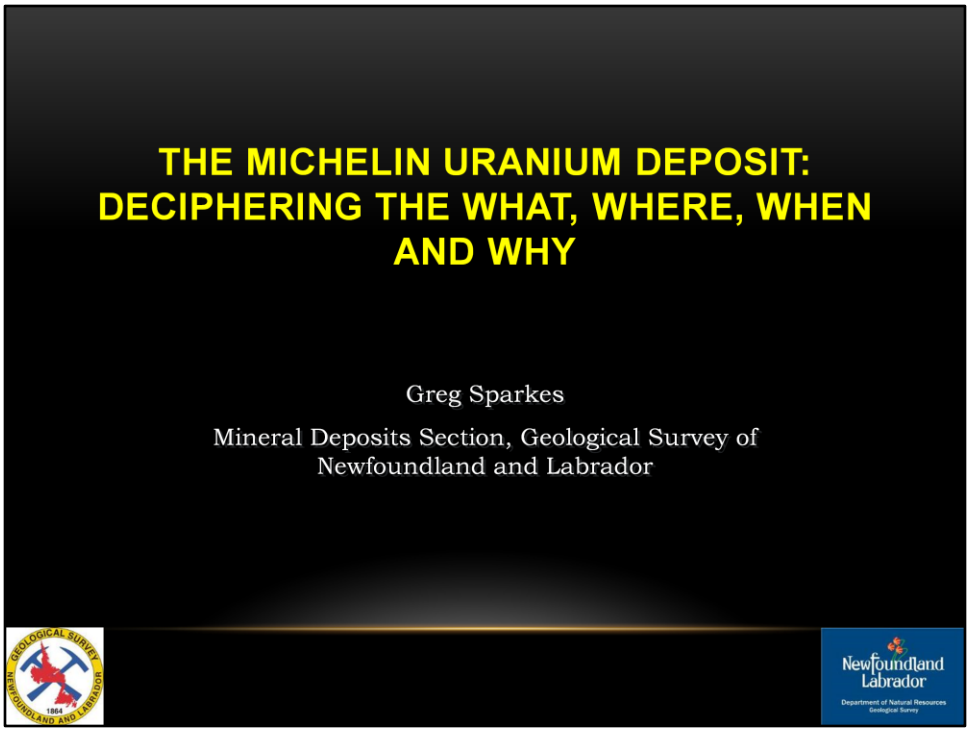
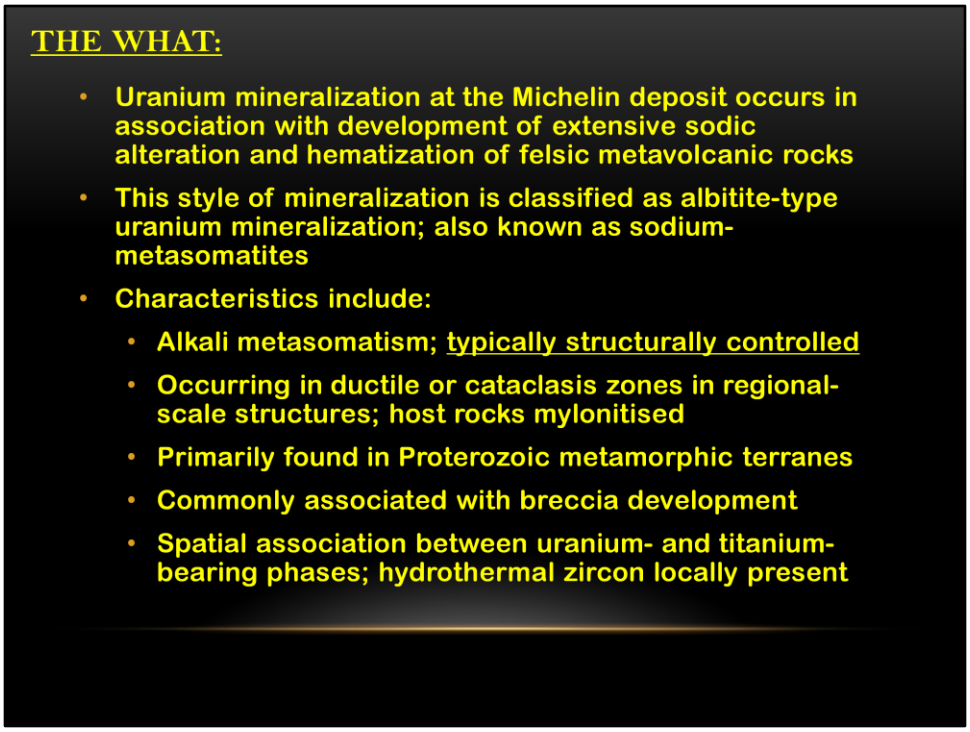


- Todays talk will focus on the WHAT, with regards to the style of mineralization the Michelin deposit is thought to represent, and like any good story starts out with two guys in a bar. The WHERE refers to both geographically and geologically location of the deposit, the WHEN deals with the timing of mineralization and subsequent overprinting events and the WHY is the million dollar question, why is Michelin is where it is

- The Michelin deposit was originally discovered in 1968, so this story has been some 50 years in the making

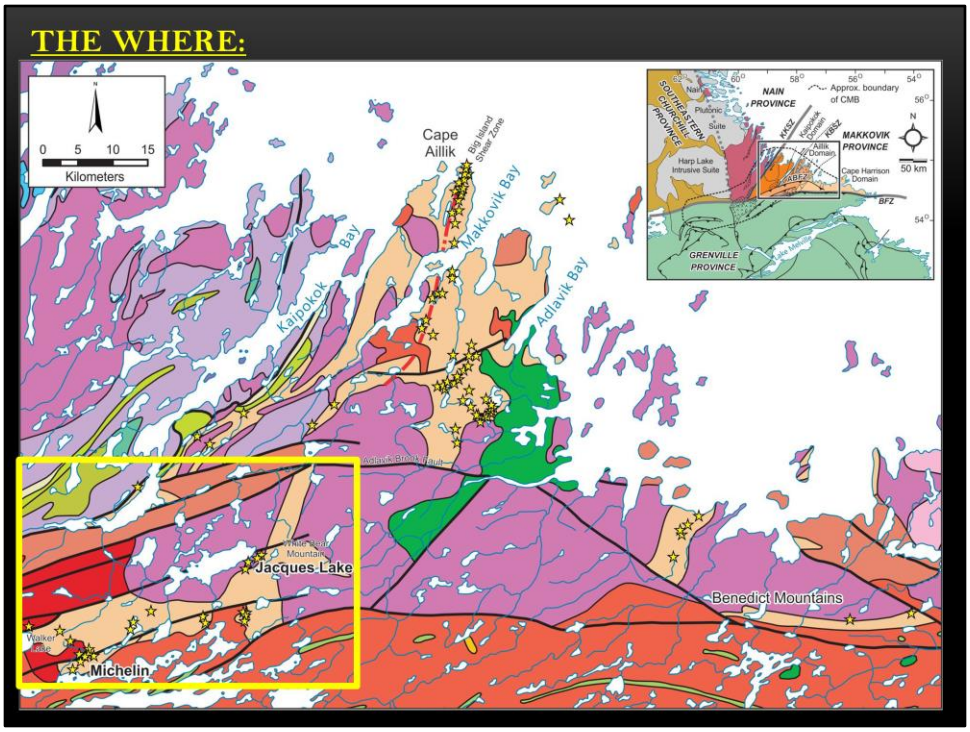


- Starting out with the WHAT:
  - The main characteristics of the Michelin deposit include extensive zones of sodic alteration and accompanying hematization in association with the development of uranium mineralization

