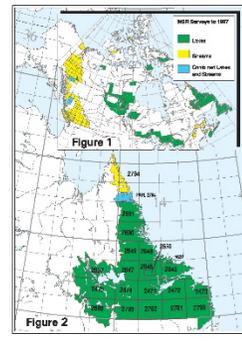
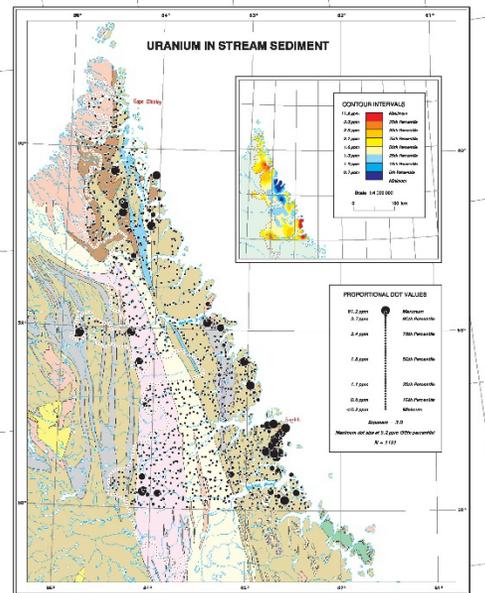
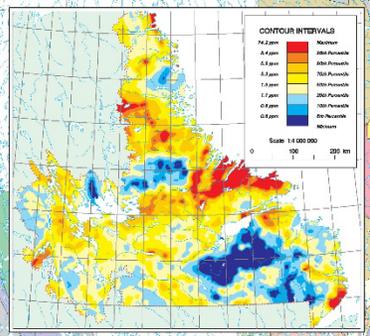
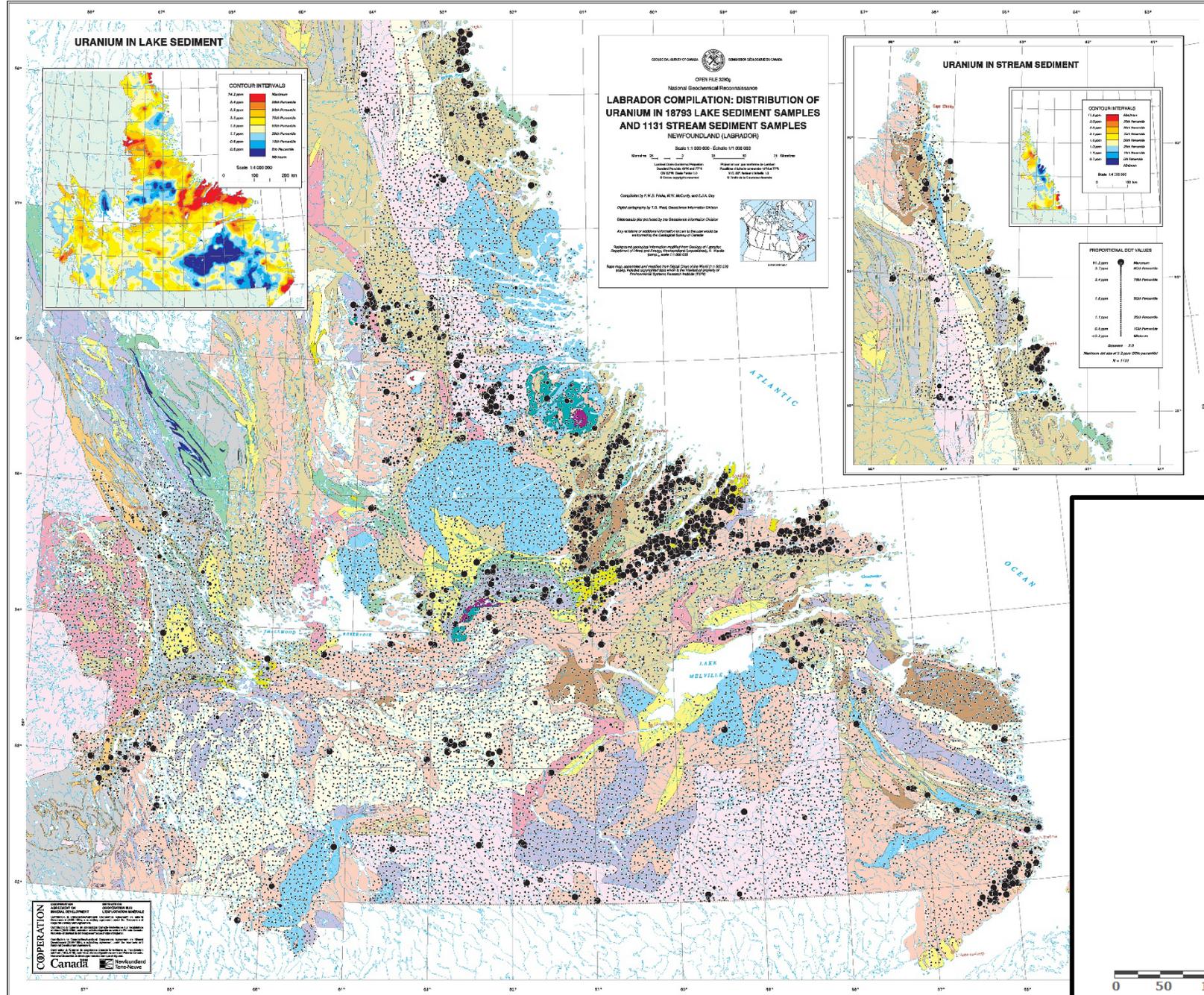
"New" Discoveries:



