

The south Newfoundland granophile mineral district: Features and opportunities for research on blind deposits

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Abstract: The south coast of the island of Newfoundland is a diverse and potentially important district of granophile mineral deposits, in which several mineralized intrusive complexes span contrasting tectonostratigraphic zones of the Appalachian Orogen. In addition to molybdenum and tungsten deposits that represent potential producers, the district includes one of the world's largest producing fluorspar deposits, at St. Lawrence. The settings of mineral deposits vary, as do their associated commodities, but there is a common magmatic thread throughout the district. All major deposits are associated with evolved, alkali-calcic, siliceous granitoid rocks emplaced within a short time interval from ca. 388 Ma to ca. 375 Ma. Coherent U-Pb and Re-Os geochronology links these deposits to spatially associated plutons, even where direct physical connections are lacking. There are common geochemical themes that link prospective magmas, but these are not always easily visible through the geochemical and isotopic diversity connected to the contrasts in basement terranes along the belt. There is a dire need for other types of diagnostic data (e.g., Pb isotopes, accessory mineral chemistry) that can better unravel the respective contributions of magma sources, contaminants and fractionation histories to regional prospectivity.

There are contrasts in the erosional levels revealed in individual complexes, from endocontact disseminated mineralization in high-level granites, to sheeted vein complexes and related hydrothermal lodes associated with hidden subsurface plutons. The Grey River - Moly Brook area provides the best example of the latter setting, and has all of the expected characteristics of a large zoned hydrothermal system. This area is of particular interest in the context of exploring such blind systems, because high-resolution geophysical data provide potential 3D information to augment the direct data from drilling. Exploring for targets associated with hidden intrusions is never going to be easy, so examples such as this, for which multiple data sets exist, are obvious priorities for expanded research.

Originally presented Fredericton 2014: Geological Association of Canada - Mineralogical Association of Canada Joint Annual Meeting, Special Session 3: Discovering the Next Generation of Porphyry Deposits: Advancements in Locating and Understanding Hidden Intrusion-related Mineralization. May 21, 2014.

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Kerr, A., 2015. The south Newfoundland granophile mineral district: Features and opportunities for research on blind deposits; *in* TGI 4 – Intrusion Related Mineralisation Project: New Vectors to Buried Porphyry-Style Mineralisation, (ed.) N. Rogers; Geological Survey of Canada, Open File 7843, p. 383-401.

The South Newfoundland Granophile Mineral District: Features and Opportunities for Research on Blind Deposits

Andrew Kerr



The spectacular south coast of Newfoundland (photo by Andy Kerr)

Logo (unofficially) modified to use colours of the (unofficial) flags for both parts of the Province

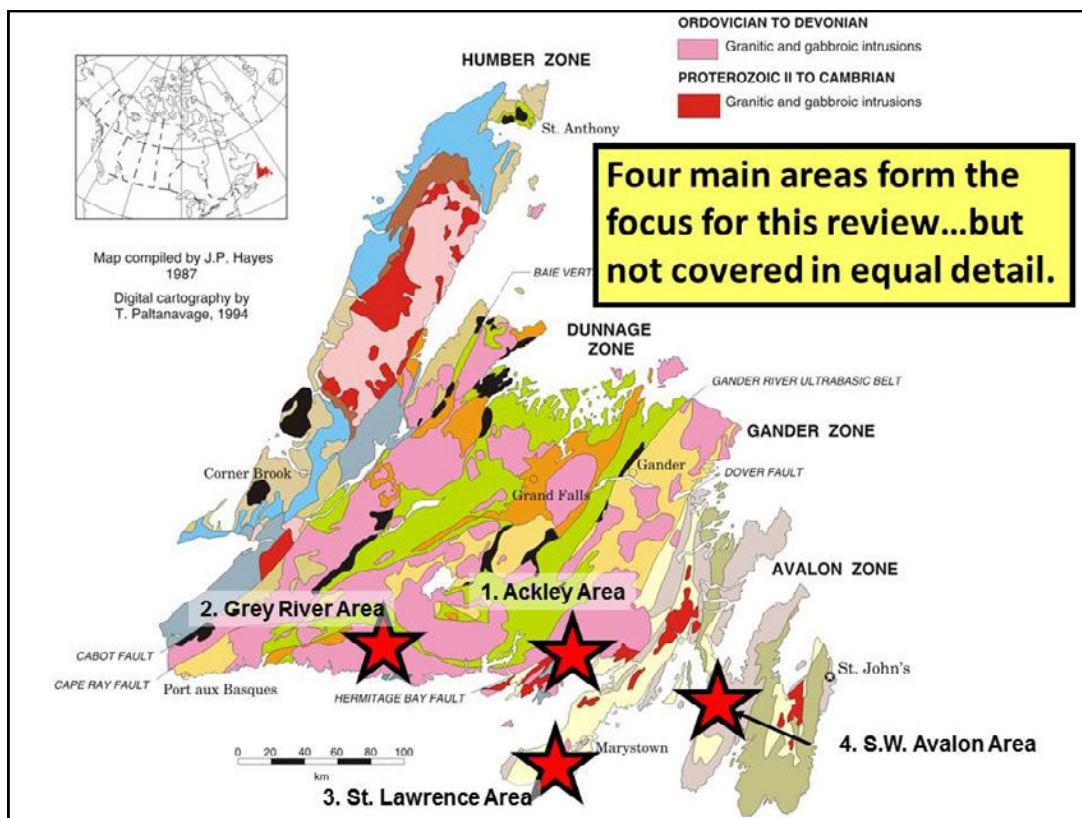


The Geological Survey of Newfoundland and Labrador was founded in 1864 by Alexander Murray, who previously worked with William Logan of the Geological Survey of Canada. We have a long history and lineage.

Sadly, I am not officially representing my organization today...

