GRANOPHILE METAL DEPOSITS

HOST ROCK: *Usually found in granitic (quartz-rich, generally muscovite-bearing) intrusions; pegmatites.*

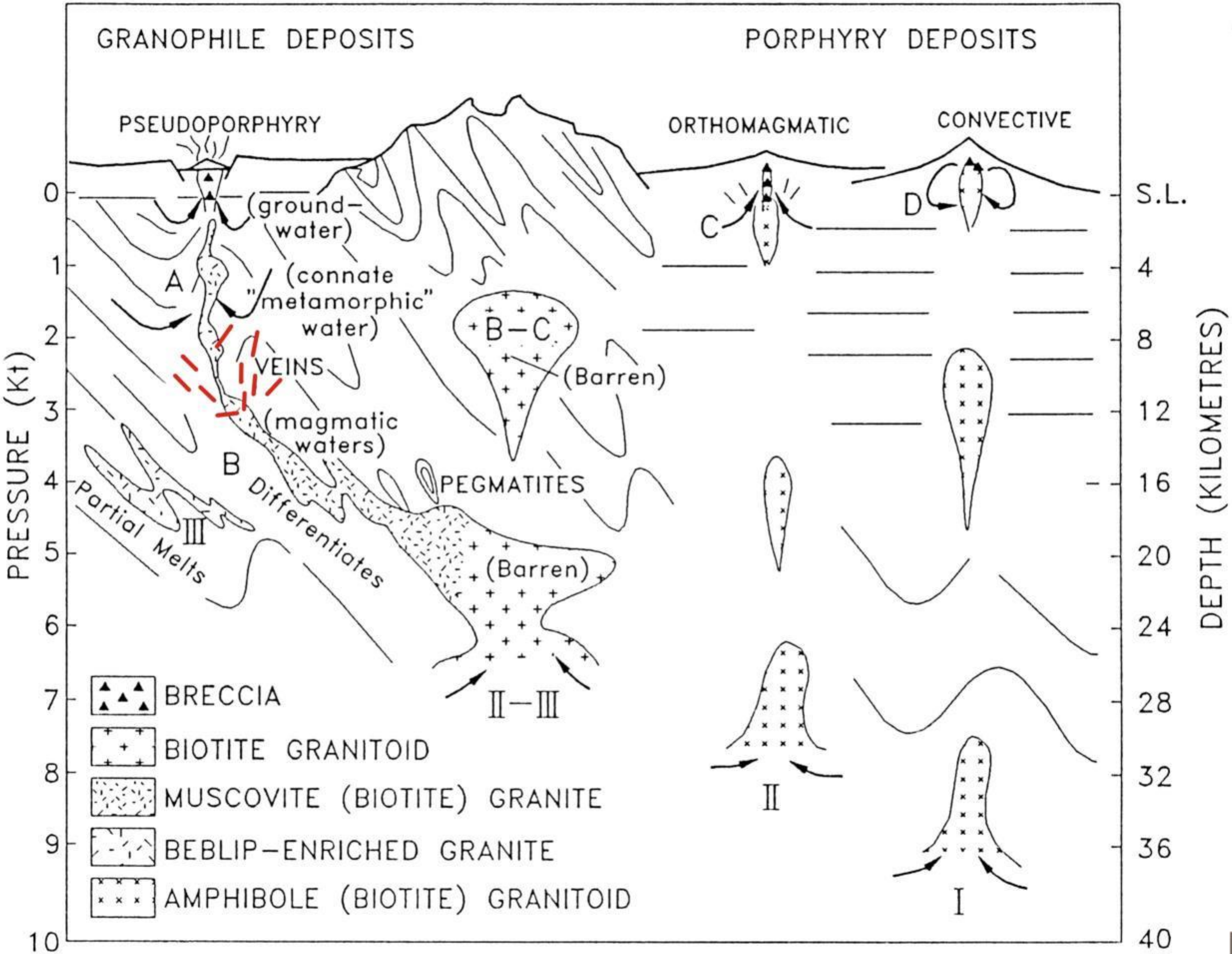
STYLE: *Granophile elements are the last to crystallize, therefore tend to concentrate in the top or roof areas and contact zones of the related intrusions. Mineralization occur as disseminations or pegmatites in the intrusion and as veins and stockworks developed upward or outward from it; a mineral zonation is often developed.*

MINERALOGY: *Cassiterite (SnO_2), scheelite ($CaWO_4$), wolframite ($(Fe,Mn)WO_4$), uraninite (UO_2), molybdenum (MoS_2), fluorite (CaF_2), and rare metals (Y, Be, Z and the REEs (La, Ce, Nd, Eu, Sm, etc)).*

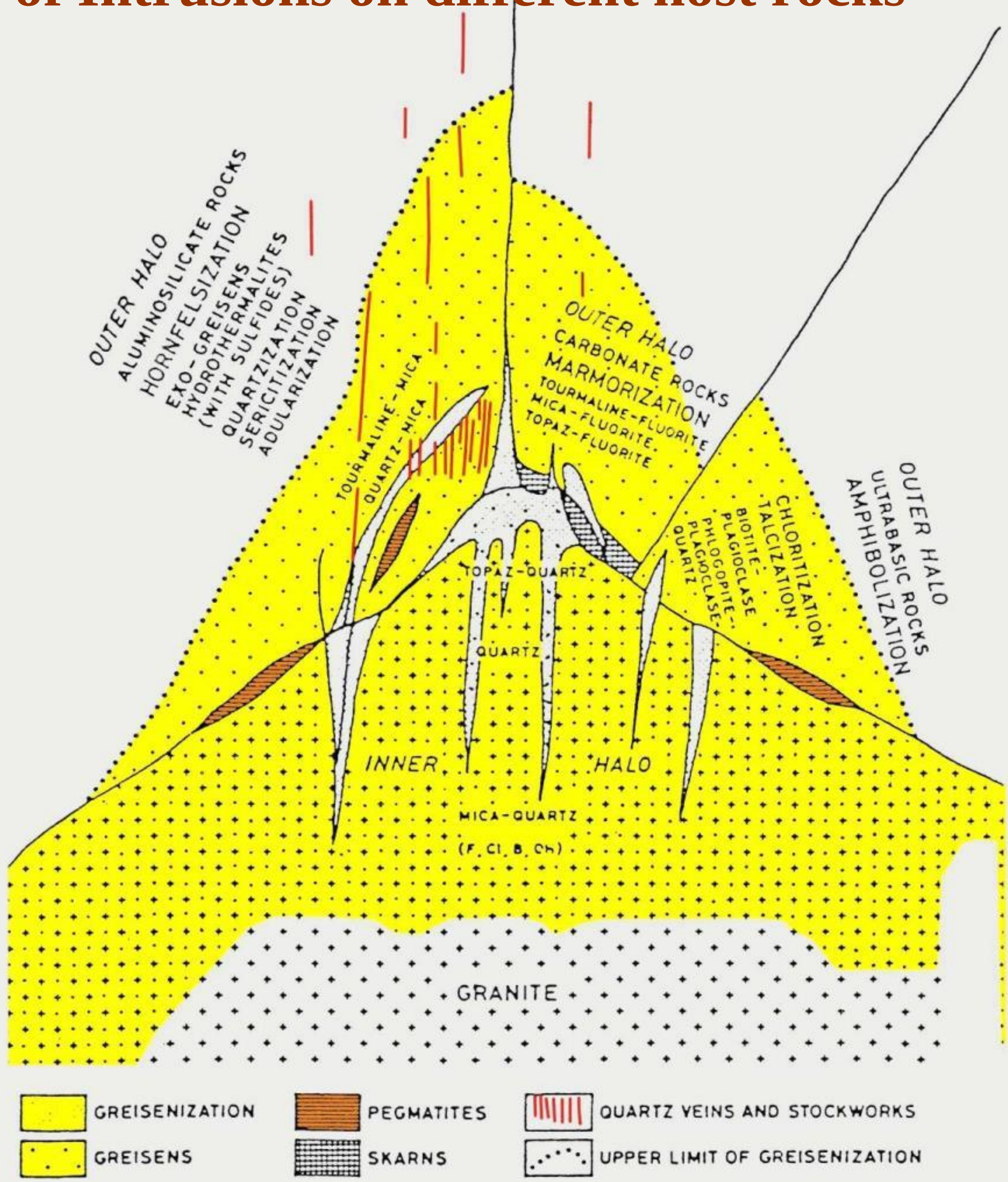
ALTERATION: *Greisens (i.e., quartz-muscovite-topaz-fluorite +/-tourmaline alteration) developed in the granite and country rock.*