Golden Dory Resources Press Release, September, 2008



Vida, 2010



SUMMARY STATISTICS FOR SELECTED ELEMENTS

Element	Co	Cu	Fe	Li	Mn	Pb	U	Zn	Cr	As
Number of Values	18 208	18 208	18 208	18 208	18 208	18 208	18 793	18 208	18 208	18 208
Maximum Value	10	10	10	10	10	10	10	10	10	10
Minimum Value	0	0	0	0	0	0	0	0	0	0
Standard Deviation	0.000 000	0.000 000	0.000 000	0.000 000	0.000 000	0.000 000	0.000 000	0.000 000	0.000 000	0.000 000
Mean	0.000 000	0.000 000	0.000 000	0.000 000	0.000 000	0.000 000	0.000 000	0.000 000	0.000 000	0.000 000
90th Percentile	0.000 000	0.000 000	0.000 000	0.000 000	0.000 000	0.000 000	0.000 000	0.000 000	0.000 000	0.000 000
80th Percentile	0.000 000	0.000 000	0.000 000	0.000 000	0.000 000	0.000 000	0.000 000	0.000 000	0.000 000	0.000 000
70th Percentile	0.000 000	0.000 000	0.000 000	0.000 000	0.000 000	0.000 000	0.000 000	0.000 000	0.000 000	0.000 000
60th Percentile	0.000 000	0.000 000	0.000 000	0.000 000	0.000 000	0.000 000	0.000 000	0.000 000	0.000 000	0.000 000
50th Percentile	0.000 000	0.000 000	0.000 000	0.000 000	0.000 000	0.000 000	0.000 000	0.000 000	0.000 000	0.000 000
40th Percentile	0.000 000	0.000 000	0.000 000	0.000 000	0.000 000	0.000 000	0.000 000	0.000 000	0.000 000	0.000 000
30th Percentile	0.000 000	0.000 000	0.000 000	0.000 000	0.000 000	0.000 000	0.000 000	0.000 000	0.000 000	0.000 000
20th Percentile	0.000 000	0.000 000	0.000 000	0.000 000	0.000 000	0.000 000	0.000 000	0.000 000	0.000 000	0.000 000
10th Percentile	0.000 000	0.000 000	0.000 000	0.000 000	0.000 000	0.000 000	0.000 000	0.000 000	0.000 000	0.000 000

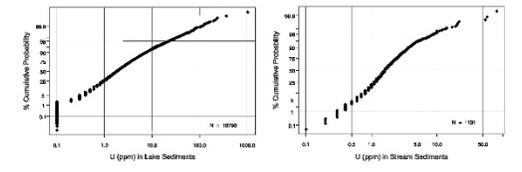
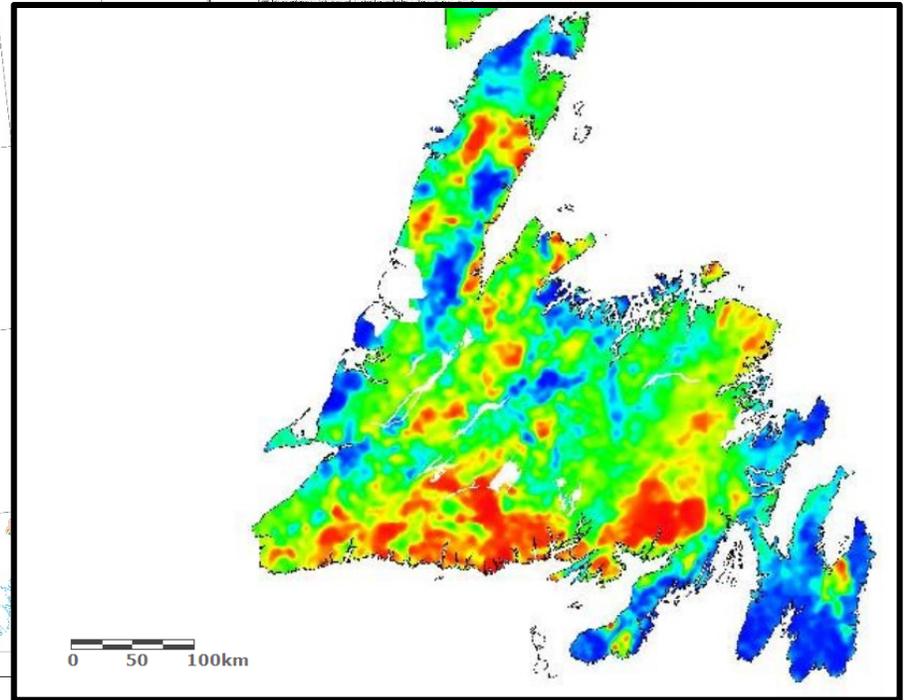


FIGURE 1 Distribution of uranium in lake sediment. The distribution is highly skewed, with most values below 1.0 ppm. The 50th percentile is approximately 0.5 ppm.

FIGURE 2 Distribution of uranium in stream sediment. The distribution is also highly skewed, with most values below 1.0 ppm. The 50th percentile is approximately 0.5 ppm.



INTRODUCTION

The purpose of this report is to provide a detailed description of the data and methods used in the preparation of the maps. The data were obtained from the Canadian Geological Survey and the Canadian Geomatics Centre. The maps were prepared using ArcGIS software.

OBJECTIVES

The objectives of this report are to provide a detailed description of the data and methods used in the preparation of the maps. The data were obtained from the Canadian Geological Survey and the Canadian Geomatics Centre. The maps were prepared using ArcGIS software.