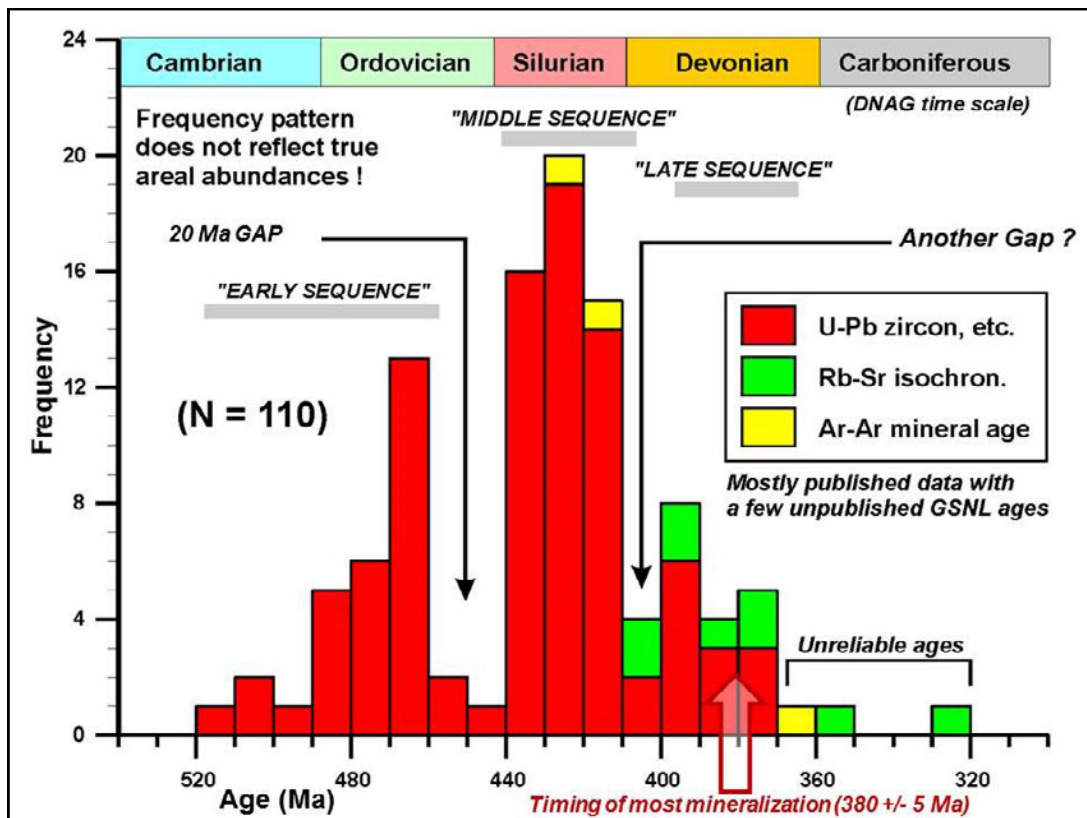
The South Newfoundland Granophile District

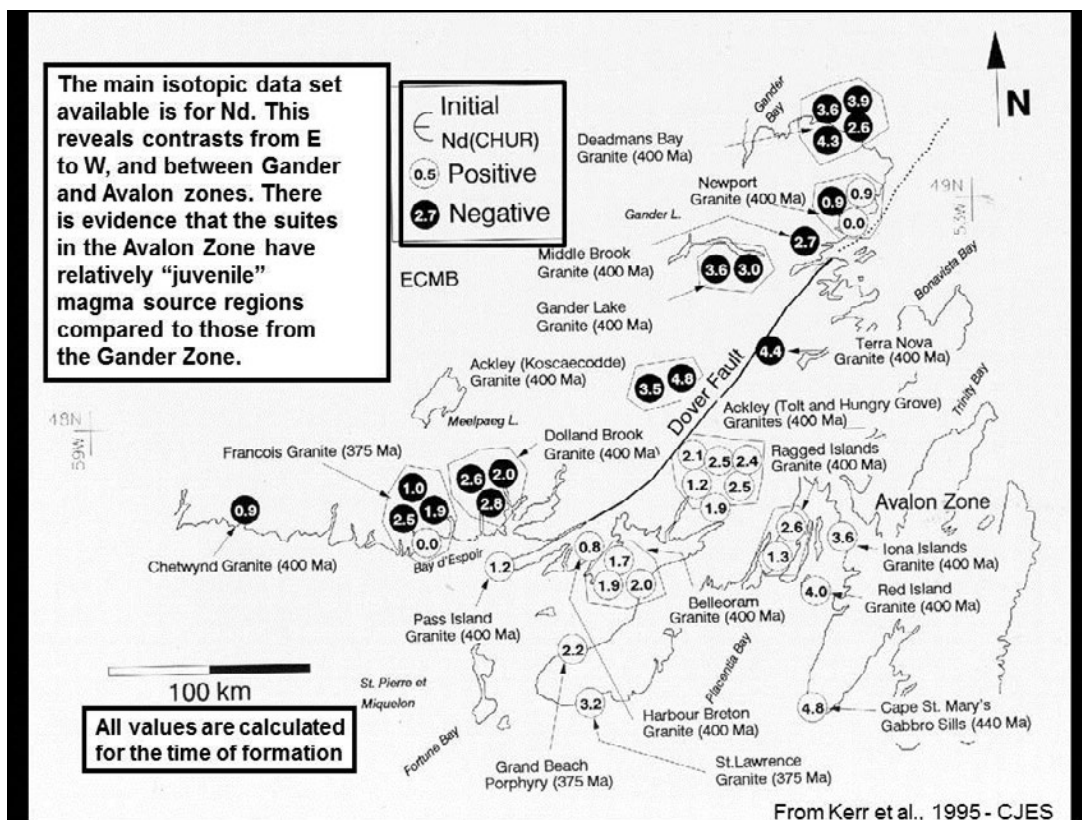
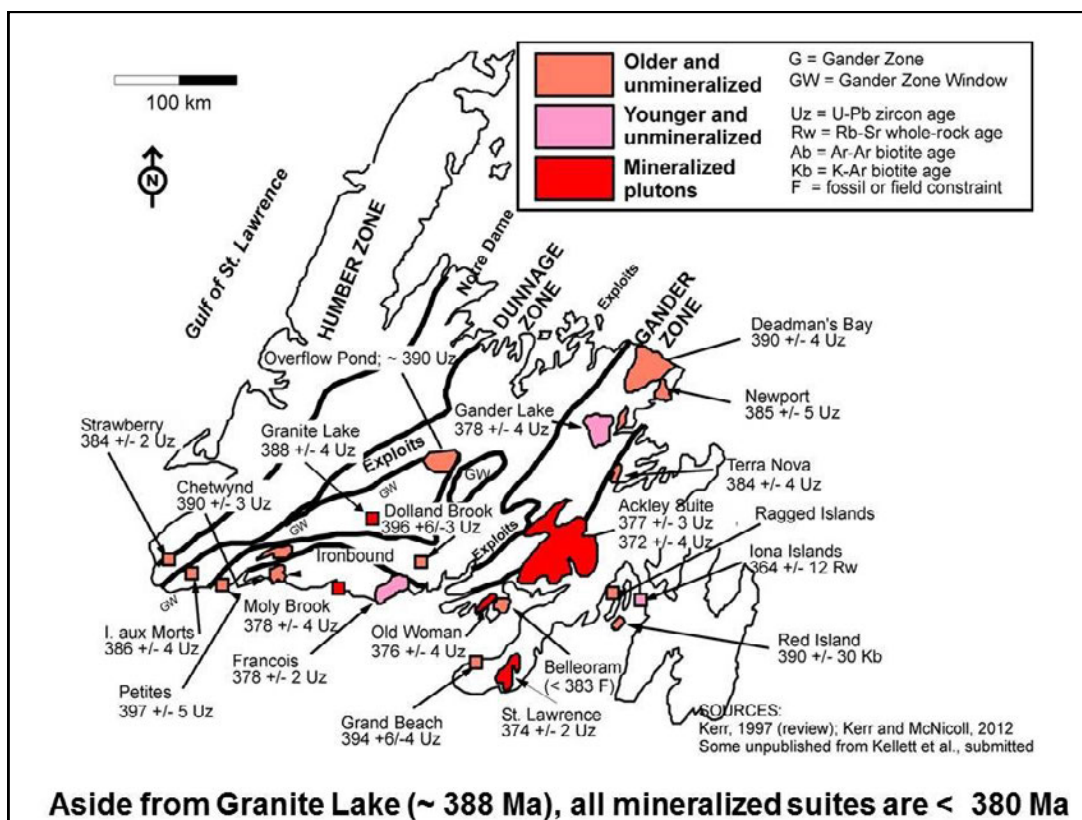
- This is a district-scale metallogenic province that stretches for some 350 km along the south coast of the island of Newfoundland.
- A common theme appears to be the link between mineralization and late Devonian plutonic activity. *(sometimes called 'NeoAcadian', although the term is unclear)*
- A diverse metal association, including Mo, W, Sn, (Cu + Pb + Zn), Ag, Au (?), fluorite, barite and silica.
- Deposits and occurrences have varied settings that range from disseminated in plutonic rocks, to contact zones, vein swarms, and discrete veins.
- Research on blind deposits/hidden plutons ?