St. Lawrence Fluorspar Mine

GRANOPHILE METAL DEPOSITS - SETTING



Effect of Intrusions on different host rocks



GRANOPHILE METAL DEPOSITS – DISTRIBUTION in NL

Newfoundland

Tungsten: Grey River and Granite Lake (sheeted quartz veins with wolframite and scheelite).

Tin: Ackley Granite.

Molybdenite: Granite Lake and southern Ackley Granite.

Fluorite: St. Lawrence Granite.

Labrador

Molybdenite and uranium associated with granites in the Makkovik area.

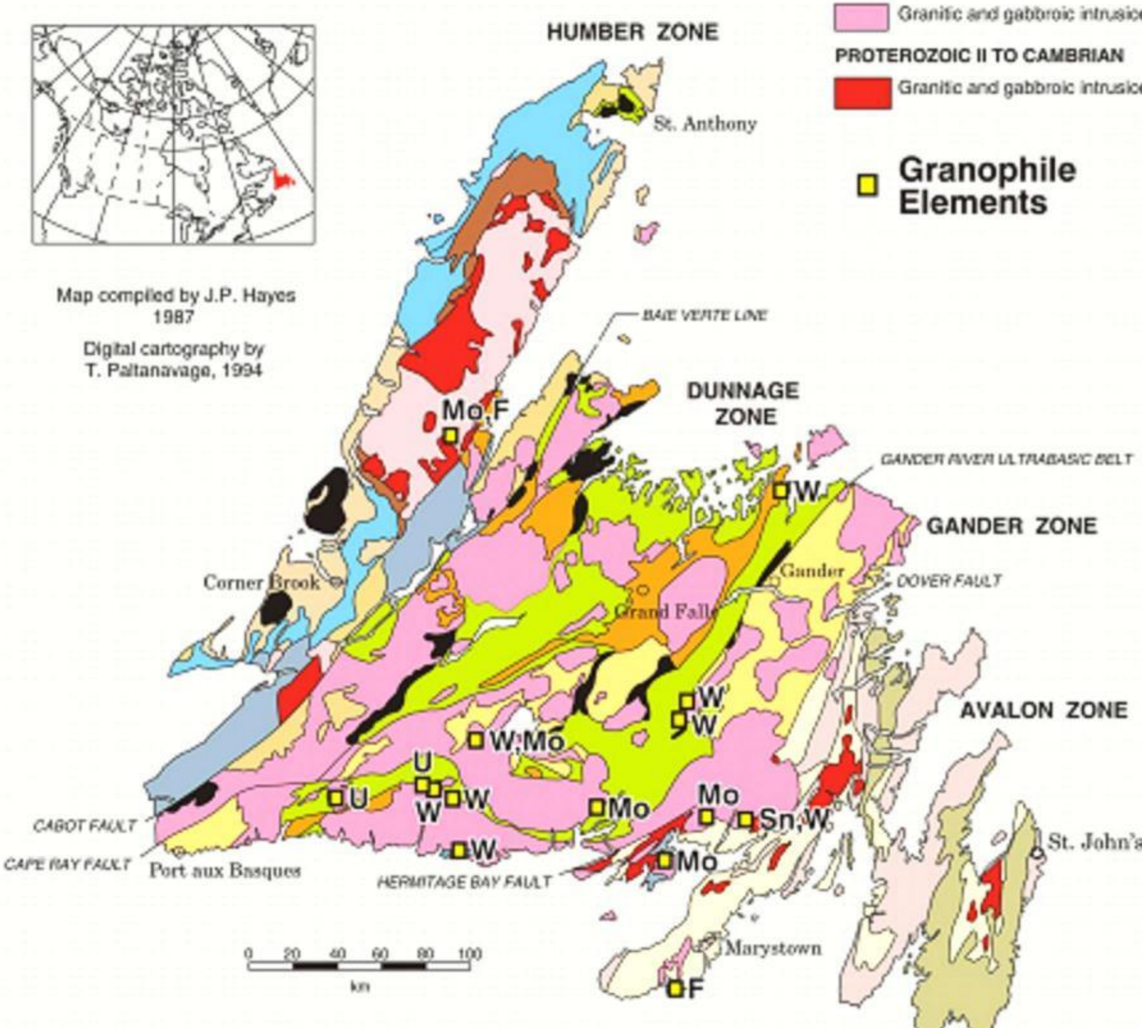
Rare Metals and REE associated with peralkaline felsic volcanic and granitic rocks in the Strange Lake and Letitia Lake areas. The mineralization occurs as: 1) pegmatite-aplite veins and lenses, 2) disseminated zones at or near the contacts of late-stage intrusions, and 3) stratiform disseminated mineralization in near-vent flows.

Rapakivi granites (Churchill Province) similar granites associated with gabbro-anorthosite intrusions in Finland host greisen veins etc.

Grenville granites potential for U-Mo-F mineralization.