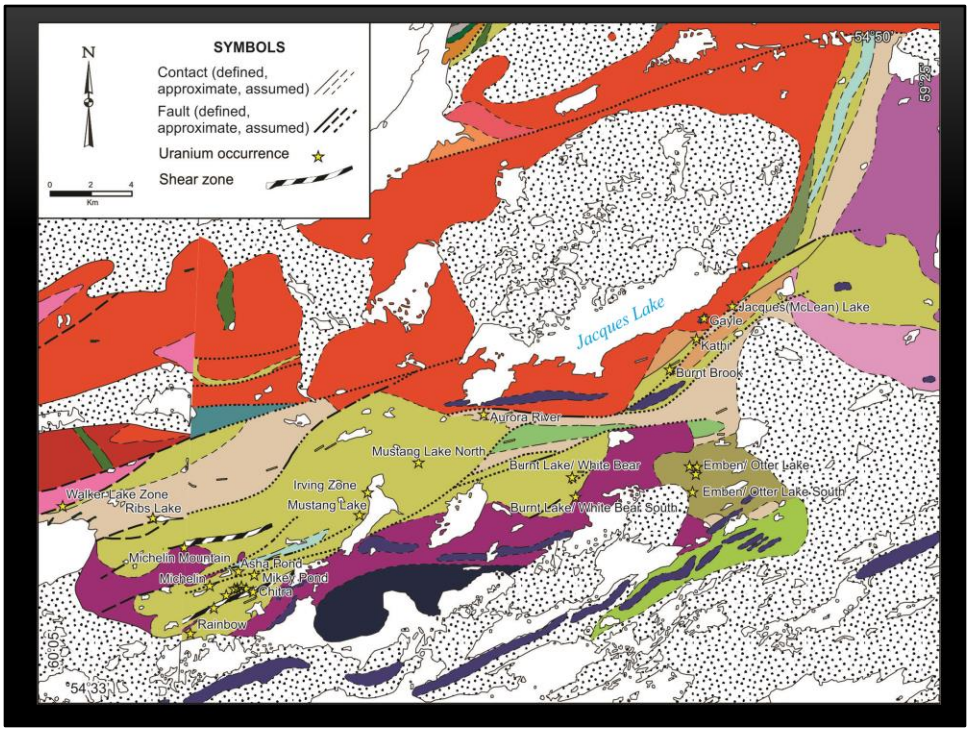
  - Michelin is now interpreted to represent so-called albitite-type uranium mineralization, also referred to as sodium-metasomatites; a style of mineralization that is most commonly found in the Baltic Shield region and Russia.
    - The first written reference that I'm aware of is a Current Research article Andy and I put out back in 2008, but the first initial discussions regarding this style of mineralization actually occurred between Andy and a uranium company representative in a bar in 2007 following our Mineral Resources Review, if my memory serves me correctly, but such a meeting is a little harder to reference!

  - The general characteristics of this style of mineralization include:
    - Alkali metasomatism; this primarily has a fundamental structural control often forming in ductile or cataclasis zones
    - Primarily occur within Proterozoic metamorphic terranes and form at two main periods; namely between 1900-1700 Ma and between 1500-1400 Ma

- Breccia development commonly displays a spatial association with the metasomatic alteration
- Common U-Ti association, in addition to development of hydrothermal zircon

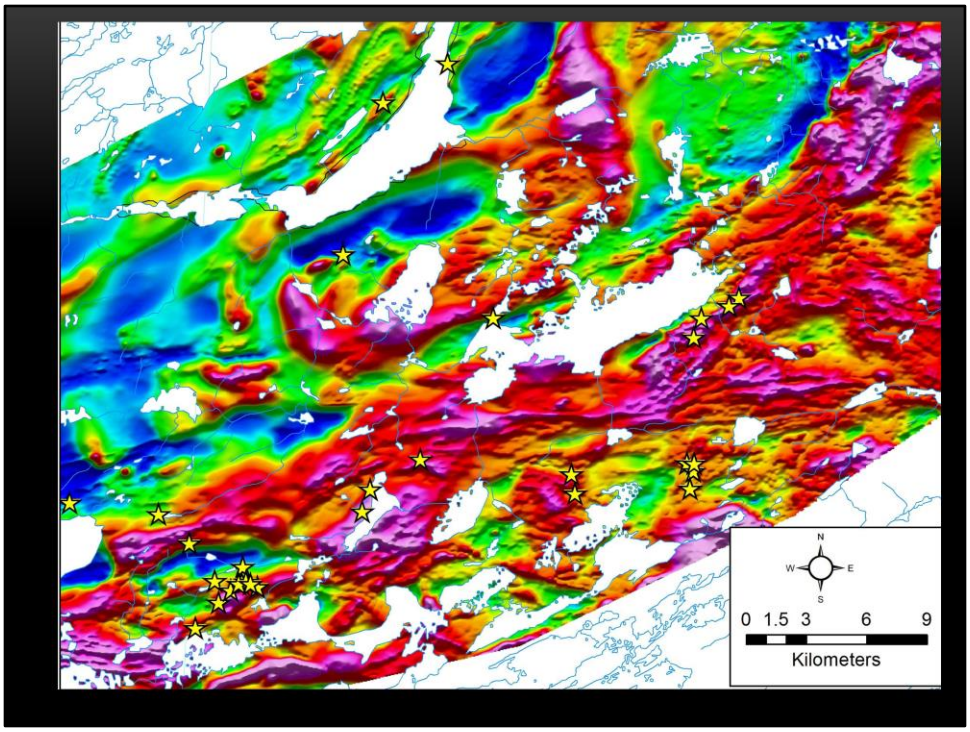


- This is a regional map showing the eastern portion of the CMB
- The rocks of the Aillik Group, which are the predominant host to uranium mineralization within the CMB, are shown in the pinkish orange colouration
- Uranium occurrences hosting within the Aillik Group are shown by the yellow stars
- One thing to note on a regional scale is the spatial association between the linear array of uranium occurrences and the Big Island Shear Zone, which represents a significant shear zone developed during the Makkovikian Orogeny, and is locally host to the development of albitite-style uranium mineralization; however this area remains exempt mineral land and was not explored form uranium since the 1980s.
- The bulk of the uranium mineralization hosted within the Aillik Group occurs south of the Adlavik Brook Fault, occurring in the southwestern portion of the Aillik Group



- There is significant glacial cover in this region, but the Aillik Group rocks general form a northeasterly trending sequence primarily consisting of felsic to intermediate volcanic rocks predominantly consisting of flows and tuffs and related volcaniclastic deposits

- The one thing that is missing in this region is the recognition of a regionally extensive structure such as the Big Island Shear Zone; however smaller scale shear zones have locally been defined by regional mapping