A General Outline for the Presentation

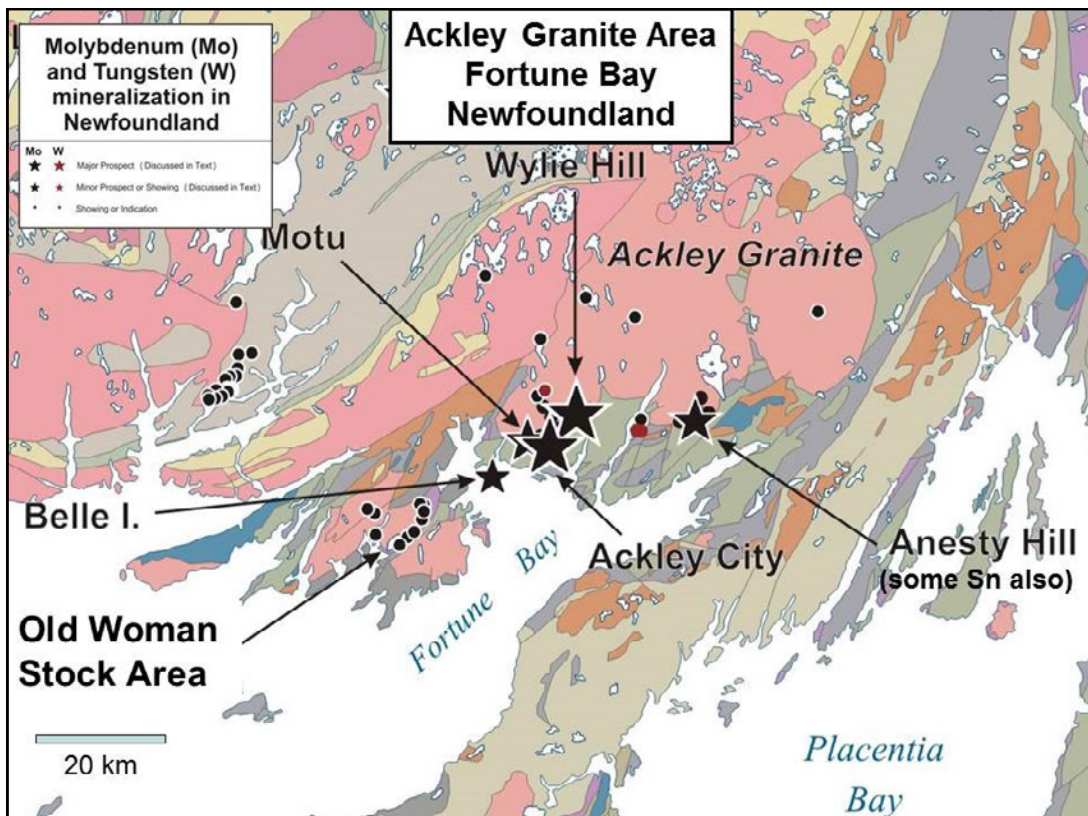
- Some background geology and the regional context of associated magmatic suites.
- Salient points for each of these areas, with emphasis on potential for research work; we proposed some of this for TGI-4, but it now looks more likely for TGI-5.
- There is a general 'upward' progression in the erosion level of these potentially large systems moving away from the Gander-Avalon boundary.
- Presentation includes discussion of U-Pb zircon data, but also Re-Os results from Ed Lynch's work, presently published in abstract form.