Note: NS and NB were important past producers at East Kemptville and Mt. Pleasant.

GEOLOGY OF THE ISLAND OF NEWFOUNDLAND



INTRUSIVE ROCKS

ORDOVICIAN TO DEVONIAN

- Granitic and gabbroic intrusions

PROTEROZOIC II TO CAMBRIAN

- Granitic and gabbroic intrusions

Granophile Elements

DEVONIAN TO CARBONIFEROUS

- Subaerial, lacustrine fluvial and deltaic clastic sedimentary rocks; minor limestone

SILURIAN

- Shallow marine and subaerial clastic sedimentary rocks; volcanic and volcaniclastic rocks

DUNNAGE ZONE

CAMBRIAN TO SILURIAN

- Marine clastic sedimentary rocks; island-arc volcanic and volcaniclastic rocks

CAMBRIAN TO ORDOVICIAN

- Ophiolitic mafic - ultramafic rocks, pillow lava and related intrusions

GANDER ZONE

CAMBRIAN TO ORDOVICIAN

- Clastic metasedimentary rocks and migmatitic equivalents

HUMBER ZONE

PROTEROZOIC III TO ORDOVICIAN

- Authochthonous and parauthocthonous clastic and metasedimentary rocks
- Platformal limestone and dolostone; includes clastic sedimentary rocks
- Allochthonous sedimentary, mafic volcanic and minor metamorphic rocks
- Basal clastic and carbonate sedimentary rocks; includes mafic volcanic rocks

PROTEROZOIC II and III

- Orthogneiss, paragneiss and amphibolite

AVALON ZONE

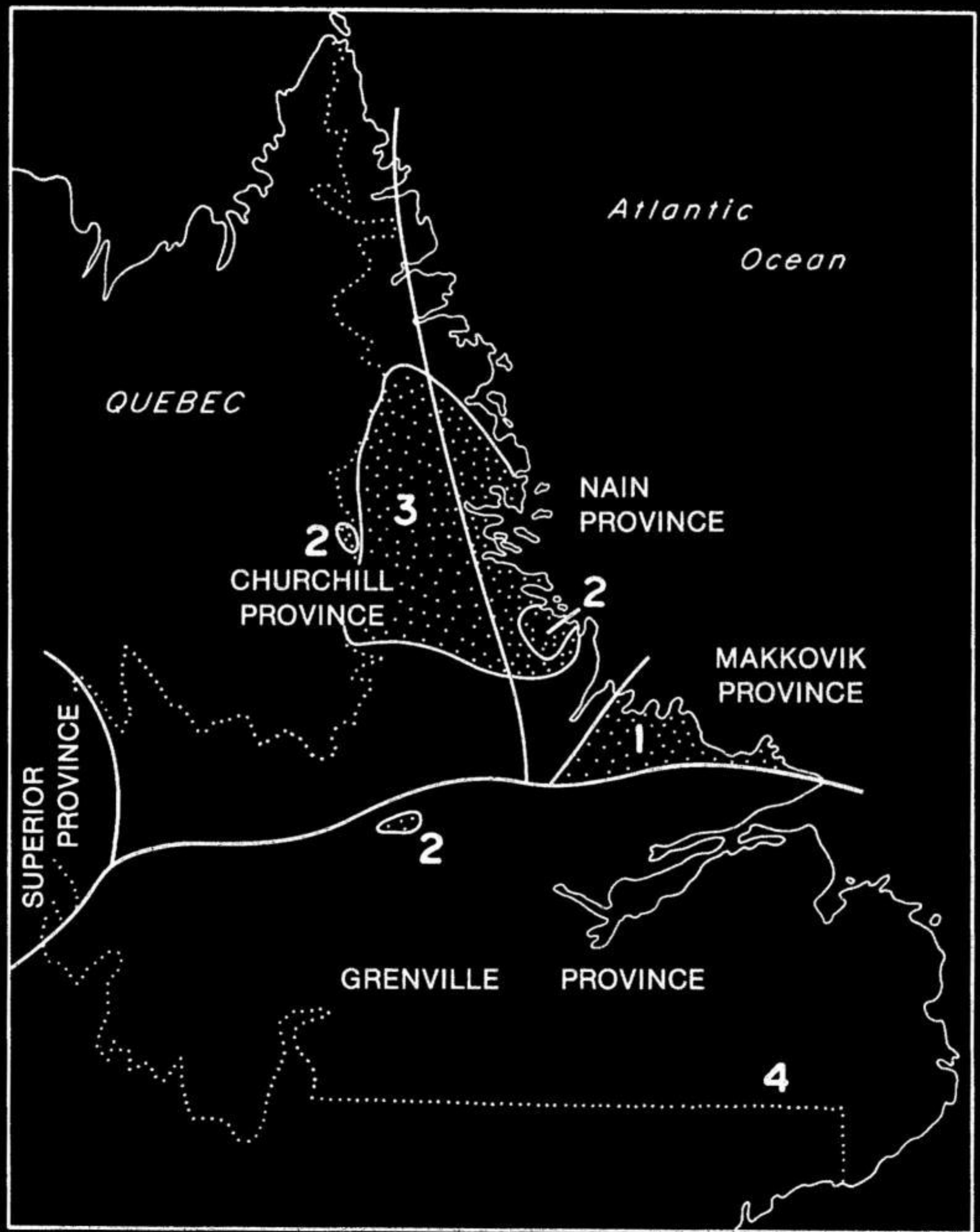
PROTEROZOIC III TO ORDOVICIAN

- Subaerial and marine clastic sedimentary rocks; minor limestone

PROTEROZOIC III

- Marine and deltaic clastic sedimentary rocks
- Mafic and felsic volcanic and volcaniclastic rocks

ENVIRONMENTS FOR GRANOPHILE ELEMENTS



1 – Makkovik Province

2 – Peralkaline Rocks

3 – Rapakivi Granite

4 – Grenville Province

PROSPECTING METHODS:

Geological	*Quartz-muscovite-rich granites with evidence for late-stage magmatic hydrothermal activity, i.e., pegmatites, quartz veins and greisenization; contact zones, especially the roof and country rocks; gas-breccia veins, cavities (vugs) containing fluorite.*
Geophysical	*Radiometric surveys (potassic alteration minerals and uranium), UV lights for scheelite (bright blue).*
Geochemical	*Mo and F in soils, tills, stream and lake sediments. Panned concentrates for topaz, tourmaline, scheelite or cassiterite.*


Granophile Deposits (cont'd)
Topaz Greisen
Sage Pond
prospectors
resource room


Topaz Greisen
Sage Pond
MM
prospectors
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Granophile Deposits (cont'd)