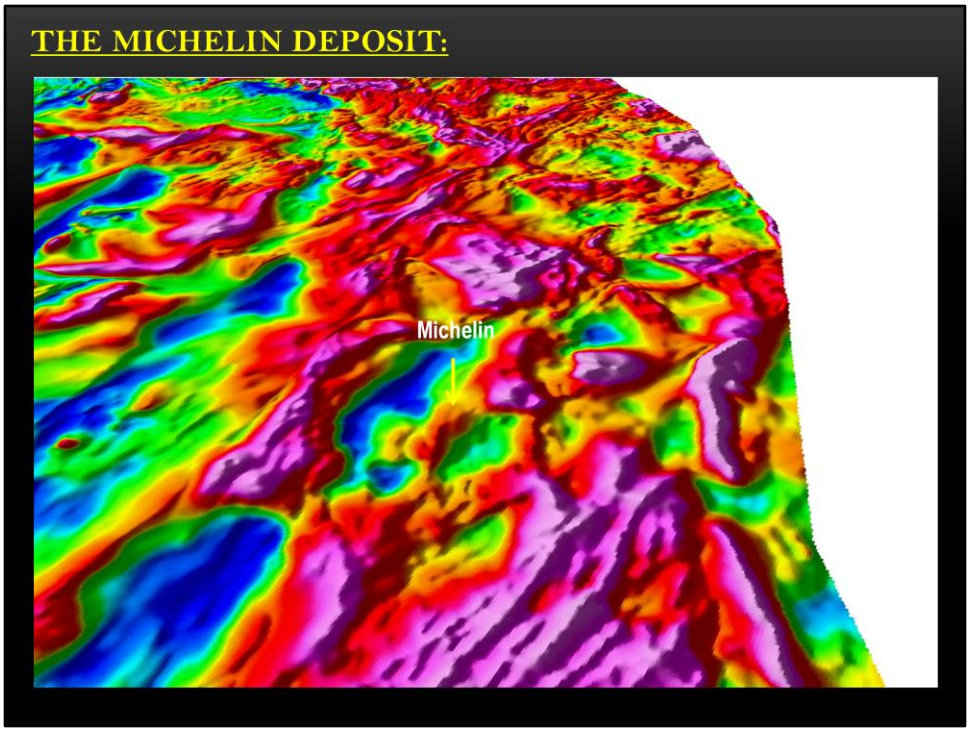


- This image shows the air borne magnetic data for the same region in the previous slide. In the northeastern most region you can see a rough northeasterly trending zone in the area of the Jacques Lake deposit, however as you move southwest this becomes disrupted by several zones of east-west displacement, but still the overall trend of uranium occurrences define a broad northeasterly trend

- One important think to note is that as you move southwest, you move into the region of the Grenville Front which may account for some of the observed disruption

- The Aillik Group volcanic rocks in the area host abundant magnetite, which accounts for their prominent magnetic signature; however in most instances this magnetite predates the development of the uranium mineralization, which generally results in magnetite destruction

THE MICHELIN DEPOSIT:

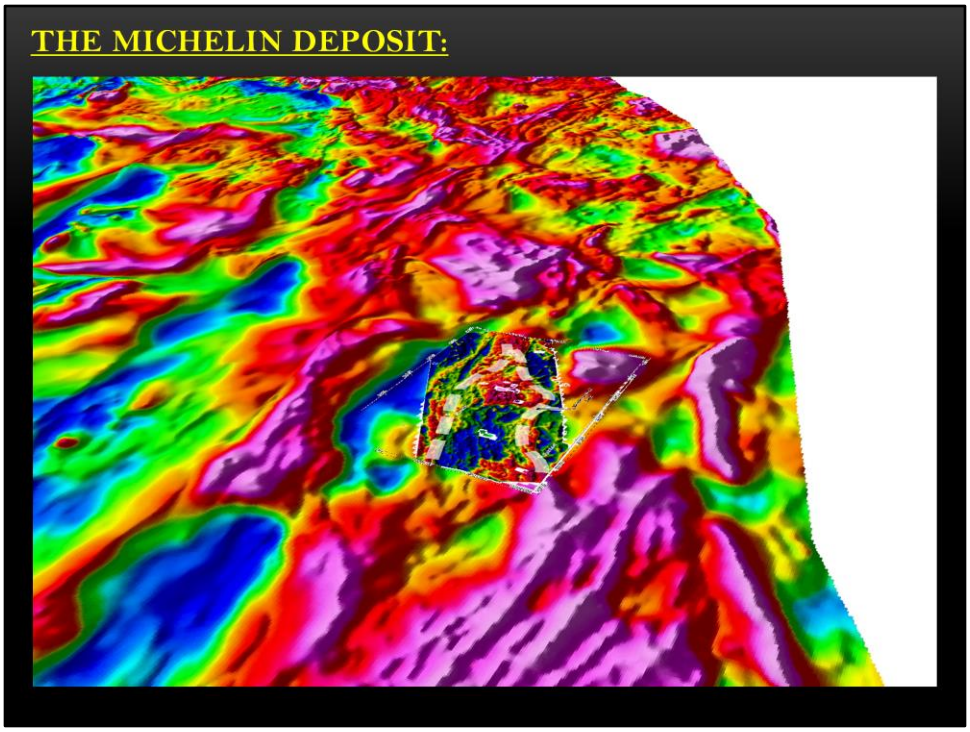


- This is what the general area surrounding the Michelin deposit looks like; this is satellite imagery draped over the digital elevation model for the area, with a slight vertical exaggeration. Some areas of reference are Mustang Lake, Running Rabbit pond, Michelin, which is located just to the southwest of Running Rabbit, and Michelin Ridge

- Had the Michelin deposit been formed on either one of these ridges to the north or south it would have been much more better exposed and therefore easier to examine; however no such luck, the deposit itself is situated in a topographic low and the actual deposit only outcropping in one or two rare instances, with the bulk of the mineralization occurring below 250 m vertical depth

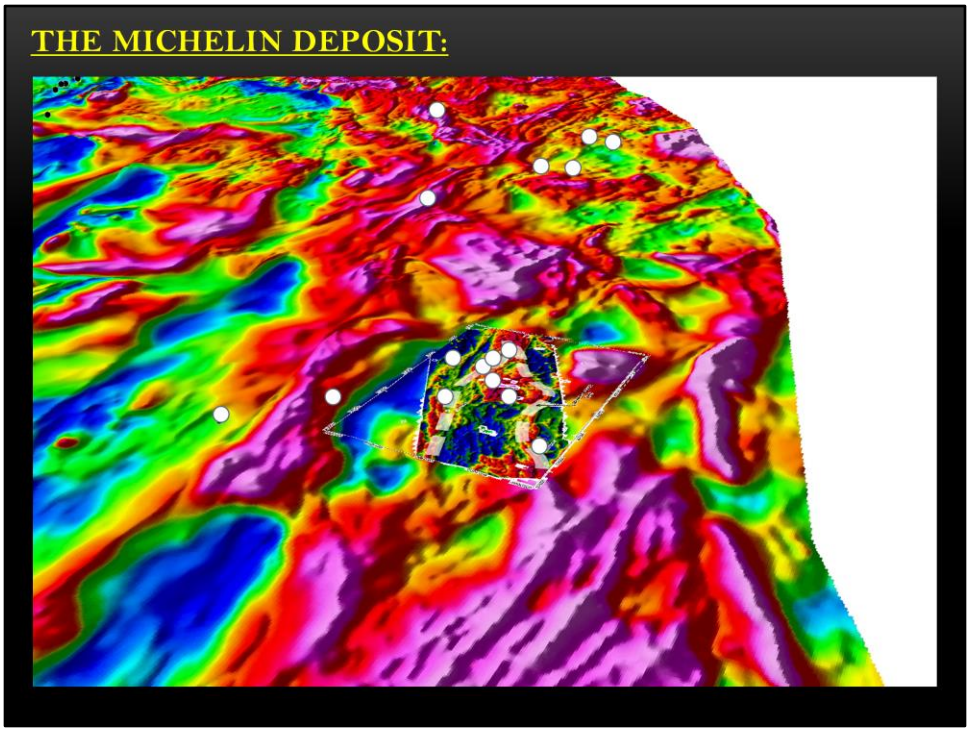
- This is what the air borne magnetic data looks like from an oblique aerial view looking to the northeast; the mag lows around the Michelin deposit are associated with the intrusion of post-mineralization, *ca.* 1640 Ma granites