Mo (+ Sn) Mineralization in the Ackley Granite and adjacent plutonic suites

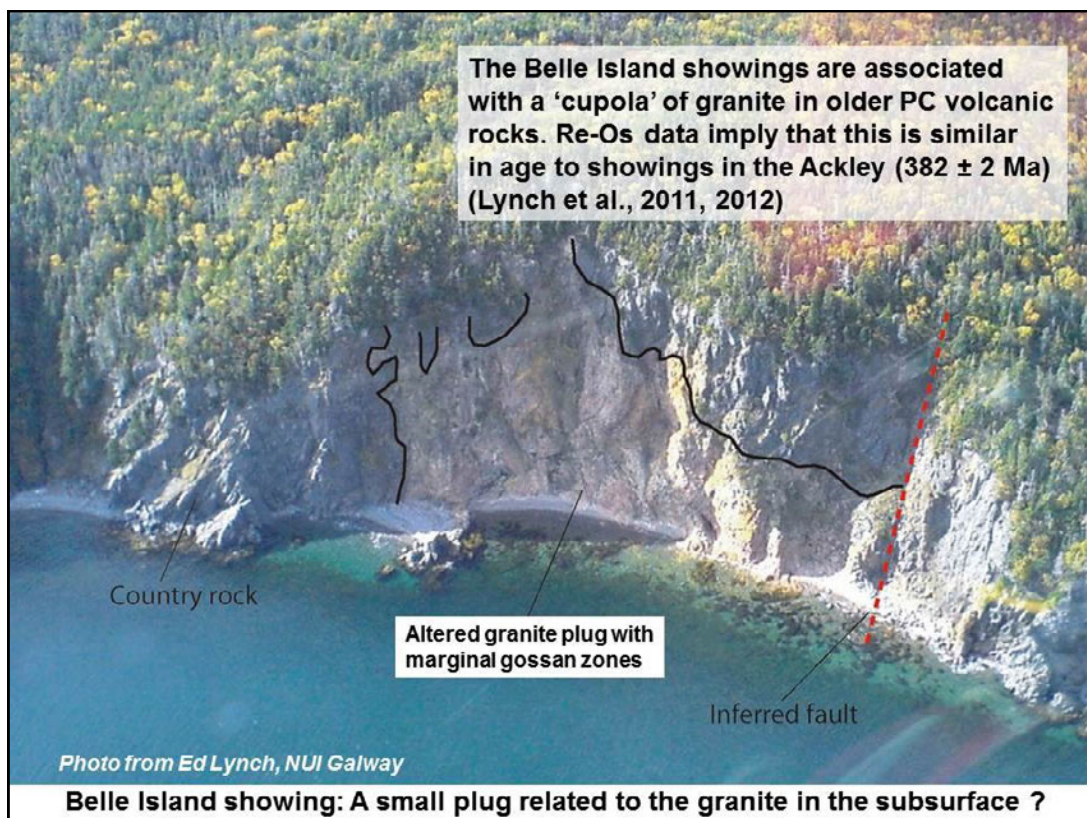
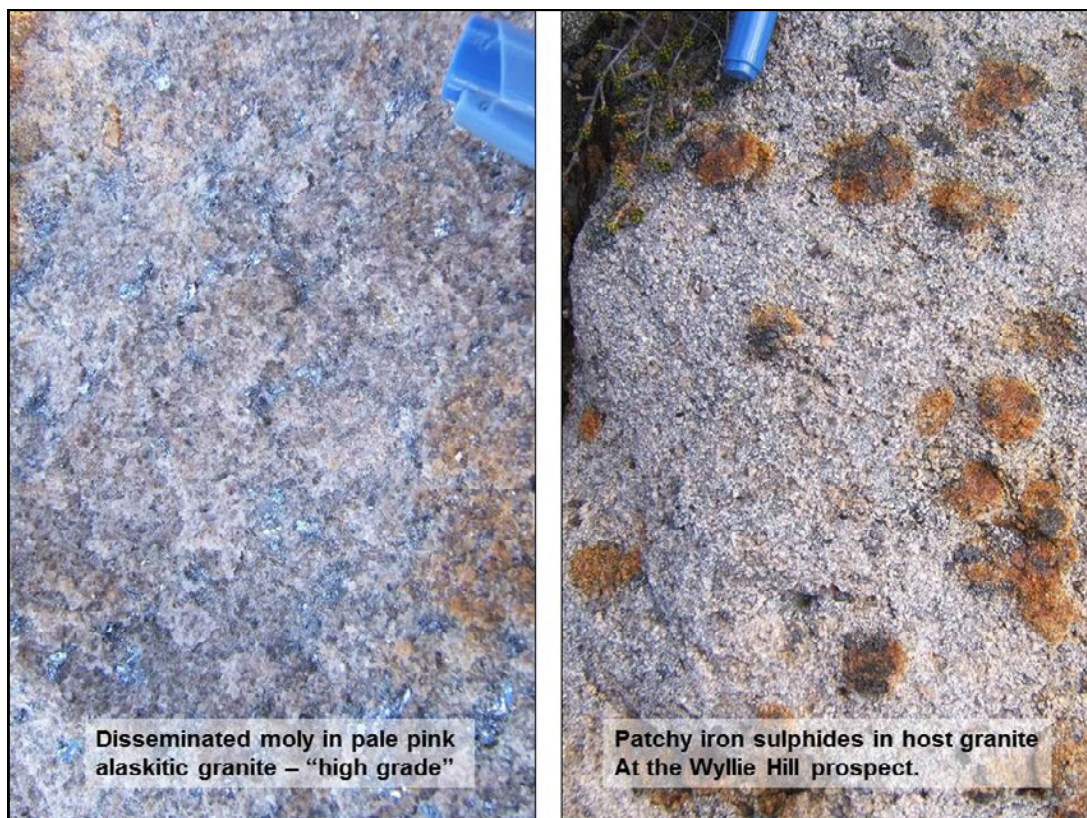
- This is largely “**endocontact**” mineralization that is associated with high-level evolved granites and in some cases greisen-like rocks.
- Little modern exploration – depth potential limited.