Granite Canal Showing

Wolframite and Pyrite in Quartz Vein

PORPHYRY COPPER & MOLYBDENUM DEPOSITS

BACKGROUND: *Very large tonnage, low-grade copper, copper-molybdenum, copper-gold and molybdenum deposits; 60% of world's copper.*

ENVIRONMENT: *Spatially and genetically related to porphyritic, multiple high-level intrusions of granitic composition at destructive plate margin settings. Occur over both oceanic and continental crust. Formed by the interaction of water and ascending magma.*

STYLE: *Veinlet stockwork as fracture fillings and in quartz veins and as disseminations within and adjacent to the stocks.*

Types:

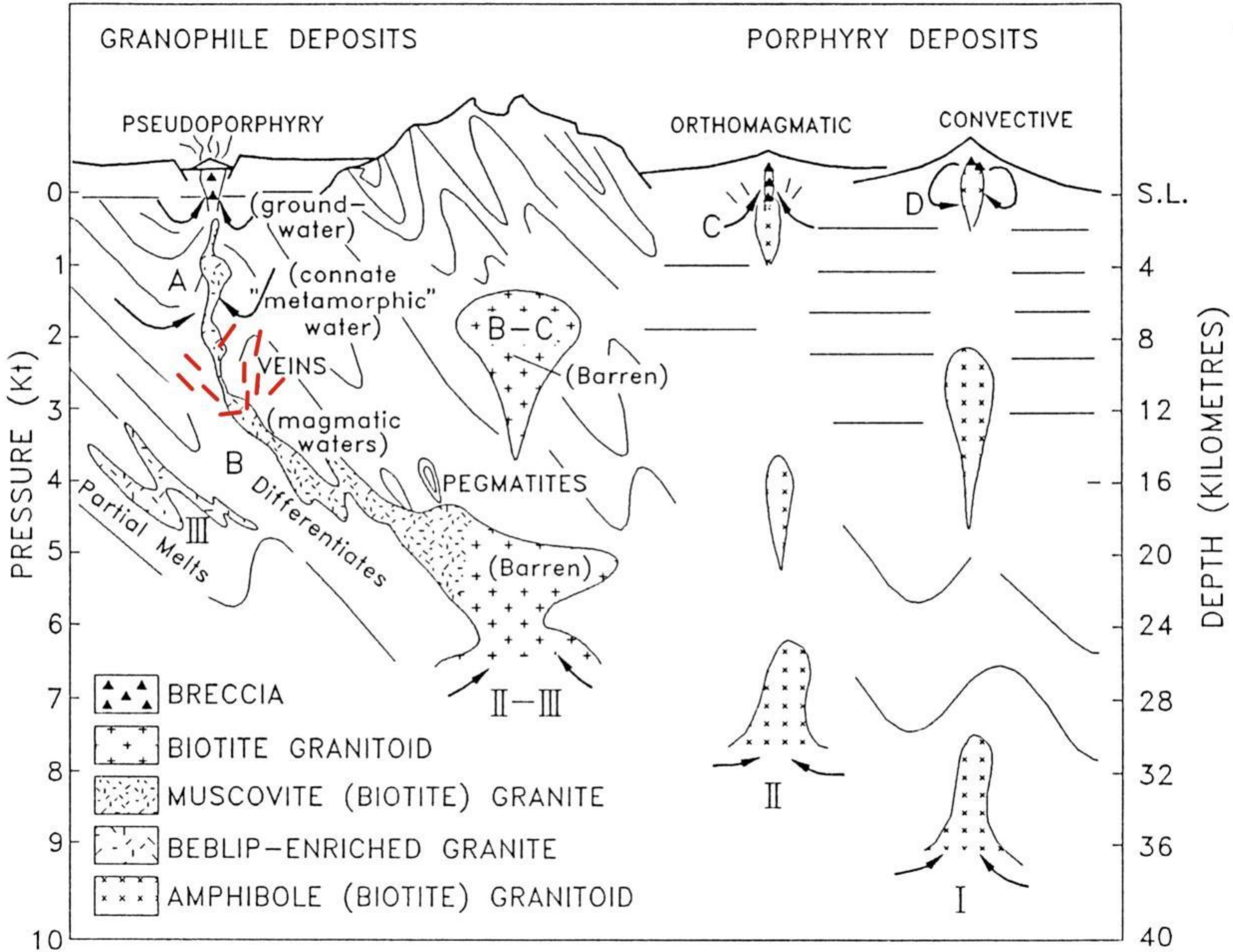
i) Porphyry Copper - Cu, Cu-Mo, Cu-Au deposits; typical grades of 0.4-1% Cu; largest porphyry copper 1.5-3 Bt of 0.8-2% Cu.

ii) Porphyry Molybdenum – Can be distinguished from Porphyry Copper deposits on Mo/Cu ratios (>1); molybdenum deposits typically do not contain recoverable copper. >0.05% Mo, generally <1 Bt.