THE MICHELIN DEPOSIT:



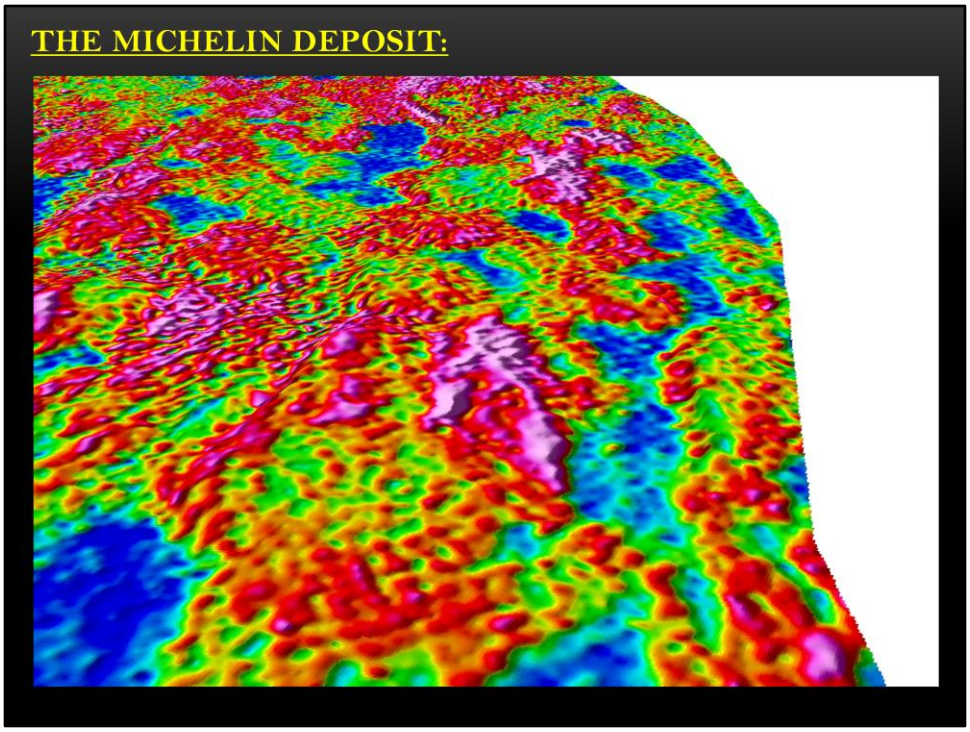
- Aurora Energy has conducted some extensive detailed ground magnetic data, which highlights two subparallel trends, the northern trend highlighted by Michelin and Running Rabbit and the southern trend by Rainbow an Chitra occurrences.

THE MICHELIN DEPOSIT:

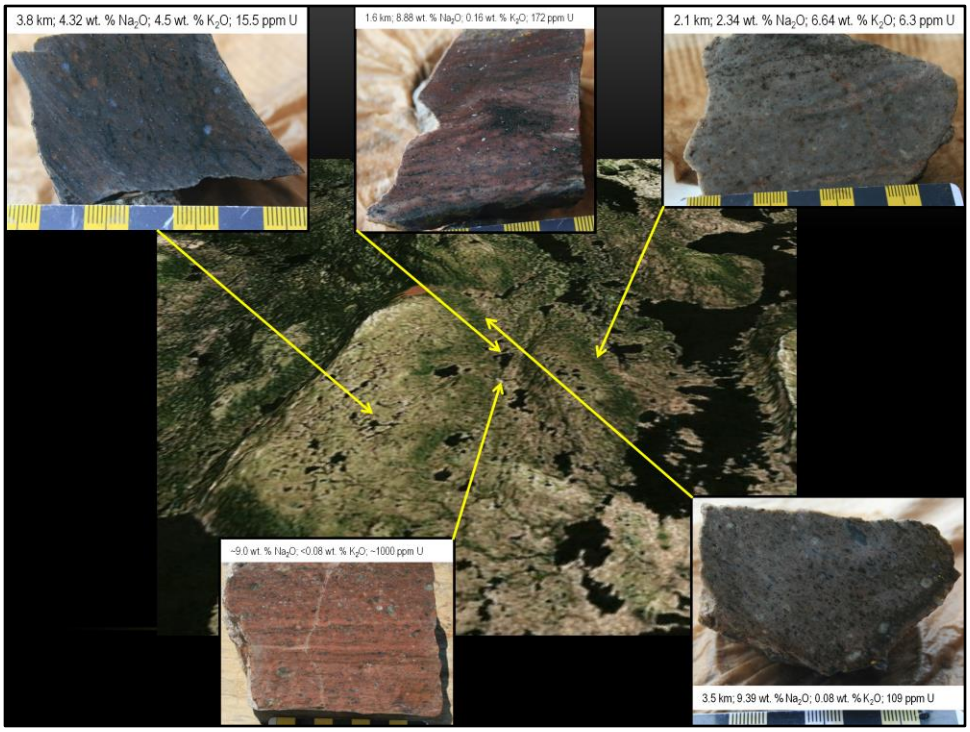


- White dots represent the most significant occurrences of uranium in the region
- However there is no real prominent signature of a significant regional structure in the area
- Some magnetite destruction occurs in association with the development of uranium mineralization resulting in mag lows, but as can be seen post mineralization granites are also associated with such features

THE MICHELIN DEPOSIT:



- This is what the air borne radiometrics looks like from the same oblique view
- Note the Rainbow an Chitra trend defines a prominent trend, the Michelin is very prominent, but this is largely artificial as material excavated from the exploration adit was used to construct crude roads in the immediate area of the deposit by Brinex
- The areas of Otter and White Bear form another area of prominent radioactivity and finally you can see the Jacques Lake deposit in the far distance; the actual deposit is located at southwester end of this anomaly and the rest represents glacial dispersion of the mineralization



- Many investigations have been carried out regarding the subsurface distribution of the sodic alteration and related uranium mineralization; however there are no maps outlining the surface distribution of the sodic alteration in the area, and I've found out that this is for good reason

- This first photo shows what the relatively unaltered felsic metavolcanic rocks look like in the area of Michelin Ridge; these rocks are inferred to be similar to those hosting the Michelin deposit, note the sub equal proportions of Na and K in unaltered samples.
-
- This next photo shows what a typical mineralized sample from Michelin looks like; up to 9 wt. % Na, no K and ~1000 ppm U; also not the strong penetrative fabric

- Along strike in the area of Running Rabbit, similar looking rock to Michelin with sodic alteration but only weakly anomalous U

- Still further along strike this is what a sodic altered sample without accompanying hematite alteration looks like and again with only anomalous U