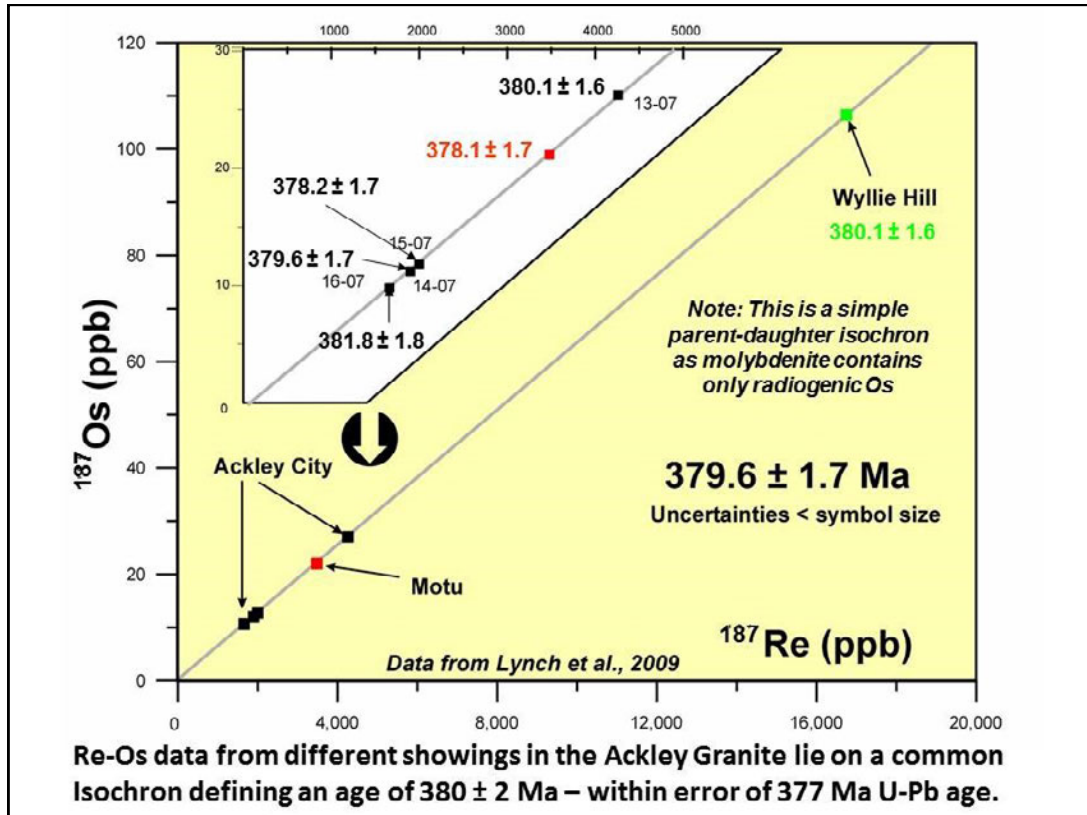


Molybdenum – Ackley Granite and Area

- Discovered in the 1880s, and evaluated through underground exploration in the 1930s. The resource here is small, but grades are locally good - 0.4% Mo.
- Mineralization is located in the roof zone of the granites, at its southern contact – associated with alaskitic granite, pegmatite and greisens.
- Mo is syngenetic, local association with Fe-Cu sulphides. Geochemical gradients in underlying granitic rocks, with no mineralization at depth.
- Low-grade Sn mineralization is associated with topaz greisens, with little Mo present; the relation between these and the Mo zones is not clear.
- Moly in the “Old Woman Stock” is broadly similar.

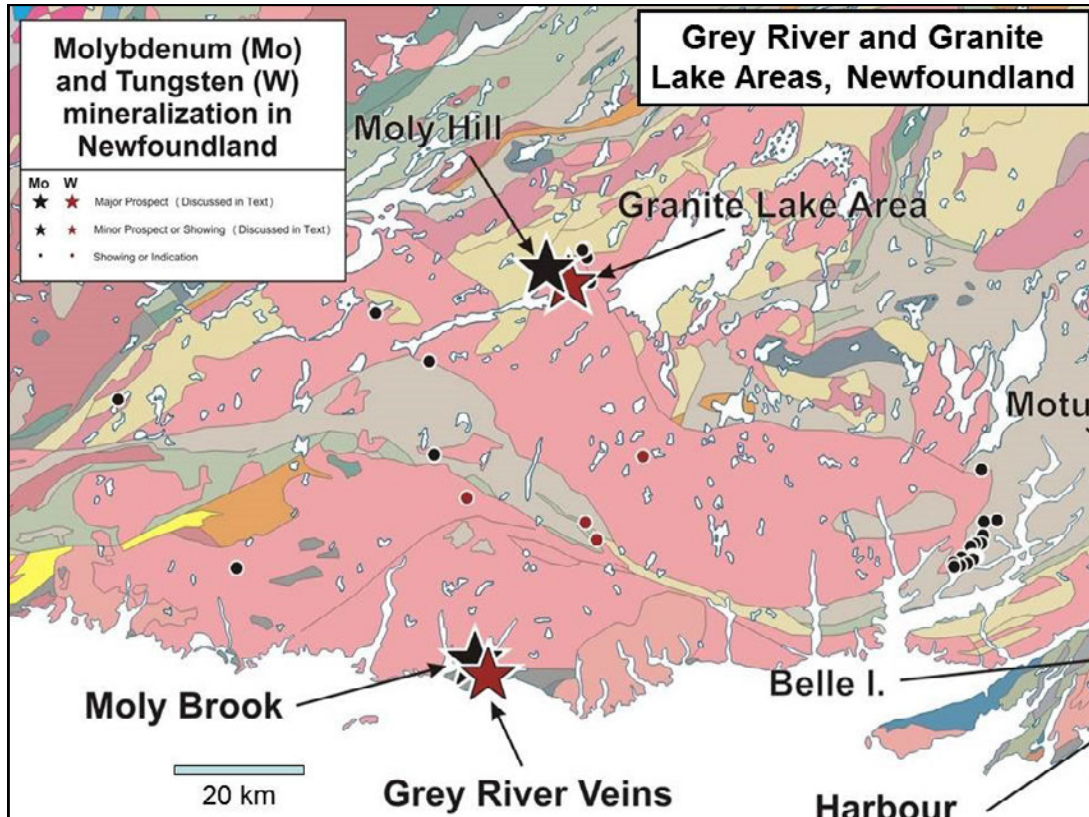






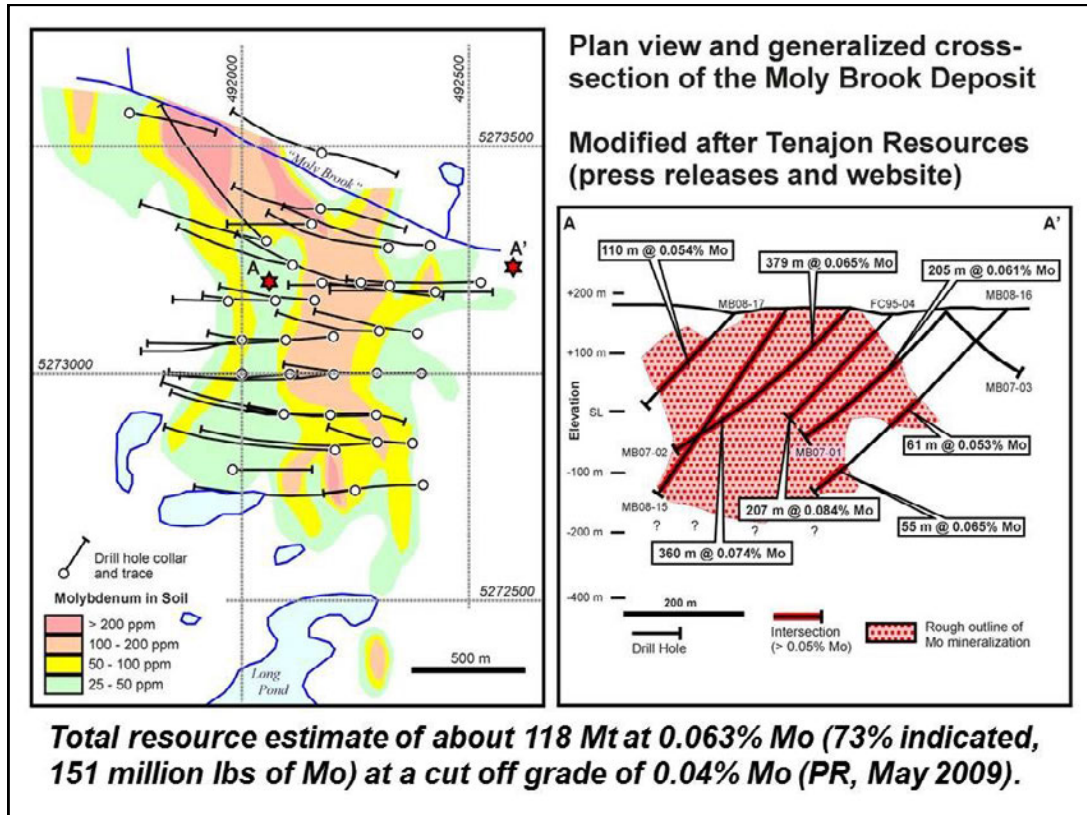
Grey River Area: Mo, W and other things as part of a larger zoned hydrothermal system