Bingham

on

PORPHYRY COPPER DEPOSITS - SETTING



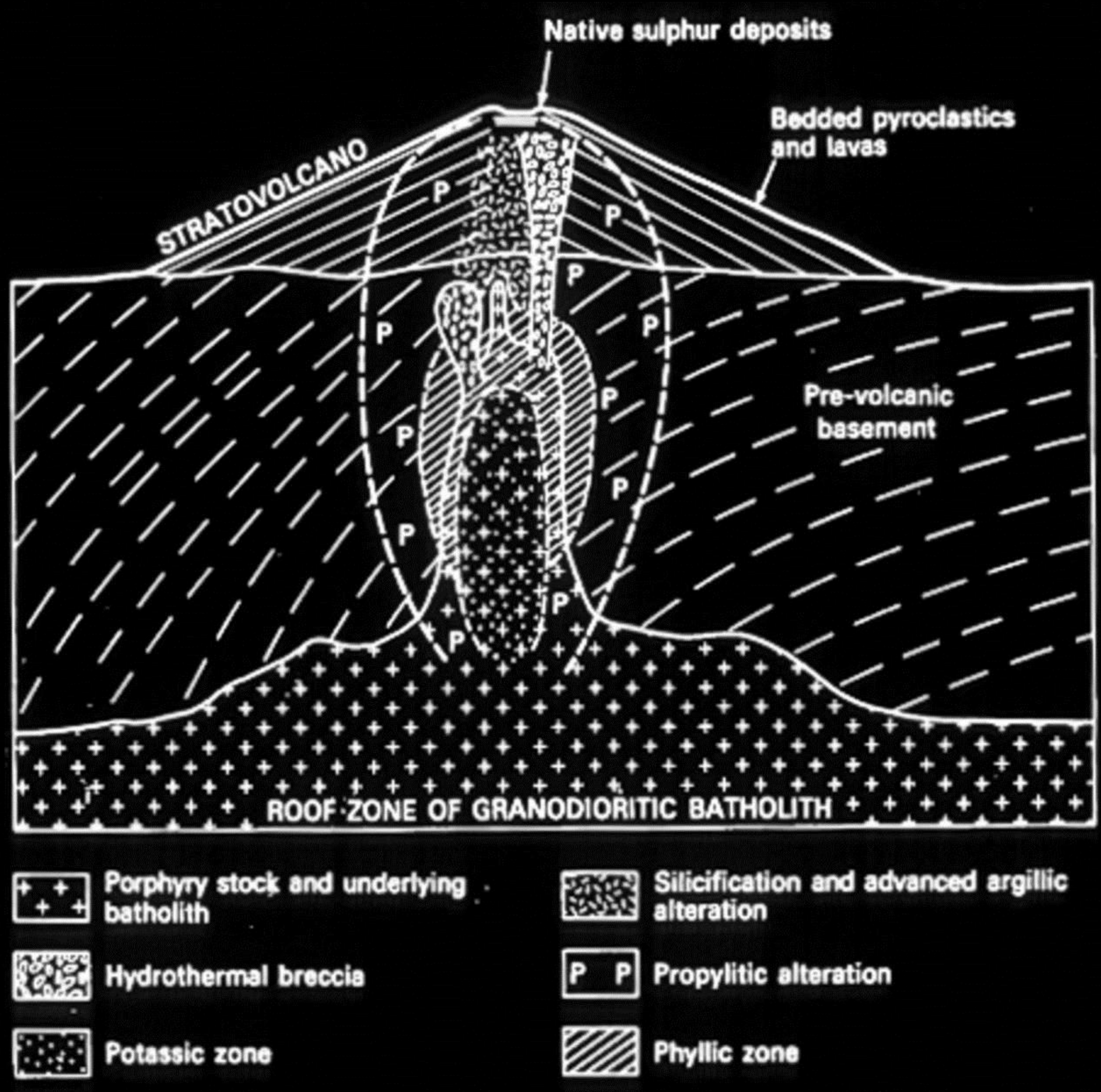
PORPHYRY COPPER DEPOSITS

MINERALOGY: *Chalcopyrite, pyrite,+/- molybdenite, bornite and native gold*

ALTERATION: *Extensive and characteristic alteration zone (halo) centred on the intrusion, as follows:*

I) Potassic zone (pink K-feldspar & biotite)
II) Phyllic zone (quartz-sericite-pyrite)
iii) Argillic zone (quart-kaolinite-chlorite)
iv) Propylitic zone (albite-chlorite-epidote-carbonate)

Diagrammatic representation of a simple porphyry copper system on the boundary between the volcanic and plutonic environments



DISTRIBUTION:

Newfoundland…. Major W prospect at Grey River on the south coast of the island (Tenajon Resources)

……………………..Minor Cu-Mo occurrences in central Nfld. in Ordovician and Avalon PreCambrian granites.

Labrador………... Potential in granitoid rocks of the Aillik-Makkovik area of the Central Mineral Belt.

PROSPECTING METHODS:

Geological…… Distinctive alteration and stockwork sulphides.

Geophysical…. Difficult, due to the nature of the mineralization.

Geochemical… Cu, Mo, Au, Ag in stream and lake sediment and in soils and till.

NOTE: Within the Appalachians and Labrador, this style of mineralization may be difficult to recognize due to deformation and metamorphism.