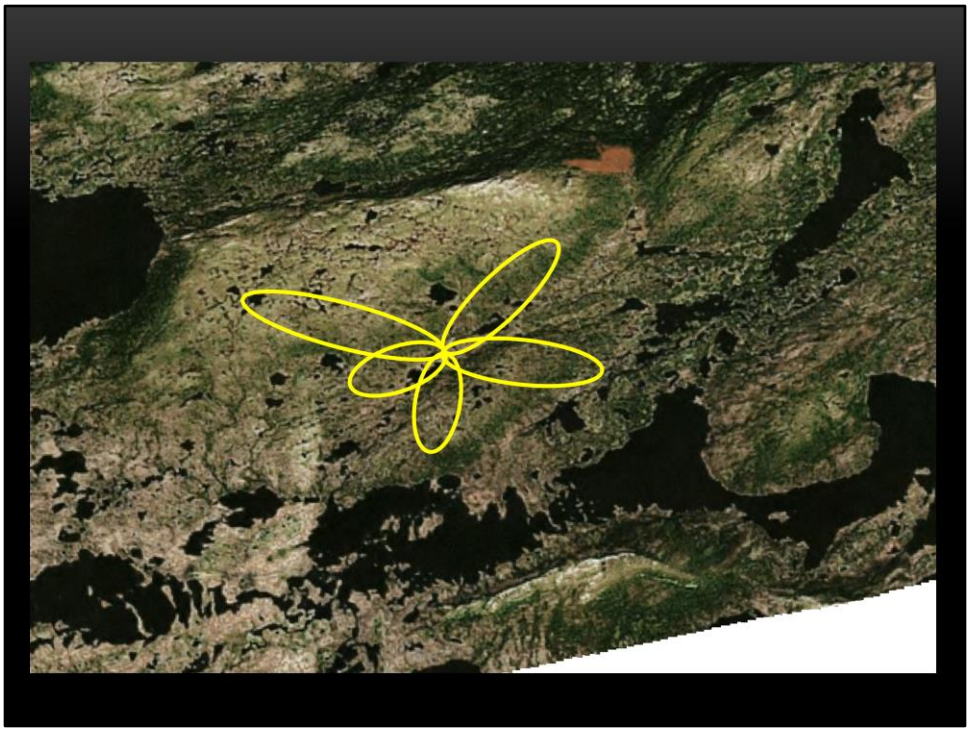
- Finally we have the sample that made me realize that the sodic alteration couldn't be mapped on visual identification alone; this sample is located within a mag low, has a very sugary texture and looks every bit like the lower photograph displaying

sodic alteration; however this sample only contains 2.5 wt. % Na

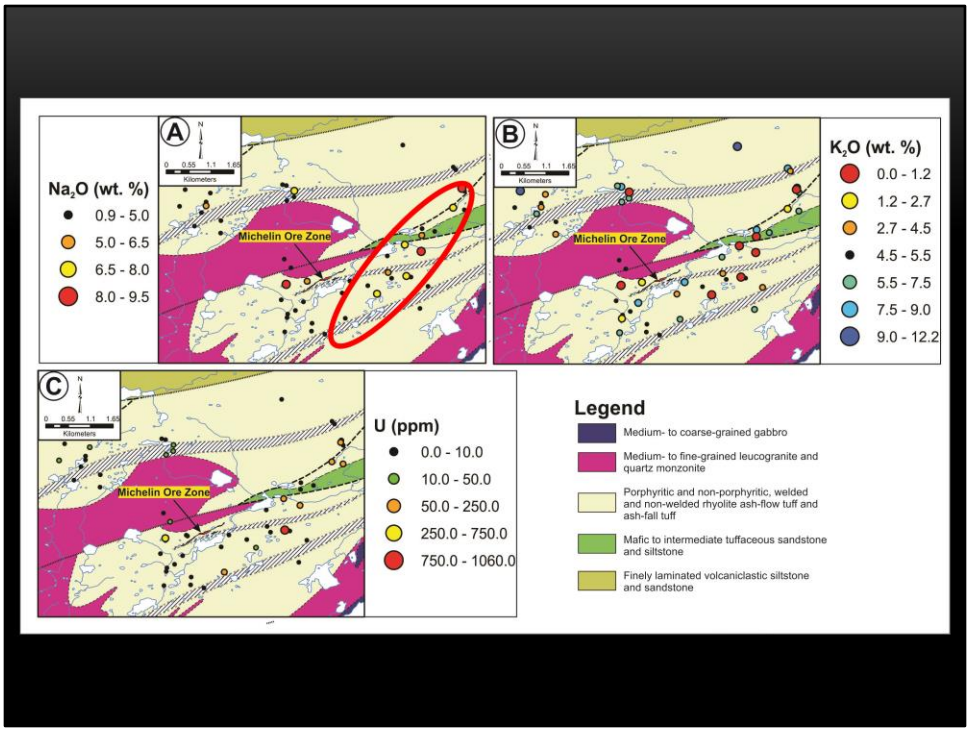
- While conducting detailed geochemical sampling around the Michelin deposit several zones of brecciation were also identified. Local relationships demonstrate that this brittle deformation was subsequently overprinted by the regional ENE trending foliation

- Examples of brittle deformation are also locally identified in drillcore

- No examples of mineralized breccias yet identified in the area of the Michelin deposit



- So I spent a week traversing out of the Michelin camp, collecting samples for geochemistry from each outcrop I visited and this is what I came up with



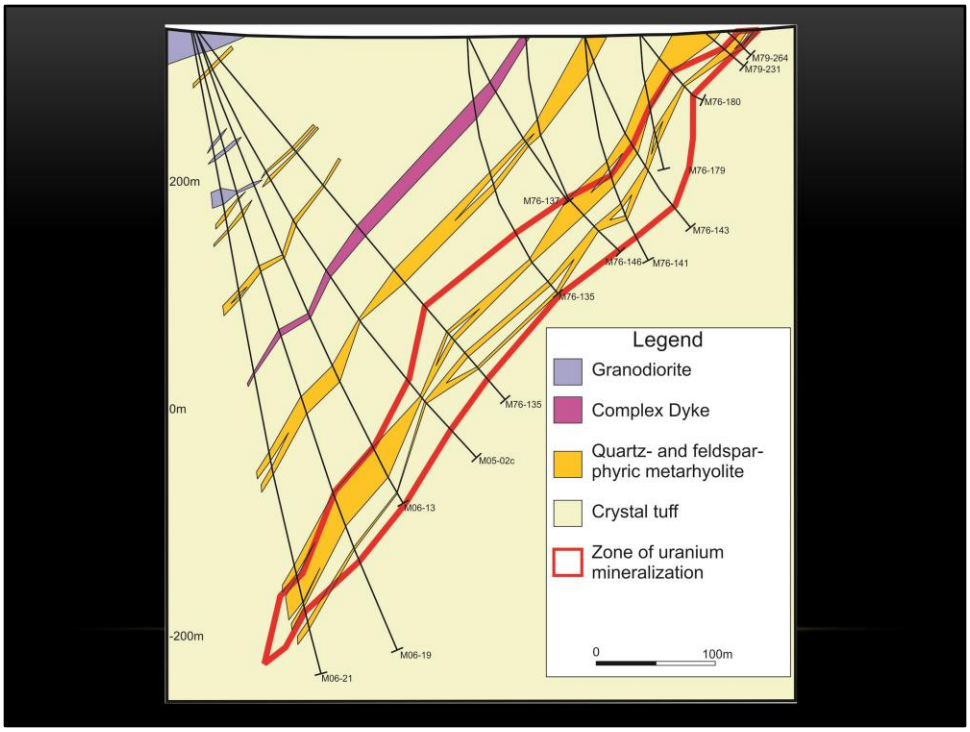
- To evaluate the surficial distribution of the sodic alteration in the vicinity of the Michelin deposit, 54 samples from the mineralized succession were collected over an area spanning some 5x6 km
- Here are several maps showing the distribution of select elements.
- Of particular note is the zone of Na enrichment developed to the east of the Michelin deposit, forming a northeasterly trending zone which is oblique to the main mineralized trend defined by the Michelin ore zone
- This zone is also accompanied by K depletion and local U enrichment
- It is interesting to note that the apparent trend of this zone is oblique to both the main trend of the Michelin ore zone and the trend of geological units in the area