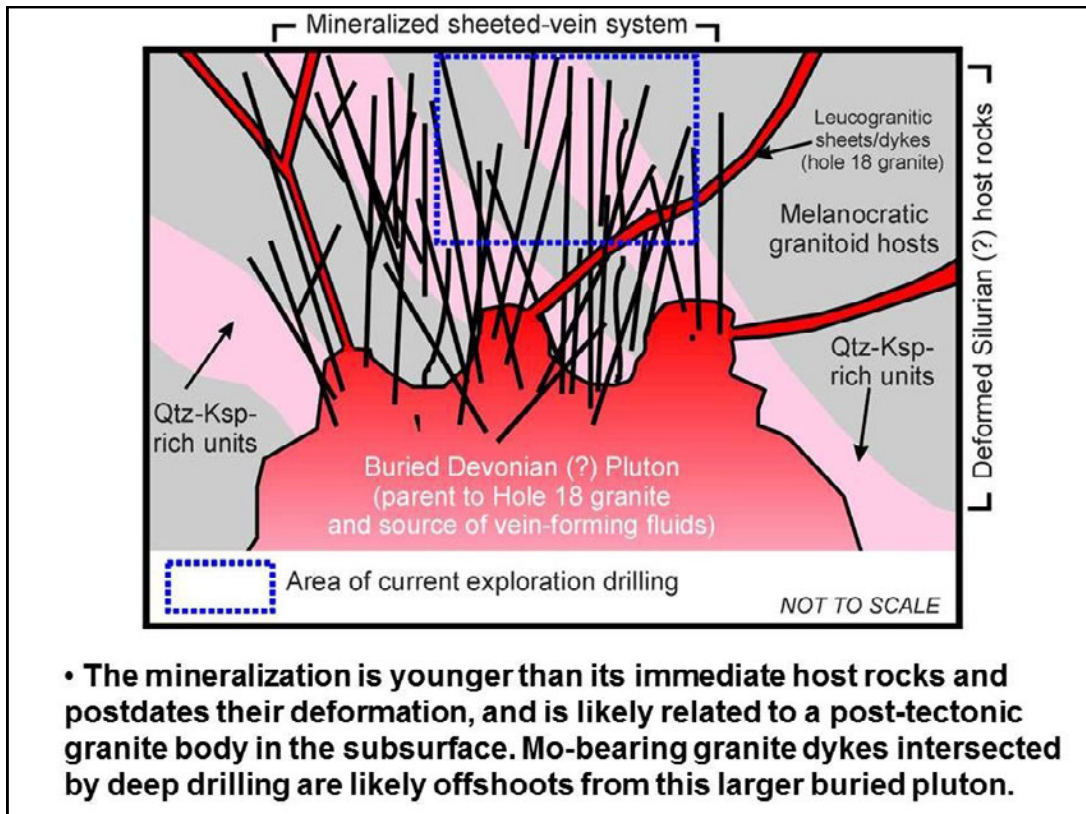
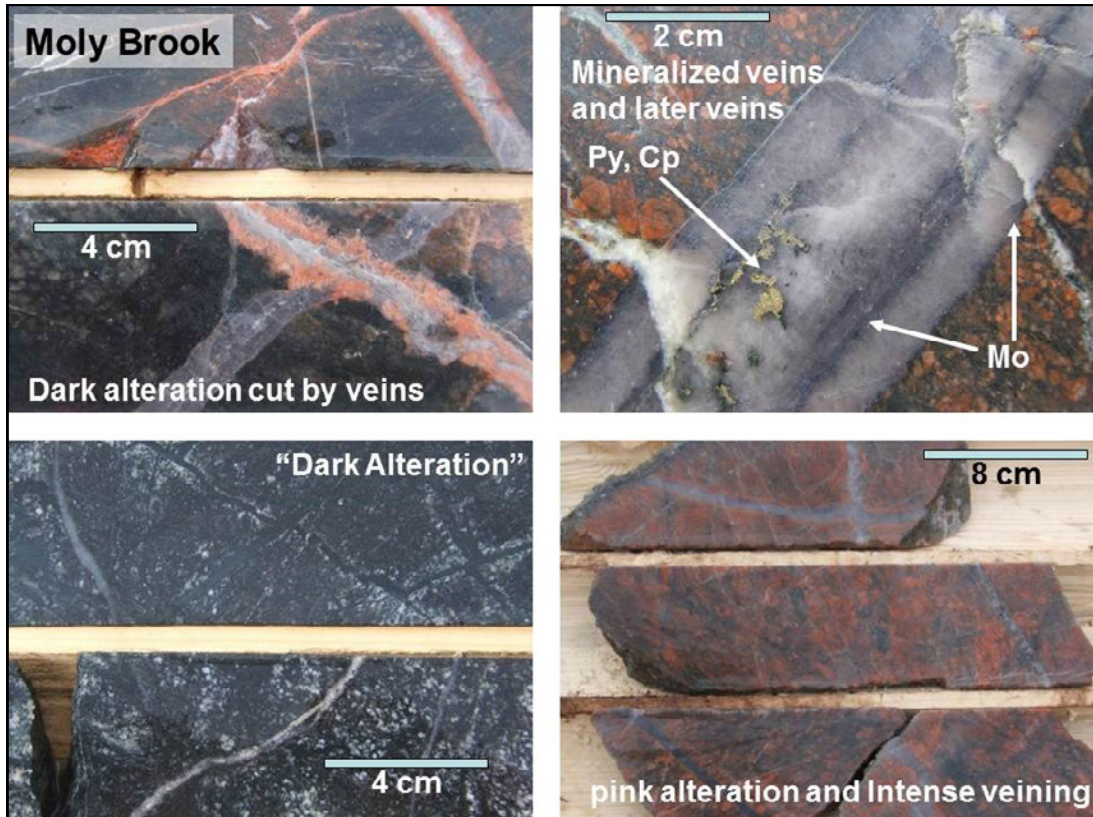