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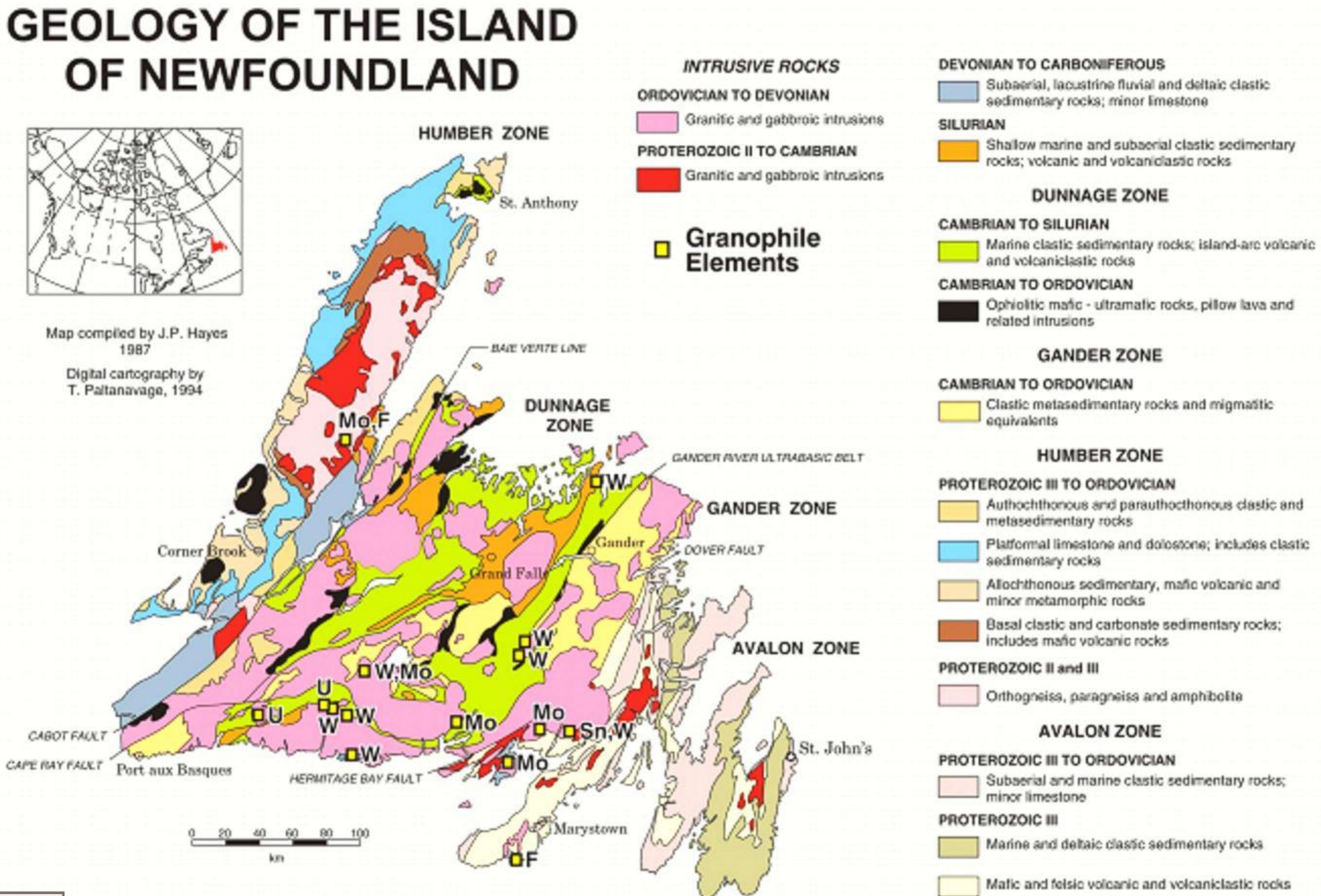
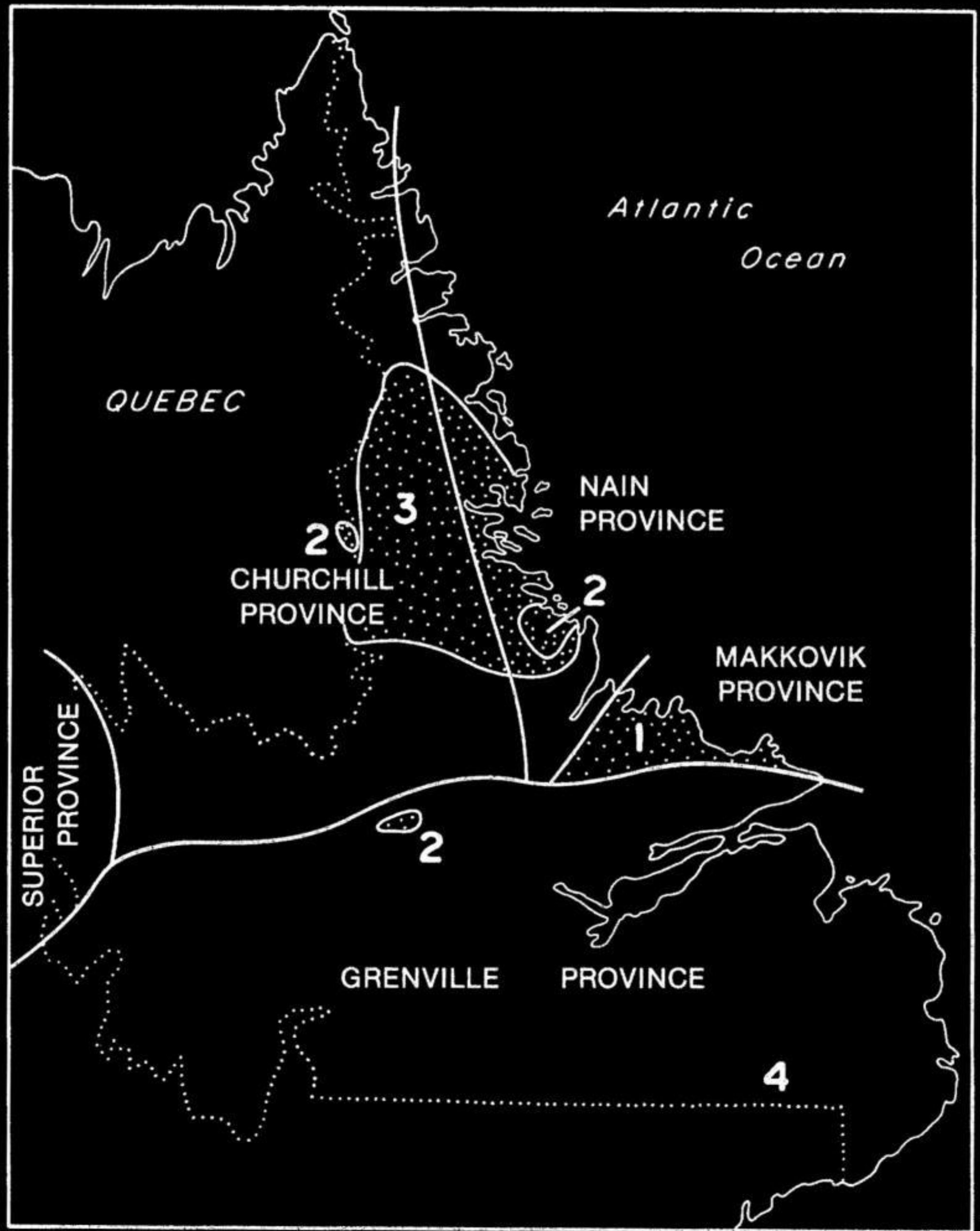
PORPHYRY COPPER DEPOSITS – Distribution in NL



ENVIRONMENTS FOR GRANOPHILE ELEMENTS



PORPHYRY COPPER

1- Makkovik Province

PROSPECTING METHODS:

Geological — *Look for high-level granitoids (quartz diorites to granites) with a distinctive alteration halo, especially kaolin (a white clay mineral) and sericitization; stockwork veinlets and disseminated sulphides.*
Intrusion and country rocks may be intensely fractured and faulted and there may be breccias.