SCOPE

The scope of this report is limited to the data and methods used in the preparation of the maps. It does not include any analysis or interpretation of the data.

DEFINITIONS

The following definitions apply to the terms used in this report:

- Map:** A graphical representation of the Earth's surface, showing geographical features and boundaries.
- Data:** Information that is used to create a map, such as coordinates, elevations, and geological data.
- Method:** A procedure or process used to analyze data and create a map.

REFERENCES

The following references were used in the preparation of this report:

- Canadian Geological Survey (1990). *Geological Map of Canada*. Ottawa: Queen's Printer.
- Canadian Geomatics Centre (1990). *Geomatics Data*. Ottawa: Queen's Printer.

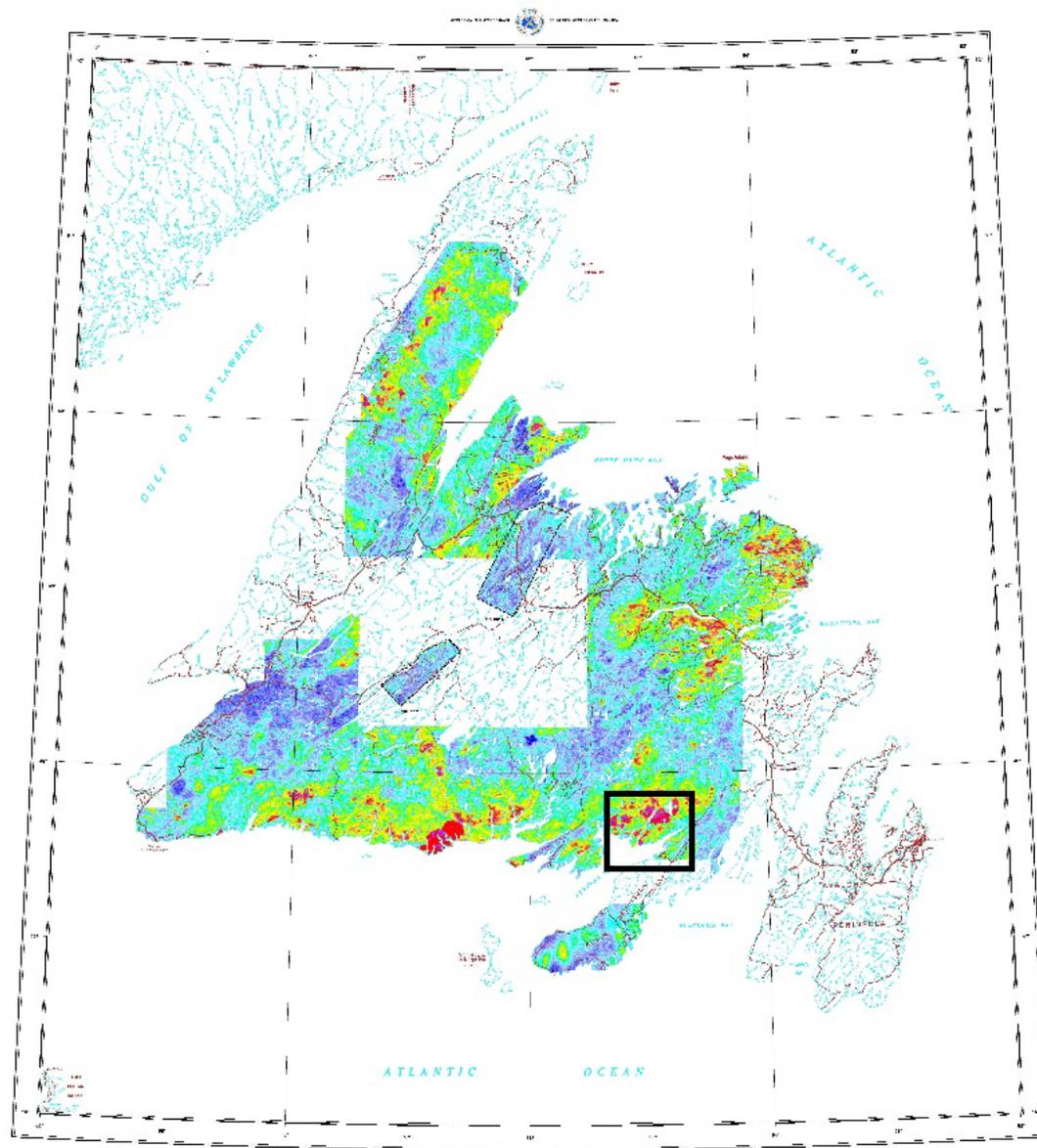
FIGURE 1

Map of the Island of Newfoundland and Labrador, showing the location of the study area. The map includes the names of the provinces and territories, and the names of the major cities and towns. The study area is highlighted in a black box.



FIGURE 2

Map of the study area, showing the location of the study area. The map includes the names of the provinces and territories, and the names of the major cities and towns. The study area is highlighted in a black box.