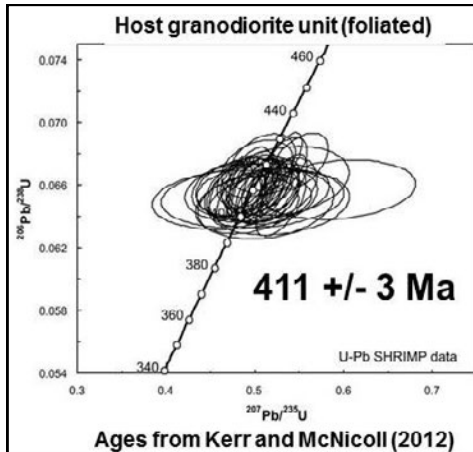
Mineralization in the Grey River Area

- The area is known mostly for wolframite in quartz veins, discovered in the 1950s. Numerous base-metal (\pm Ba) veins are known. Low-grade Mo-Cu discovered in the 1980s was evaluated in more detail from 2007-09; W veins were also reassessed at that time.
- Mo-Cu associated with sheeted quartz veins/stockworks hosted in older (Early Devonian) granite. Mineralized granite veins imply a younger buried pluton, now confirmed by geochronology.
- The 'Moly Brook' deposit is a large, low-grade resource that remains open – long intersections (e.g., 370 m at 0.084% Mo) suggest potential for growth.
- Total resource of 120 Mt at 0.063% Mo (May 2009).



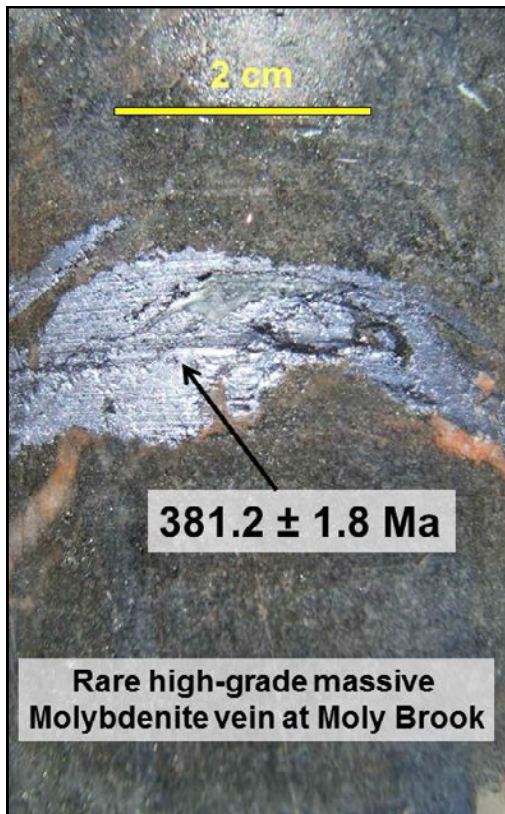
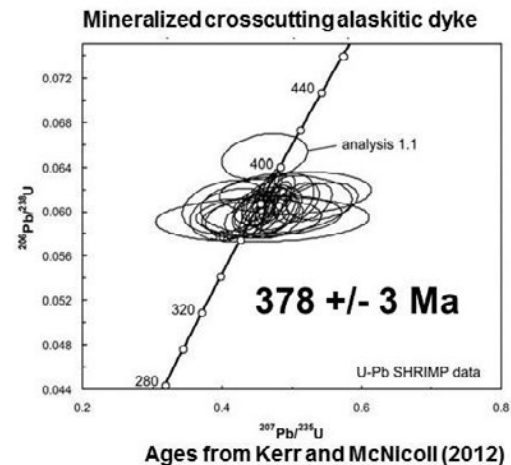
Quartz veins with two main trends cutting altered K-feldspar porphyritic granite at Moly Brook – mineralization is associated almost entirely with vein systems





- The host rocks to veins at Moly Brook acquired a penetrative fabric before the veins were emplaced, and yield an early Devonian (411 Ma) U-Pb zircon age.

- Alaskitic veins are seen to cut some Mo-bearing veins, but contain some veins and also contain disseminated Mo. These give a late Devonian (378 Ma) age.



Direct Re-Os Age Information

From Lynch et al., 2011; AGS

- Not easy to collect molybenite!
- Four samples from veins at Moly Brook gave an isochron age of 381.2 ± 1.8 Ma, which is within error of the 378 ± 3 Ma age from alaskitic granites.
- There is also molybdenite in the early paragenesis of the tungsten veins. Two determinations from this material gave a weighted average of 381.2 ± 1.8 Ma.
- Demonstrates a clear temporal and genetic link between these as part of a hydrothermal system.

Research Potential at the Moly Brook Deposit

- This is an area where there is good evidence of a link between Mo-Cu-W and a largely hidden granite body.
- Exploration is now dormant but there is a large amount of geochemical and geophysical data available in assessment reports that are now public domain.
- This includes IP data, magnetic data; also large amounts of measured geochemical data from multielement assays.
- Excellent resource for research applications.



Re-Os age on the molybdenite (Lynch et al., 2012)
 386.6 ± 1.6 Ma (n=3)



Photos courtesy
of Playfair Resources



- Mineralization in the Granite Lake area is not as well defined in terms of resources, but seems similar in many respects. Possibly deeper – seems to be as veins in granite (388 ± 4 Ma; U-Pb zr).