Geophysical — *Difficult, due to the nature of the mineralization.*

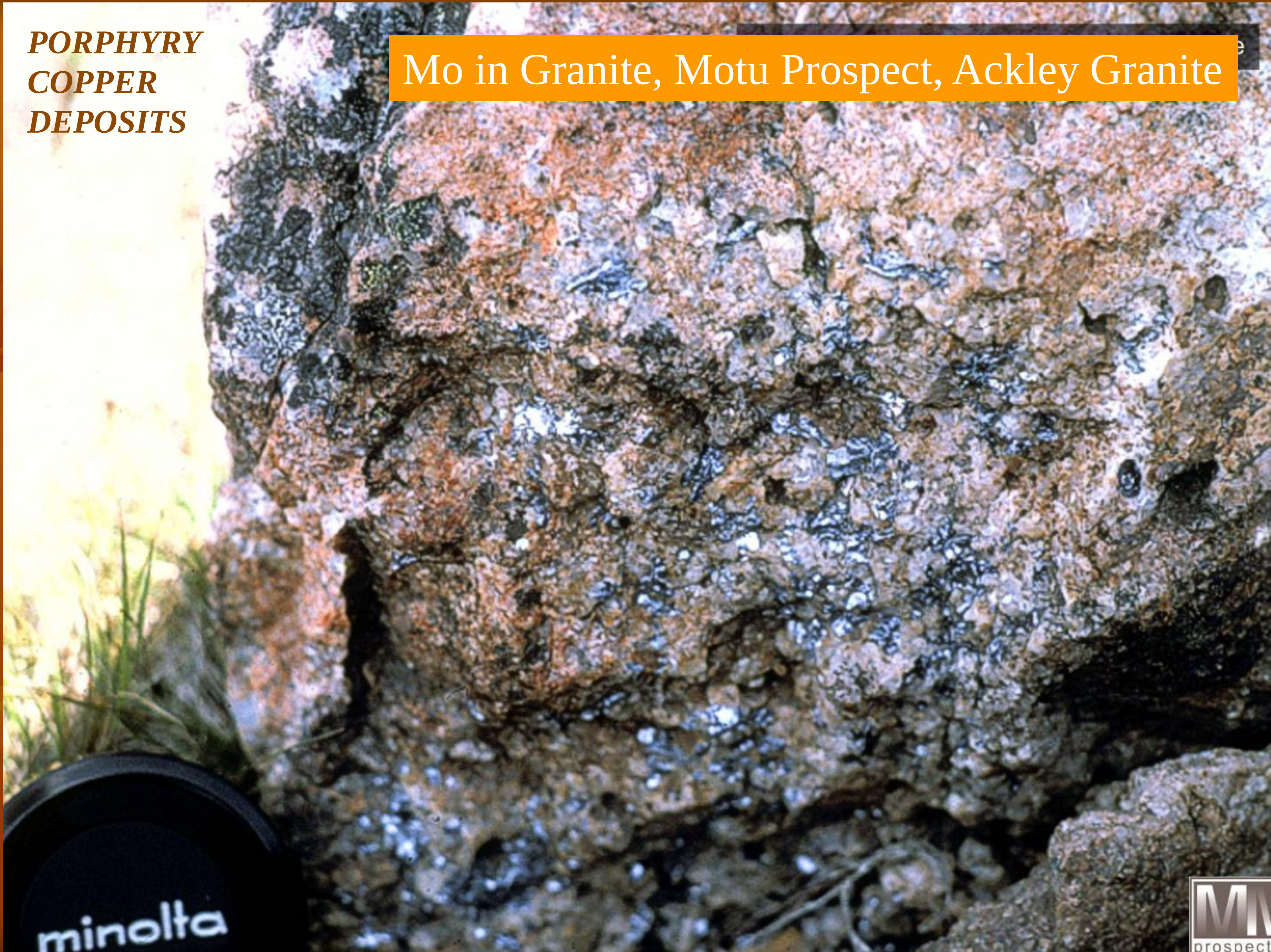
Geochemical — *Cu, Mo, Au, Ag in stream and lake sediment, and in soils and till.*

NOTE: This style of mineralization may be difficult to recognize due to deformation, metamorphism, and erosion.