THE WHEN:

- This is a photograph of one of the few outcrops where the Michelin deposit occurs at surface; the bulk of the mineralization actually occurs below a vertical depth of 250 m

- The mine stratigraphy consists of two main units, consisting of a non- to weakly porphyritic crystal tuff and a more coarsely porphyritic unit, both of which are shown here, and were generally inferred to represent interlayered ash flows

- The coarsely porphyritic unit is the main host to the uranium mineralization and new geochronological data now demonstrates that this unit actually represents later porphyry dykes which intrude the volcanic stratigraphy

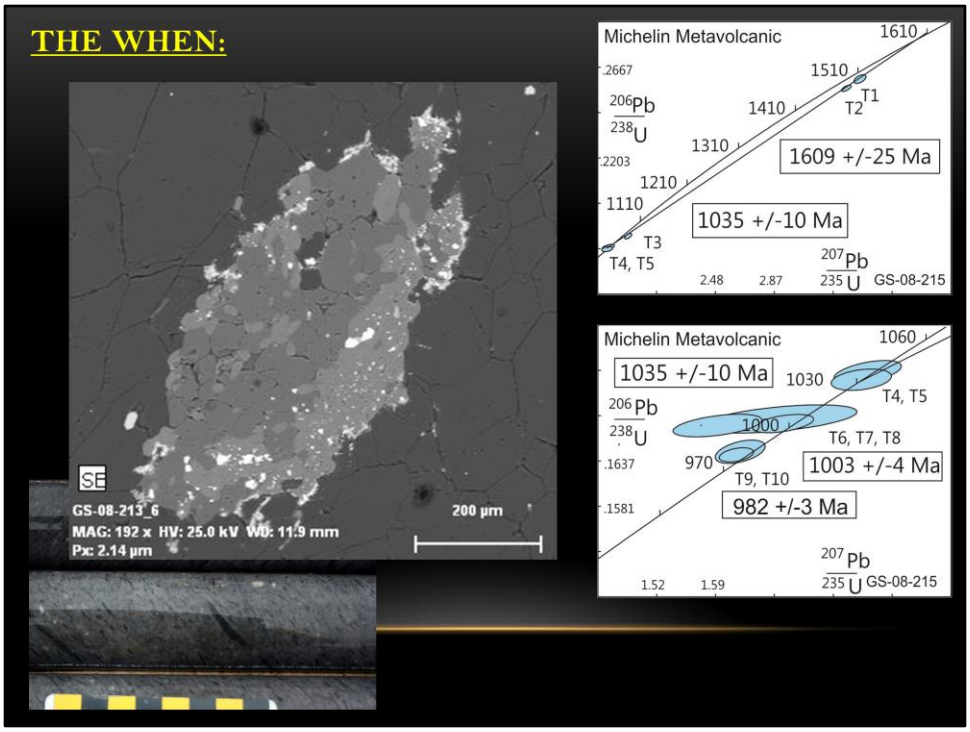


- This is a schematic cross-section through the Michelin deposit. The bulk of the succession is formed by the weakly porphyritic crystal tuff unit, the second most abundant unit consists of the more coarsely porphyritic dykes; note the strong spatial association this unit shares with the development of the uranium mineralization

- The other unit that is present consists of a mixed mafic-felsic dyke termed the complex dyke and is one of the few distinct marker units that can be traced throughout the deposit

- One thing to note is that aside for some mafic dykes, no units suitable for geochronological study are seen to crosscut the mineralization within the deposit.

- The deposit is inferred to have formed during the Makkovikian Orogeny based on other regional relationships, such as that at the Jacques Lake deposit where mineralization is crosscut by a 1800 Ma QFP dyke

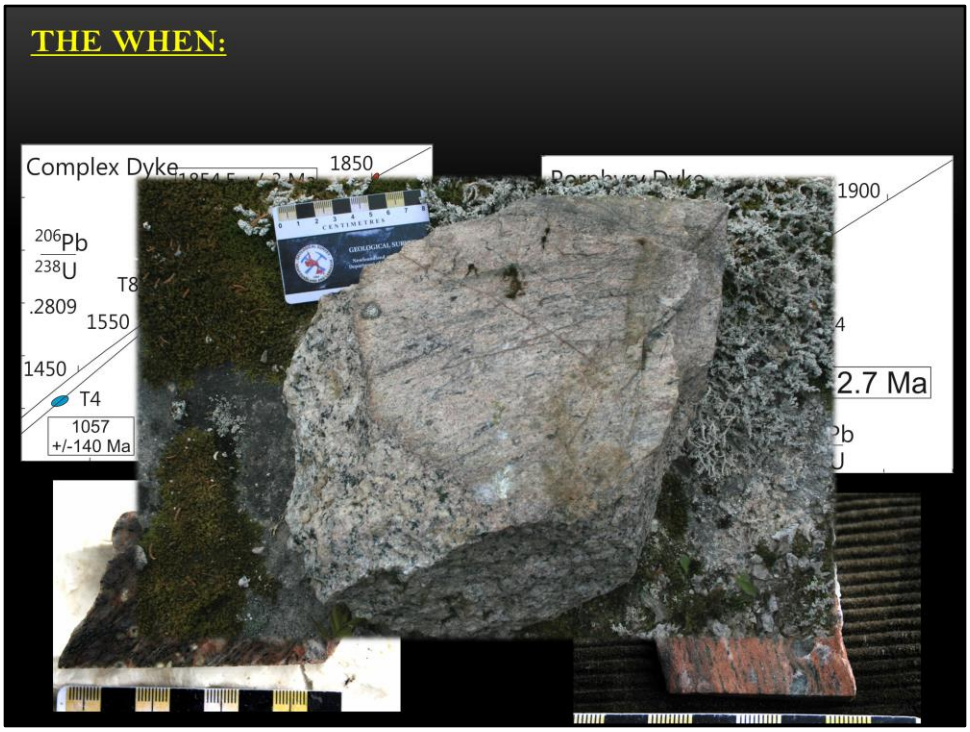


- First attempts at constraining the age of the Michelin deposit started with the unaltered, unmineralized weakly to non-porphyritic unit, which produced an age of 1858 +/- 2 Ma.