ISLAND OF NEWFOUNDLAND
 NEWFOUNDLAND AND LABRADOR
 CANADA

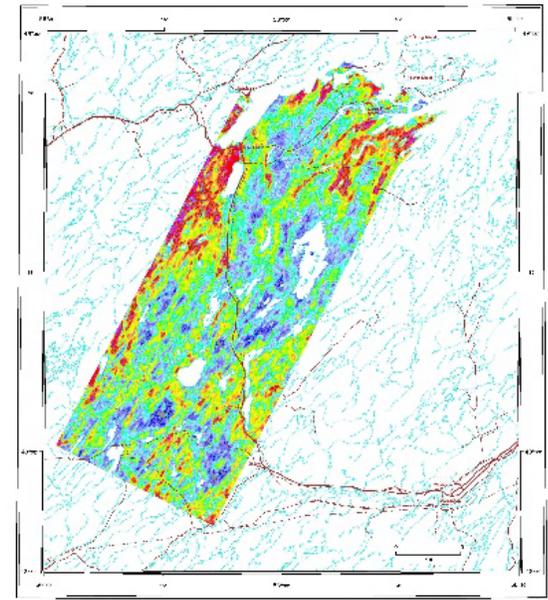
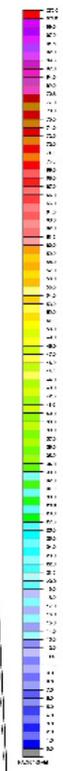


Figure 1
 Area of Aborted Core Pits
 GREAT GULL LAKE

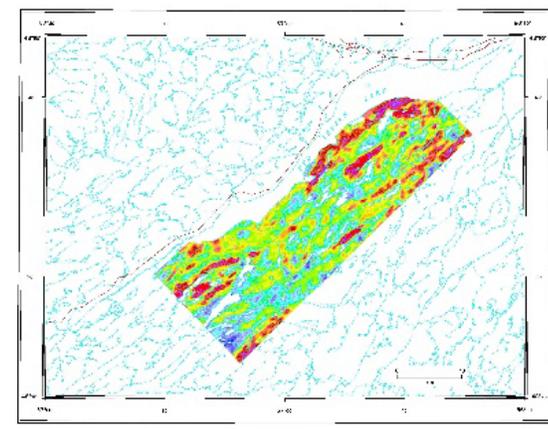


Figure 2
 Area of Aborted Core Pits
 TULKU VOLCANIC BELT

Color	Value
Blue	0
Light Blue	100
Light Green	200
Green	300
Yellow	400
Orange	500
Red	600
Dark Red	700
Black	800

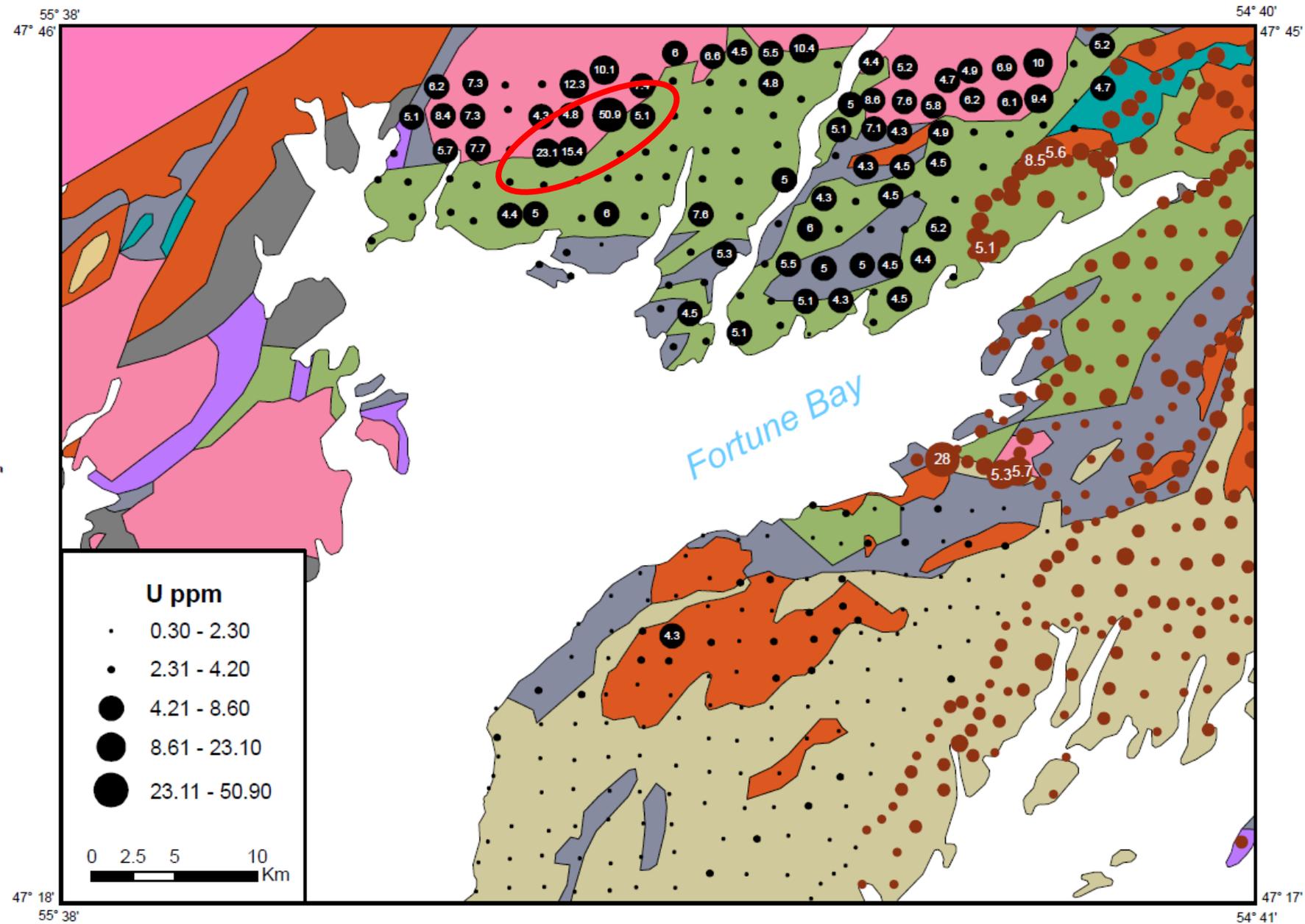


Figure 3a. Distribution of uranium (U) in till, north half. Brown data points are from Batterson and Taylor (2006).