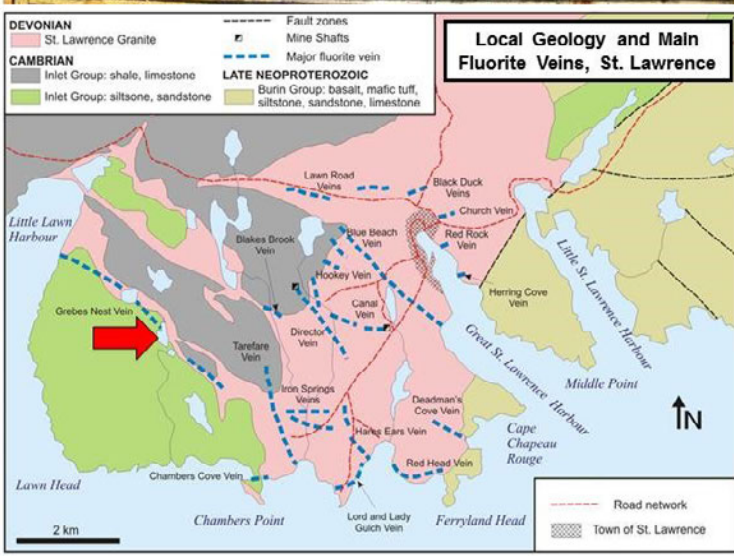
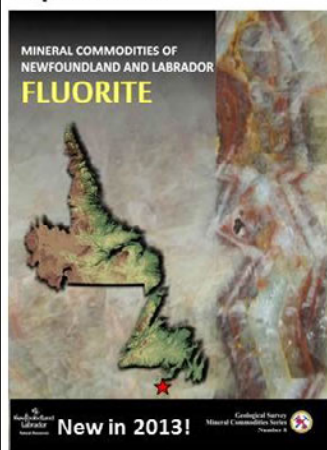
St. Lawrence Area

- St. Lawrence mining district is centred on a high-level alkaline granite, which contains abundant fluorite veins, some of which also have barite and base-metals.
- Mined discontinuously for over 75 years – and currently efforts are to reactivate this (again).
- Granite once thought to be Carboniferous (~ 320 Ma) but U-Pb data indicate 374 ± 2 Ma.
- Re-Os from moly in a fluorite vein gave an age of 366 ± 3 Ma.
- Some research work in the 1980s, but generally not well studied.

St. Lawrence Granite (with fluorite veins)

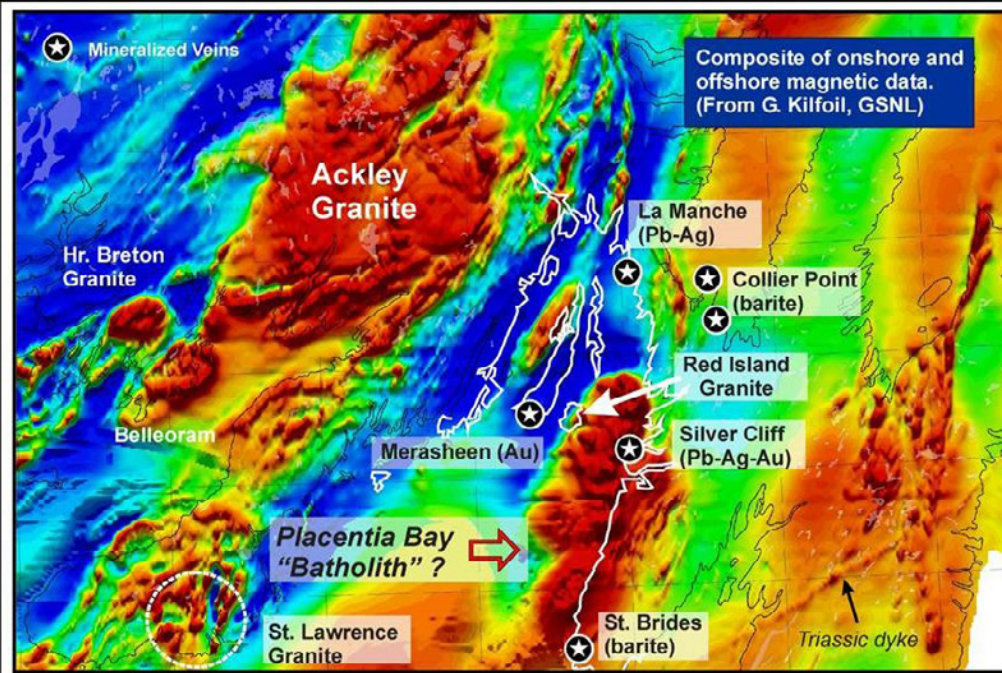
Traditionally, most work was conducted where the wall rocks are the granite.....

New resources defined at the Grebes Nest vein occur in sedimentary wall rocks – these open new possibilities for exploration.



Southwest Avalon Peninsula Area

- The site of some of the earliest mining ventures in Newfoundland – centred on vein-style base metal deposits (mostly Pb-Zn +/- Ag) and barite.
- Geophysical data suggests a large Paleozoic batholith in this area, even though surface expression is limited.
- Minor production from La Manche (Pb) and from Collier Point (Ba); potential remains in the latter.
- Other minor showings across the region (e.g., Mo near St. John's, fluorite in Placentia Bay *might* have some connection to Paleozoic magmatism.
- Much of the research to date is through B.Sc. Theses.



Aeromagnetic data strongly suggest the existence of a large Paleozoic batholith beneath eastern Placentia Bay – possibly linked to vein-style mineralization.



Galena- and sphalerite-bearing vein material, La Manche area.



Barite vein within normal fault cutting Cambrian sedimentary rocks and also Silurian (?) or Devonian (?) dykes , St. Brides.

Summary – Regional Characteristics

- Southern Newfoundland hosts diverse granophile mineralization, most of which seems to be linked to late Devonian (ca. 380 Ma) magmatism.
- The most deeply eroded examples lie in the Ackley Gramite and other areas close to the G-A boundary.
- Elsewhere, associated plutonic suites appear to be in the subsurface – mineralization is largely associated with vein swarms and discrete vein systems.
- Historical production from fluorite and barite veins, but resources occur elsewhere (Moly Brook).
- Moly Brook also represents an interesting research opportunity, in which new work could be linked to an extensive exploration database.

Other Questions and Potential Topics

- The new U-Pb and Re-Os data improve resolution of timing constraints, but some remain unpublished.
- Are there regional controls imposed on fertility by the nature of basement terranes? I think not, but this is difficult to prove. More data needed!
- Understanding of magma sources would be better with regional data for isotopic systems other than Nd. I think I might have suggested this before.....
- Is there potential to use mineral chemistry as a tool for regional exploration?
- Does deeper erosion eliminate mineral potential in the northeast Gander Zone area?