- It was at a Winter Seminar series like this when Mr. Dunning was giving a presentation on the applications of dating titanite that I foresaw its applications to the Michelin deposit given the demonstrated spatial association between the development of the uranium mineralization and the formation of titanite

- SEM image of amphibole rimmed by titanite contain abundant inclusions of uraninite

- However, investigations into age dating of titanite at Michelin has shown a complex metamorphic history is developed within the region; this particular sample contained titanite of 4 different generations

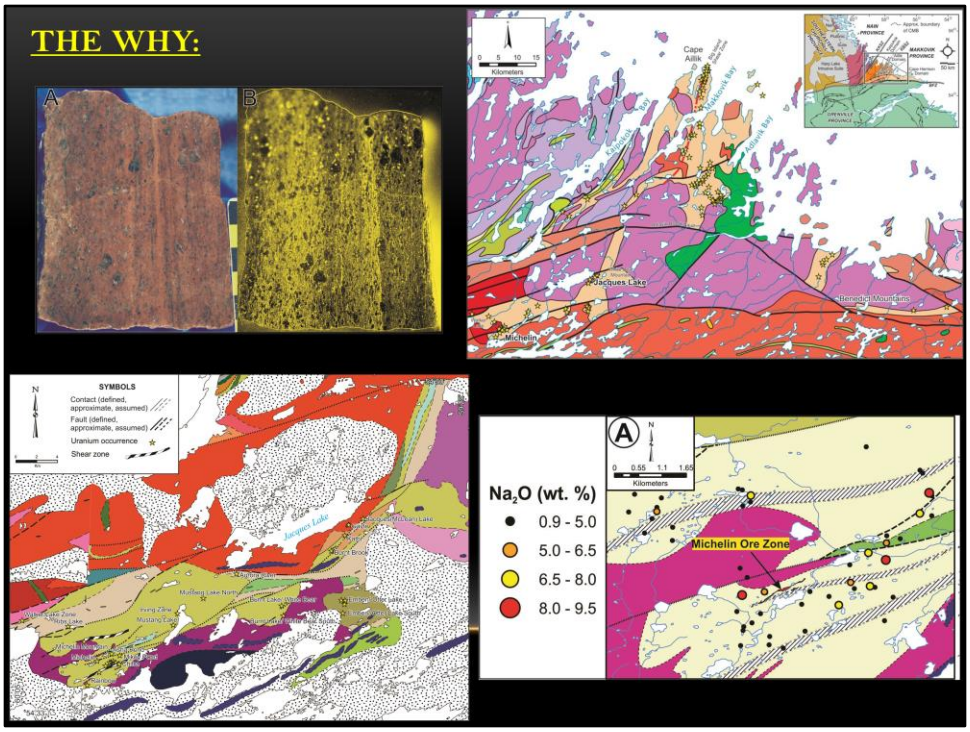


- More recent data coming out in this years Current Research with Greg Dunning

- Secondly the Complex Dyke unit was sampled, but the results were essentially inseparable from the non-porphyritic unit within analytical error

- So finally we processed a weakly mineralized sample of the coarsely porphyritic unit, initially targeting possible hydrothermal zircon; however after obtaining the results the sample produced an abundant population of zircon displaying well-developed igneous growth zoning. These zircon produced an age of 1848.4 +/- 2.7 Ma. No hydrothermal zircon were identified.

- During my last field season I visited the Dufus prospect; here a post-mineralization granite intrudes and crosscuts albitized and uraniferous metavolcanic rocks, and would undoubtedly be a candidate for geochronological study in the future. This granite currently would be inferred to represent one of the other 1800 or 1640 Ma intrusions similar to those dated elsewhere in the region.



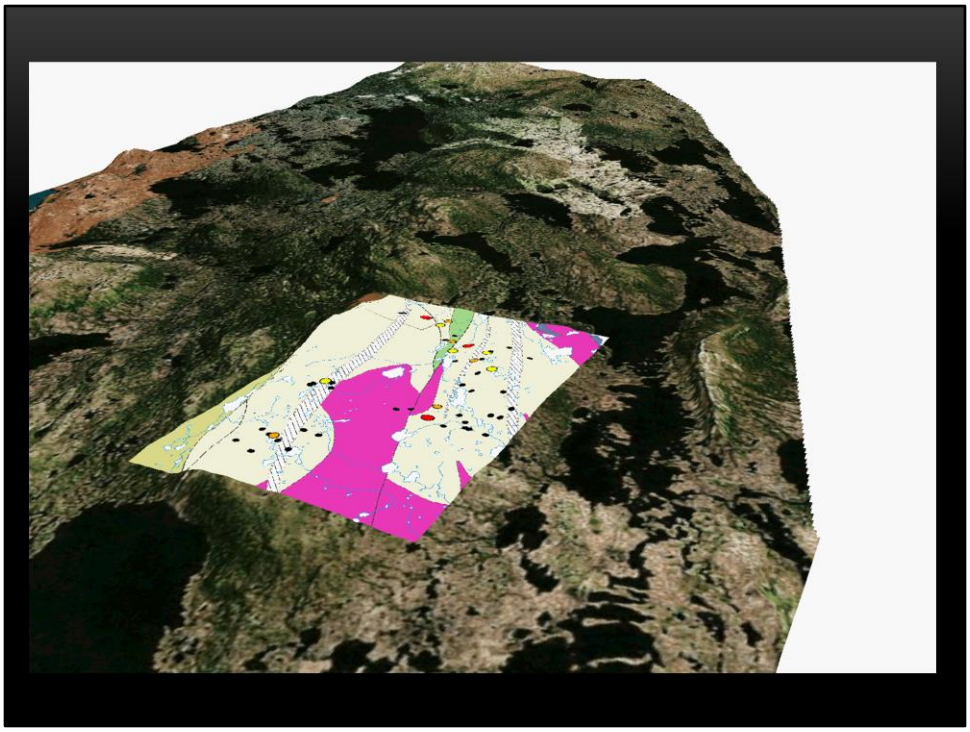
- Now to the million dollar question, why is the Michelin deposit where it is?

- The locally developed breccia's proximal to the deposit are inferred to represent brittle deformation related to the development of the overall mineralizing system. The development of the alteration and accompanying uranium mineralization is also commonly strongly foliated, and the mineralization is generally inferred to be introduced late syn-deformation as it displays little effects of this deformation.