Handheld scintillometers:

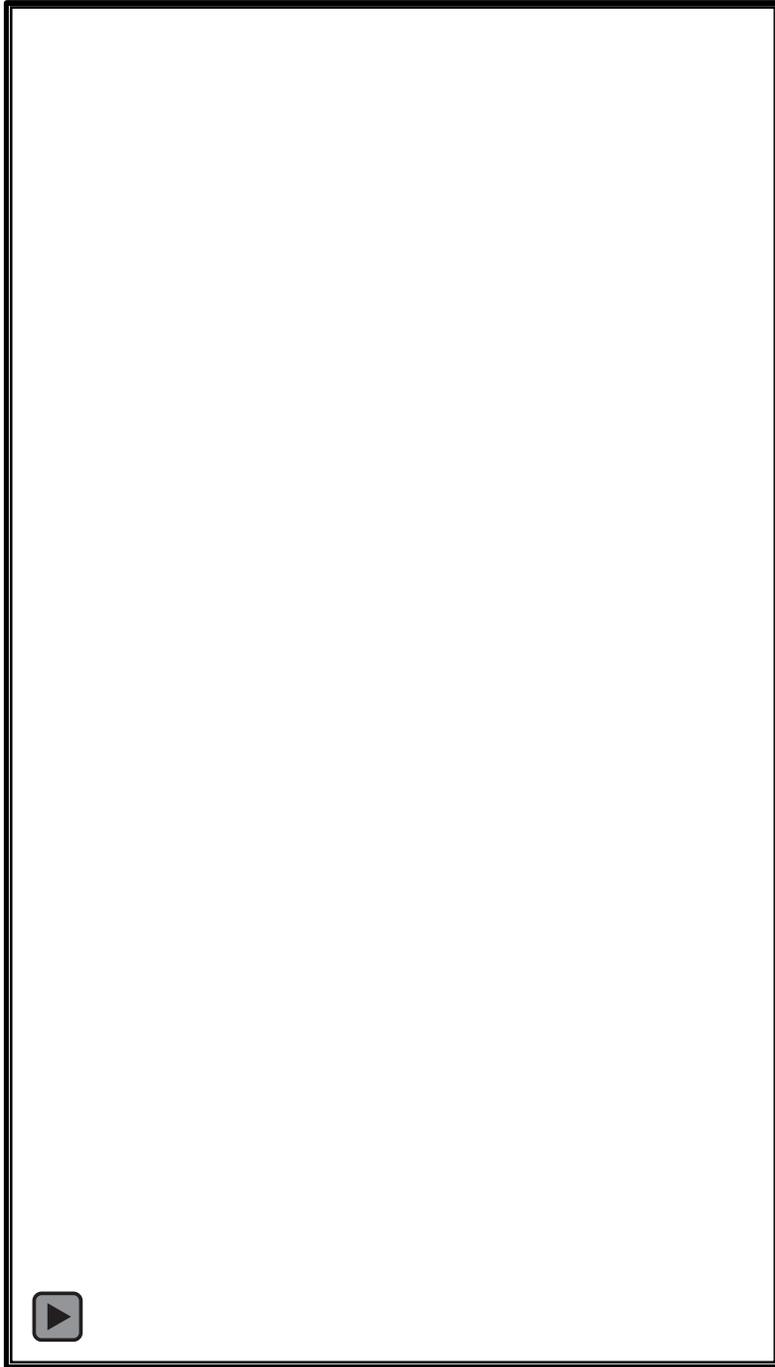
- Measures gamma radiation generated from long-lived radioactive elements (uranium, thorium and potassium)
- Rapid and effective means of quickly identifying areas of elevated radioactivity in the field
- But keep in mind background radioactivity varies with the underlying geology, and beware the effect of ground cover and the mass effect of large outcrops.



Handheld scintillometers:

- The GR-110 is an older model scintillometer
- Dial allows for mode selection
 - B – battery check/display test
 - 1 – 1 sec. readings
 - 10 – 10 sec. readings
 - HE – for higher-level areas
- Positive points:
 - The unit is ruggedized for field
 - Long battery life
- Negative points:
 - No automatic background detection
 - Constant sound

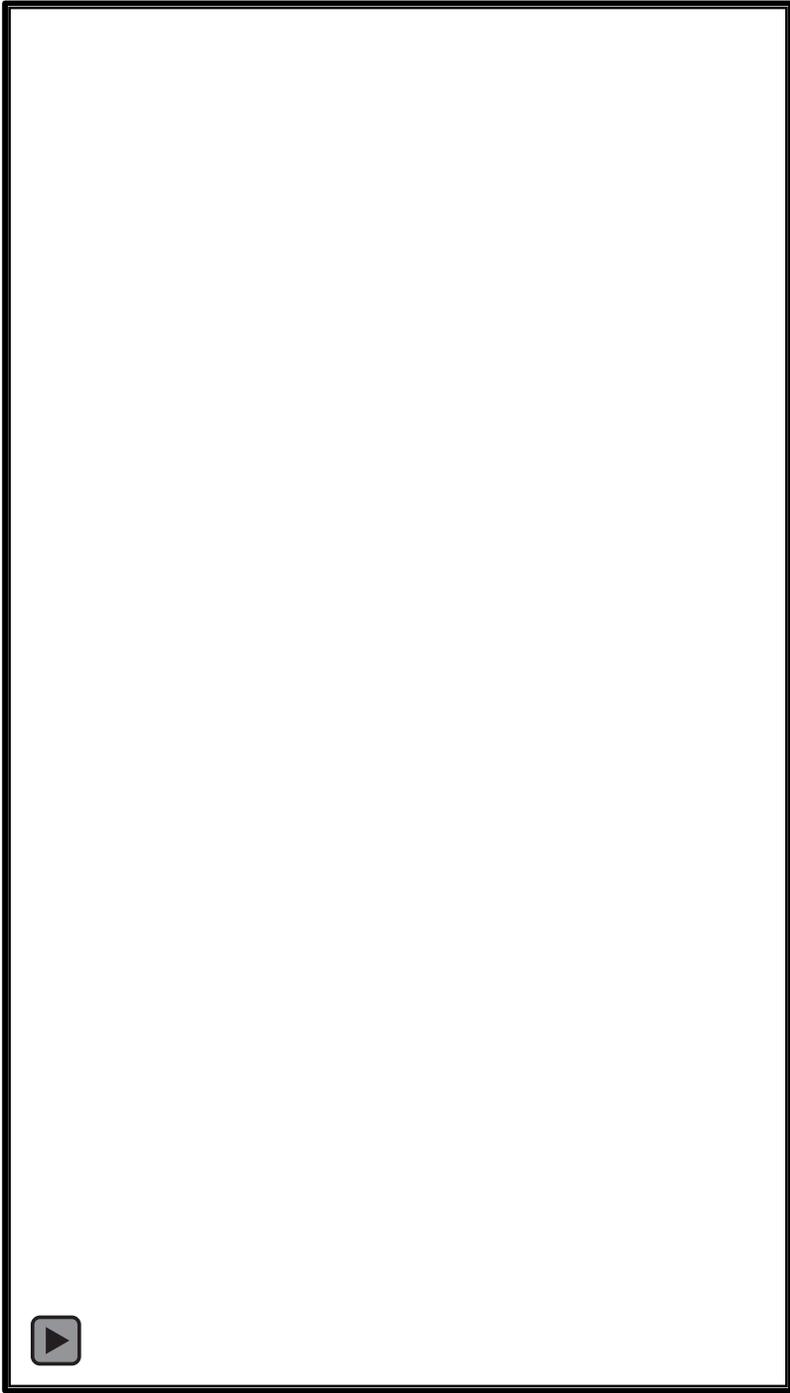




Handheld scintillometers:

- The RS-120 is a more modern unit
- Positive points:
 - Acquires background upon startup
 - Higher upper detection limit
- Negative points:
 - Shorter battery life
 - More prone to getting wet





Sources of Radioactivity:

- Long-lived radioactive elements include uranium (U), thorium (Th) and potassium (K).
- Potassium anomalies can generally be disregarded; this is generally a major component of granite intrusions, hence their higher background and prominent radiometric signatures.
- Uranium and thorium commonly occur together in magmatic rocks, and are often enriched with rare-earth element mineralization.





Common rock types associated with elevated radioactivity:

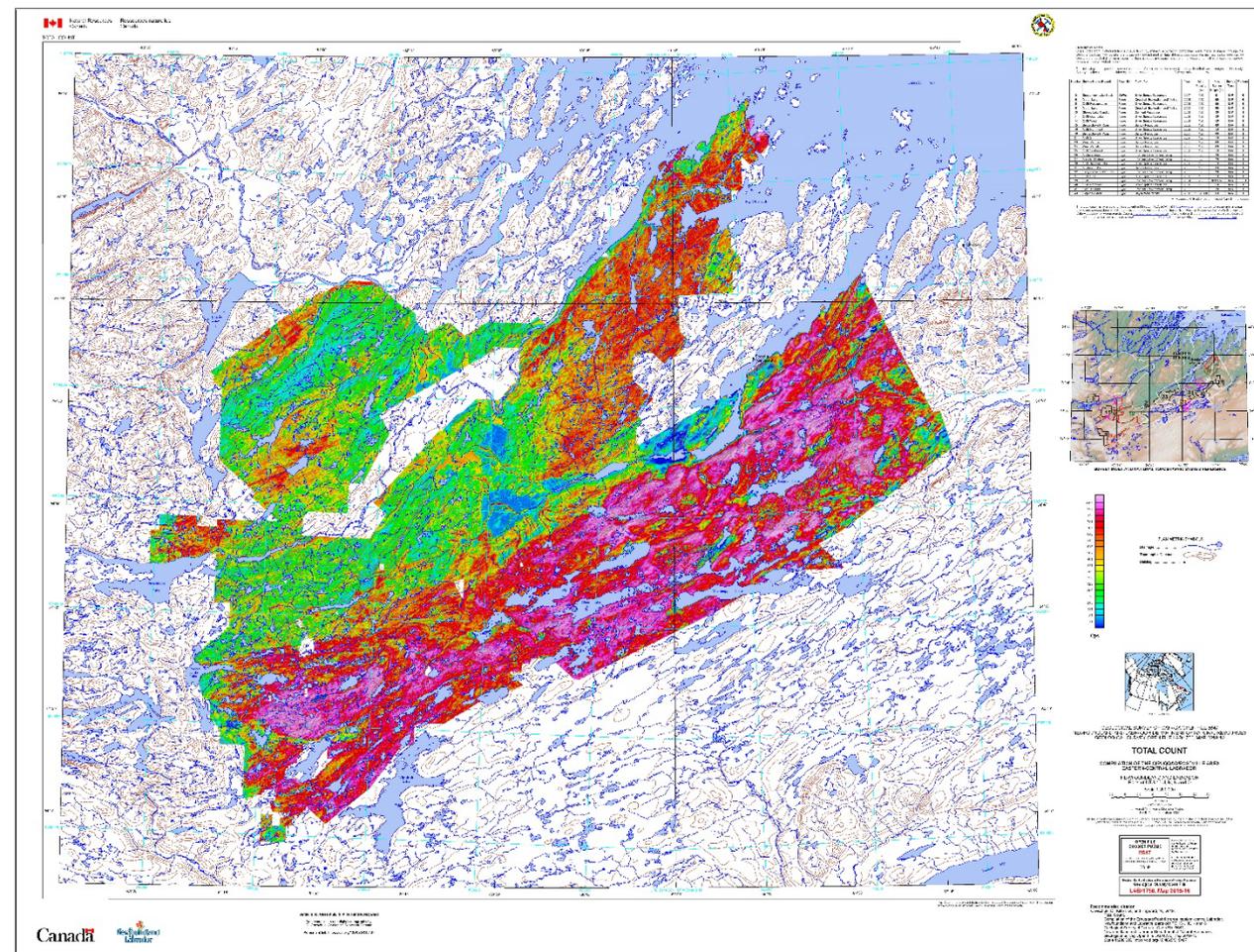
- Igneous (Intrusive and volcanic rocks)
 - Mafic (0.1-3.5 ppm)
 - Felsic (1.0-20 ppm)
- Sedimentary
 - Shale (1-15 ppm)
 - Black shale (3-1000 ppm)
- High-grade uranium (NL) ~900 ppm