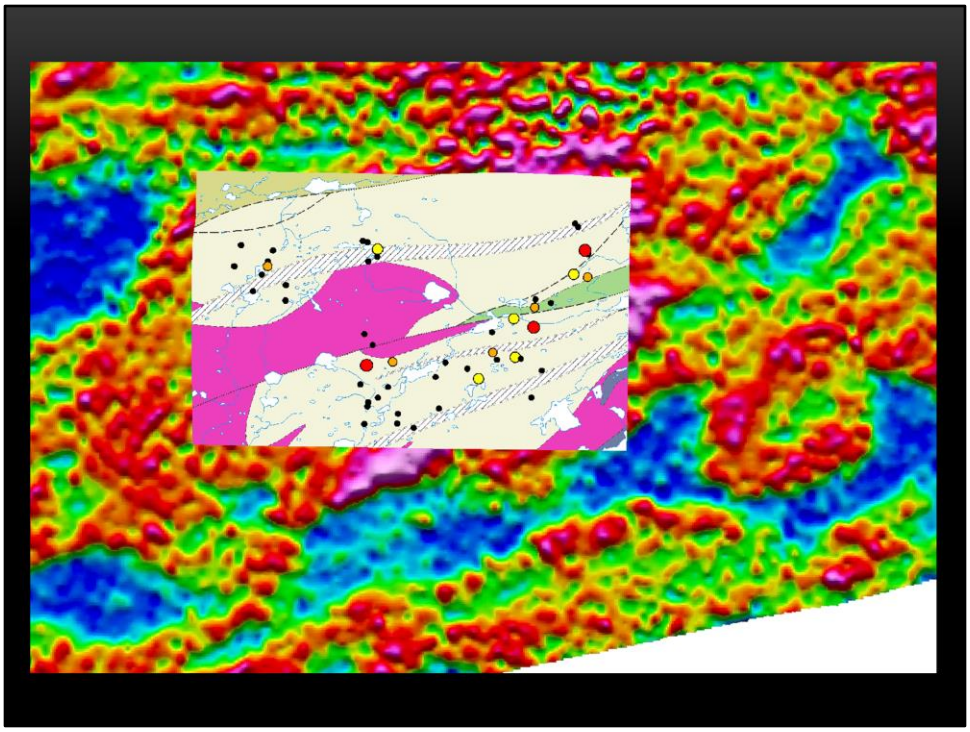
- The deposit model suggests the probable existence of a regional-scale structure, which provides a structural control on the development of the uranium mineralization and accompanying alteration. A potential analogue to this might be the Big Island Shear Zone to the northeast.

- The northeast trending alteration zone highlighted by the distribution of sodic alteration within the outcropping volcanic sequence in the area surrounding Michelin may highlight the location of such a structure.

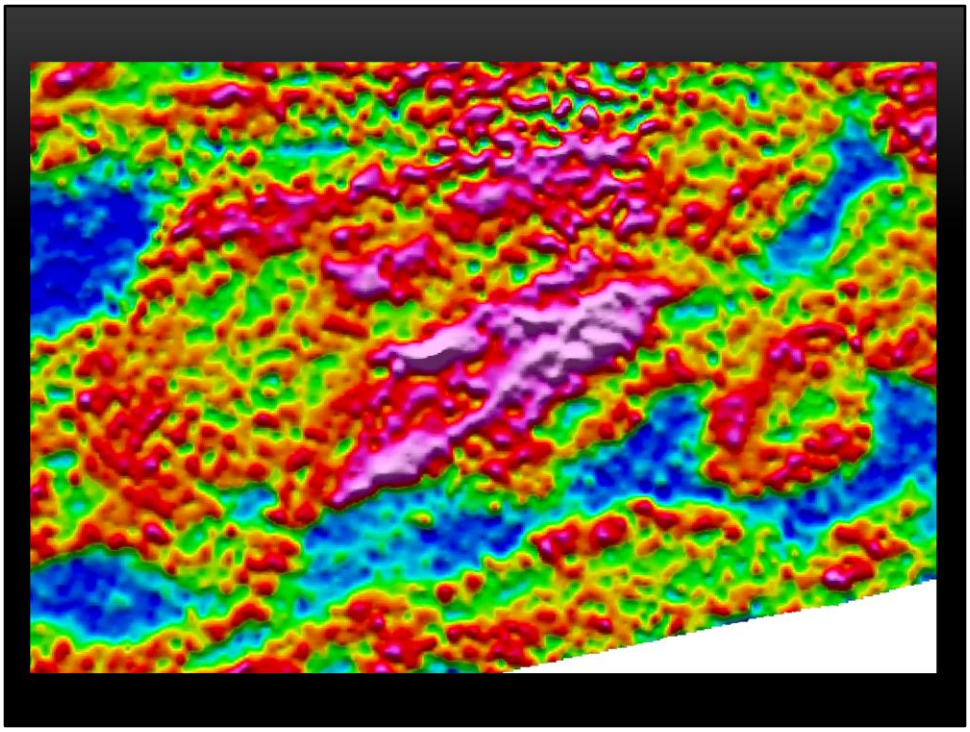
- However as indicated by the titanite data from Michelin, such a structure, which is inferred to originally formed during the Makkovikian Orogeny, is subsequently overprinted by Grenvillian related deformation; however the full effects of this later deformation on the redistribution of the uranium mineralization is not yet fully understood

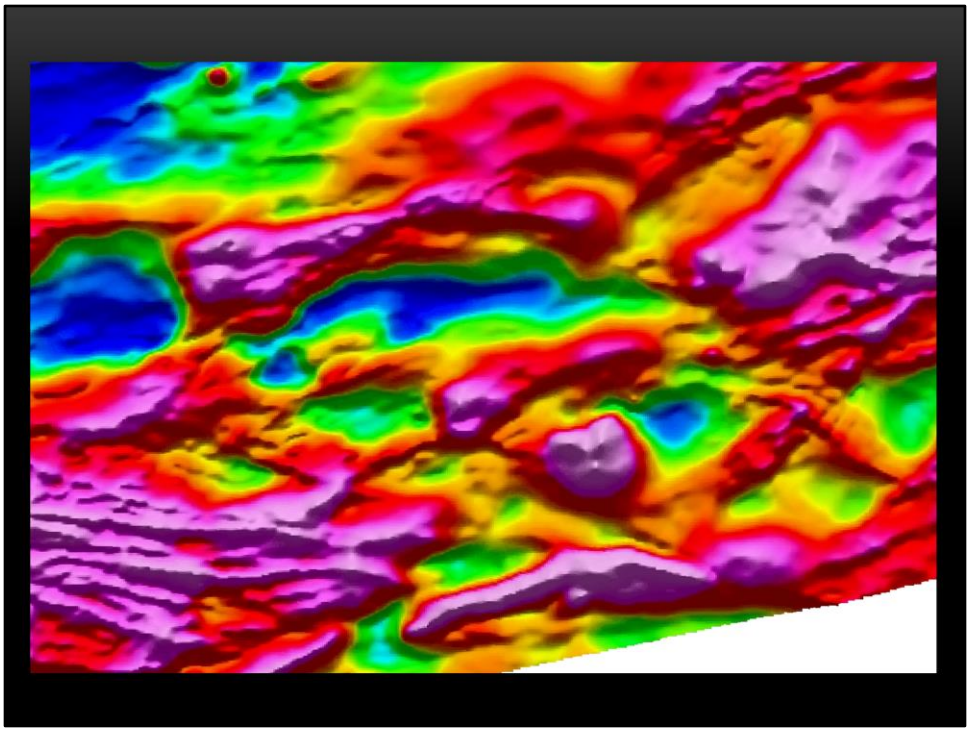


- In comparing the apparent northeast trending zone of alteration with other possible features which might support the existence of a structure in this area, one thing that is evident is the presence of a fault which roughly parallels the potential alteration trend. The location of this fault coincides with a break in the ridge to the north of the Michelin deposit



- In looking at this general region, and comparing it with the air borne radiometics, the anomaly along the Rainbow – Chitra trend forms a similar sub parallel trend





SUMMARY:

- Michelin represents an example of albitite-hosted uranium mineralization
  - Inferred to have formed between 1851-1800 Ma during Makkovikian Orogeny
  - Potential link with development of IOAA styles of mineralization developed in western portions of the CMB
- Development of mineralization and associated alteration likely control by regional structure
- Outlining the distribution of the accompanying sodic alteration could provide a potential vector to the host structure
- Ongoing U-Pb geochronology continues to highlight the complexities developed within the deposit


THANK YOU