Mineralized pegmatite, containing 140 CPS; assayed 525 ppm U.

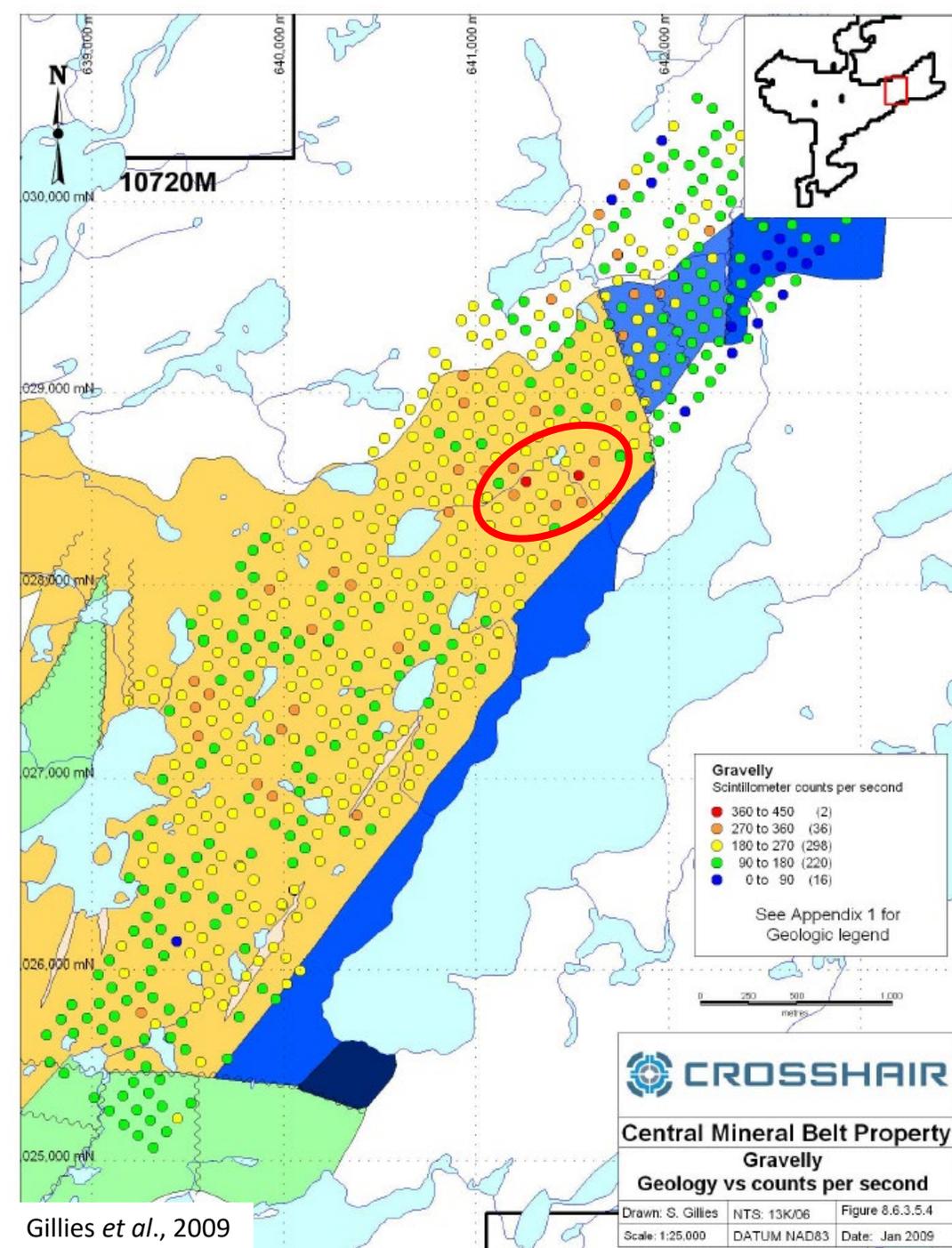
Determining background:

- Beware the mass effect, where abundant low-grade enrichment gives strong signal response.
- Boggy areas can also be associated with elevated radioactivity due to the leaching of uranium from nearby rock sources.
- Anomalous radioactivity – 2x to 3x background.



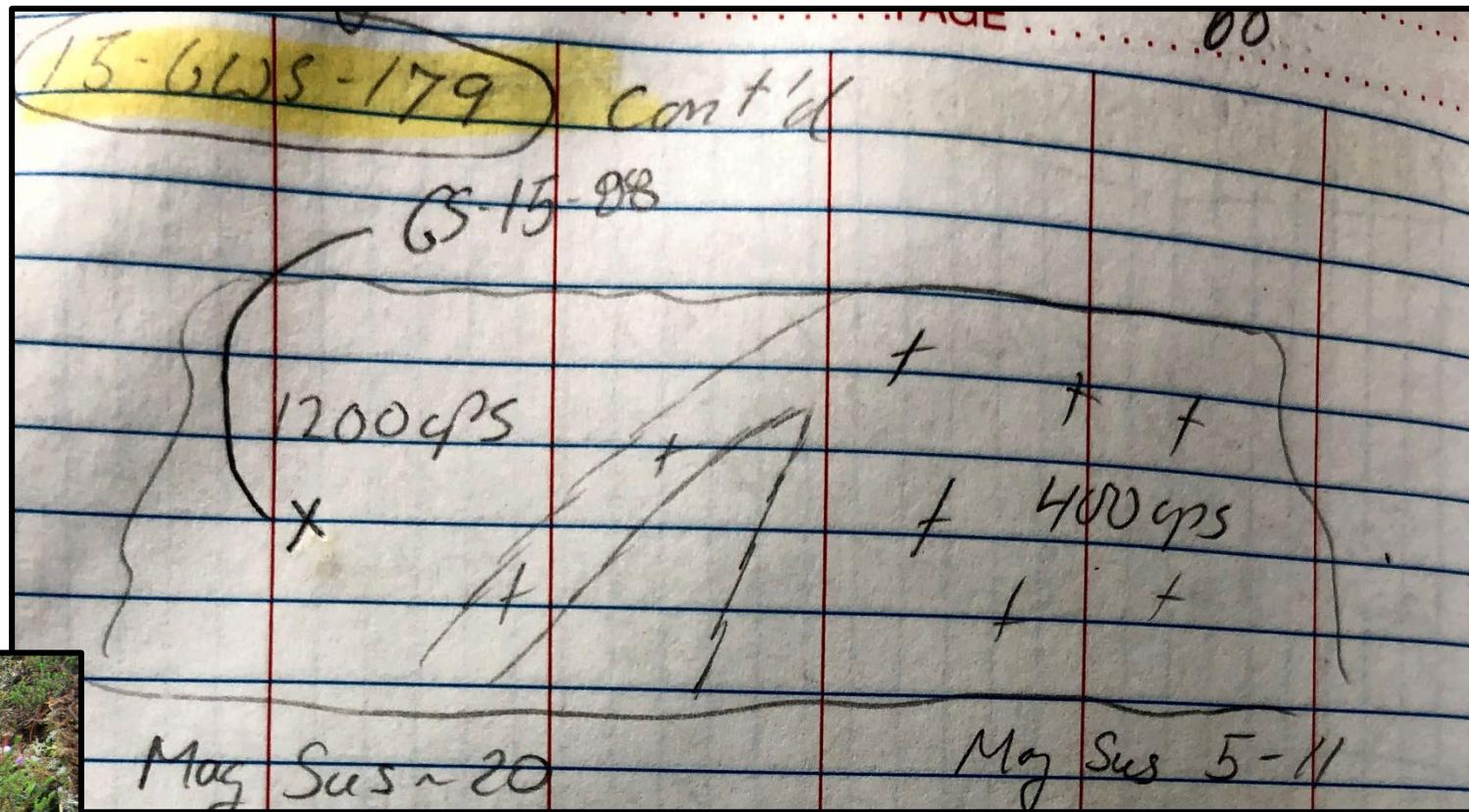
Determining background:

- Background varies depending on many factors (*e.g.* depth of cover, underlying geology)
- Systematic recording of scintillometer values allows for identification of “anomalous” areas
- Anomalous radioactivity, if under cover, is a target for a test pit to check for increased radioactivity with depth



Real time data:

- Scintillometer allows the identification of sample sites in the field



- GS-15-088: 1200 cps in outcrop; 250 cps in the bag; assay results of 77 ppm U.



Counts in the bag:



The effect of cover:

- Surficial cover greatly reduces the detectable radioactivity; the same goes for bodies of water.
- Digging a small test pit in area of anomalous radioactivity may result in increased counts per second (CPS).
- Potential masking of signal should be taken into account when reviewing results from airborne radiometric surveys.



Health and Safety:

- Two main ways for radioactive material to enter the body
 - Ingestion
 - Inhalation
- Avoid inhalation of rock dust when sampling highly radioactive material
- Practice good hygiene
 - Wash hands before eating



Ingestion



Inhalation

Source: ablemployment.com





Summary:

- Scintillometers provide a fast and effective way of identifying anomalous radioactivity in the field and helps direct sampling.
- Allows vectoring towards areas of increased radioactivity, even in areas with no outcrop, but shallow cover.
- Scintillometers can be used to produce radiometric maps over areas of interest, but systematic record keeping is key.
- Double check samples once collected in areas away from radioactive outcrop to ensure a suitable sample was collected.



Thank You!