Wylie Hill Mo Prospect
Ackley Granite

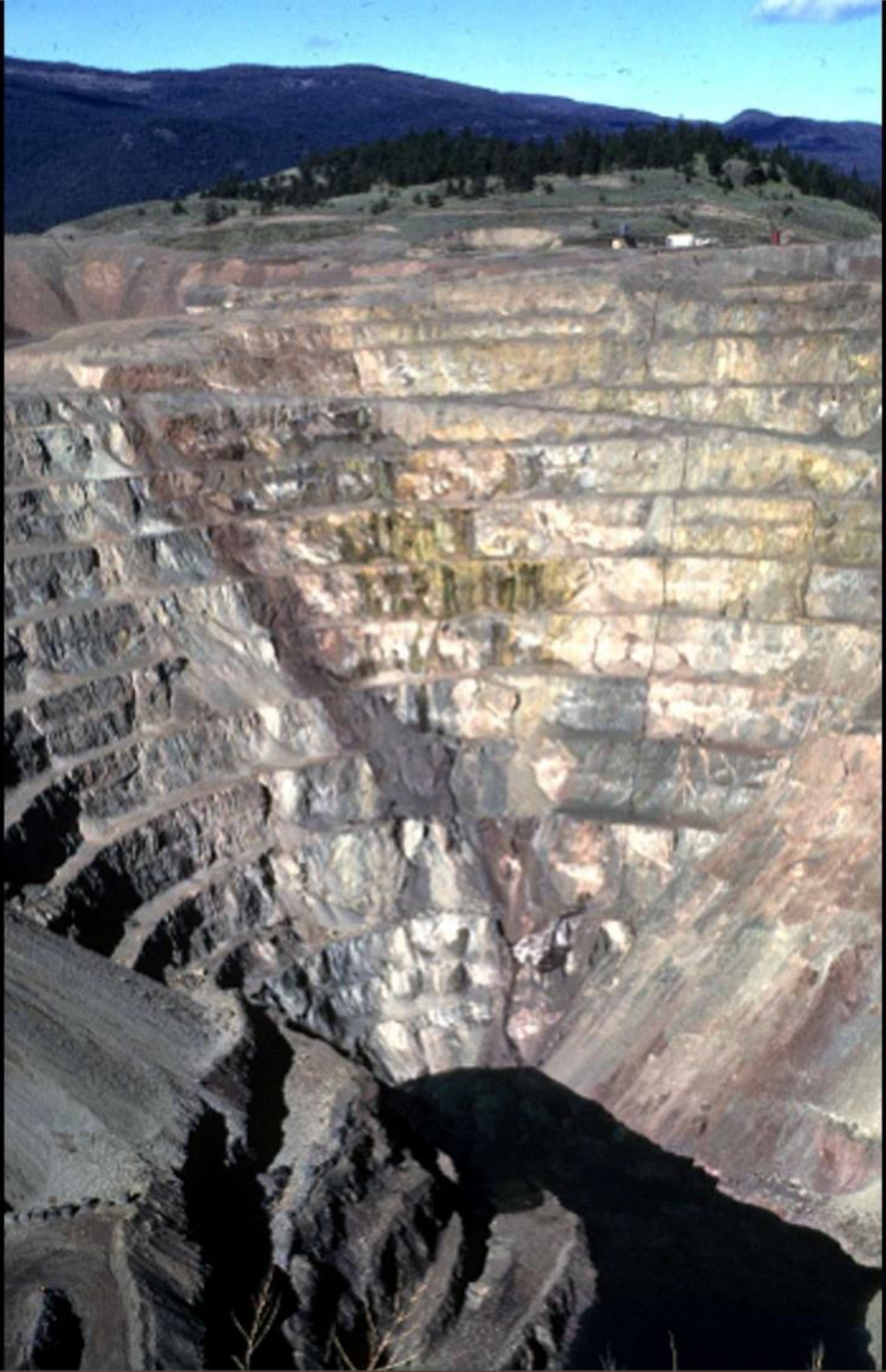
PORPHYRY COPPER DEPOSITS

Mo in Granite, Motu Prospect, Ackley Granite



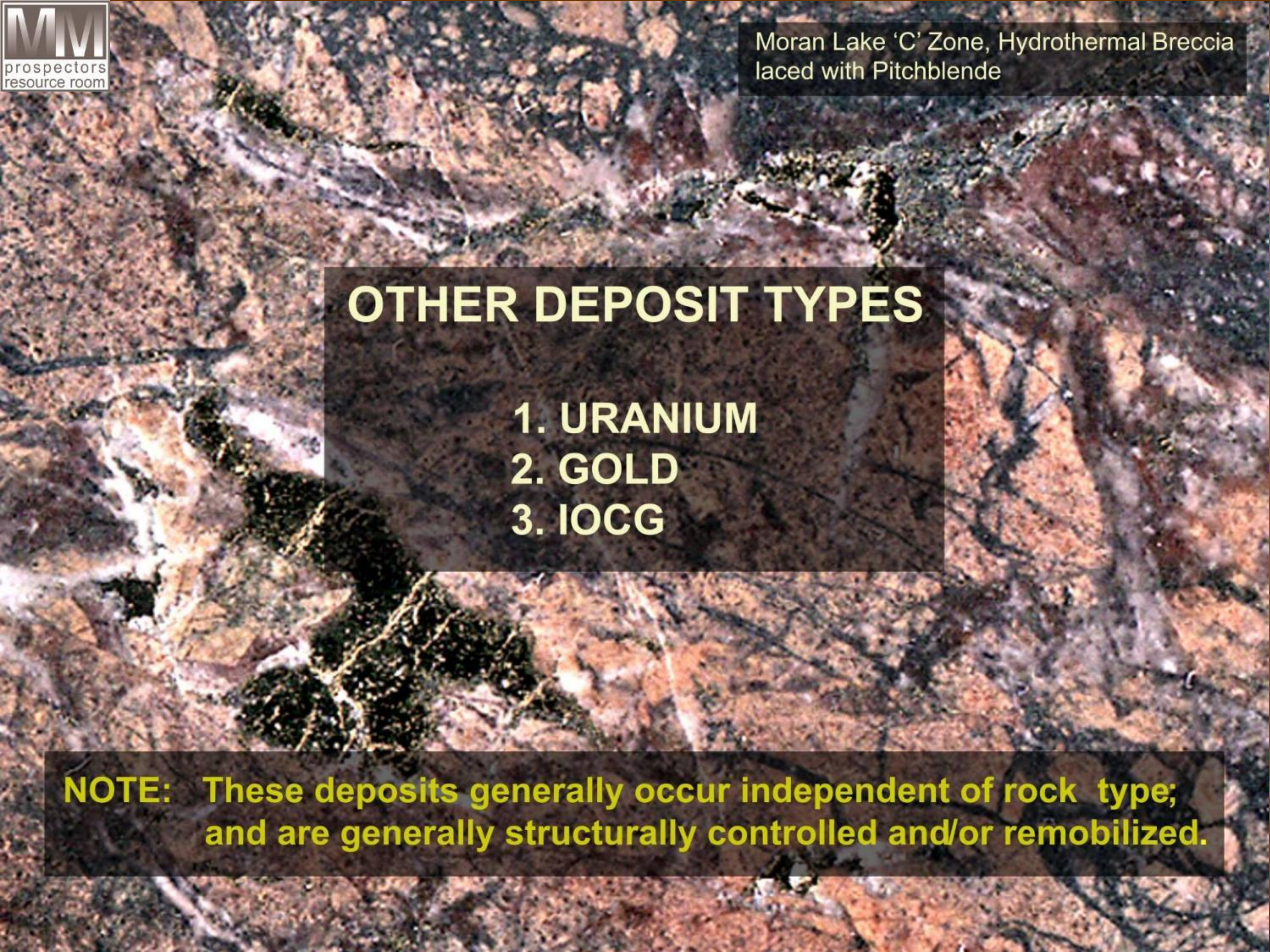
PORPHYRY COPPER DEPOSITS

Molybdenite (grey Mineral) in Porphyry; Note malachite



Highland Valley Mine

Copper in Porphyry
Highland Valley Mine



Moran Lake 'C' Zone, Hydrothermal Breccia laced with Pitchblende

OTHER DEPOSIT TYPES

1. URANIUM
2. GOLD
3. IOCG

NOTE: These deposits generally occur independent of rock type; and are generally structurally controlled and/or remobilized.

URANIUM

BACKGROUND ***Uranium is a relatively mobile element. It occurs in nearly all major rock types, and has an average crustal abundance of 2 - 4 ppm.***

ENVIRONMENT ***Uranium mineralization may be hosted by a variety of rock types, including sedimentary rocks (sandstone, shale, conglomerate), felsic and mafic metavolcanic rocks and intrusive rocks. However, there are several major environments in which significant uranium deposits form:***

1. Paleoplacer uranium deposits with detrital pyrite and gold occur in quartz-pebble conglomerates greater than 2.4 billion years old (e.g. Elliot Lake, Ont). The uraninite is derived from uraniferous pegmatites in the source area. About 150,000 tonnes produced.

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Uranium (cont'd)

2. Unconformity-Type mineralization is common in rocks younger than 2.4 billion years. Spatially and maybe genetically(?) associated with very old crust (called basement) overlain by younger sandstone, shale and carbonaceous mudstone laid down in basins or hollows on continental rock. Mineralization occurs in either or both the basement and cover rocks. Form largest known high-grade deposits of uranium (e.g., Athabaska Basin, Sask. and Northern Territory, Australia).

3. Carbonaceous pelite (metamorphosed mudstone) - hosted uranium in Proterozoic pelitic sediments in both North America and Australia. Many classify them with the Unconformity-type as they occur in similar environments, rocks and age.

Uranium (cont'd)

***4. Sandstone-hosted** deposits, also known as "roll-fronts", "tabular bodies" and "channel-type". Most commonly developed in permeable sandstone at the so-called oxydation/reduction (Redox) front .*

Generally younger than Carboniferous (less than 290 million years). An important source of uranium; about 300,000 tonnes produced. Examples, southwestern US, Argentina and Niger.

***Miscellaneous** mineralization…. covers most mineralization that has no significant production; most of the Labrador Central Mineral belt uranium mineralization would probably be here. It includes magmatic-related mineralization in both intrusions and flows and may occur in the bodies themselves or in the country rock as veins; recirculated uranium mineralization due to heat; uraniferous coals and phosphates; IOCG type, etc.*

URANIUM (cont'd)

MINERALOGY: Pitchblende (Uraninite) – UO_2 but generally oxidized to U_3O_8. Pyrite and other metals (e.g., Ag, Cu) may be present.

ALTERATION: Sodic metasomatism, hematization; oxidized pyrite and base metals (gossans); orange carbonate and brecciation.

DISTRIBUTION:

Newfoundland Sandstones of the Deer Lake and Bay St. George Basins; granitoid rocks.

Labrador: Central Mineral Belt, Double Mer, Labrador Trough, Mugford Group. The Central Mineral Belt hosts several distinct mineralization environments in a wide range of rocks types and age that form geographically distinct belts, including:

i) volcanic-hosted, stratabound mineralization (possibly syngenetic) in rhyolitic ash-flow tuffs, e.g., Michelin and Burnt Lake deposits.

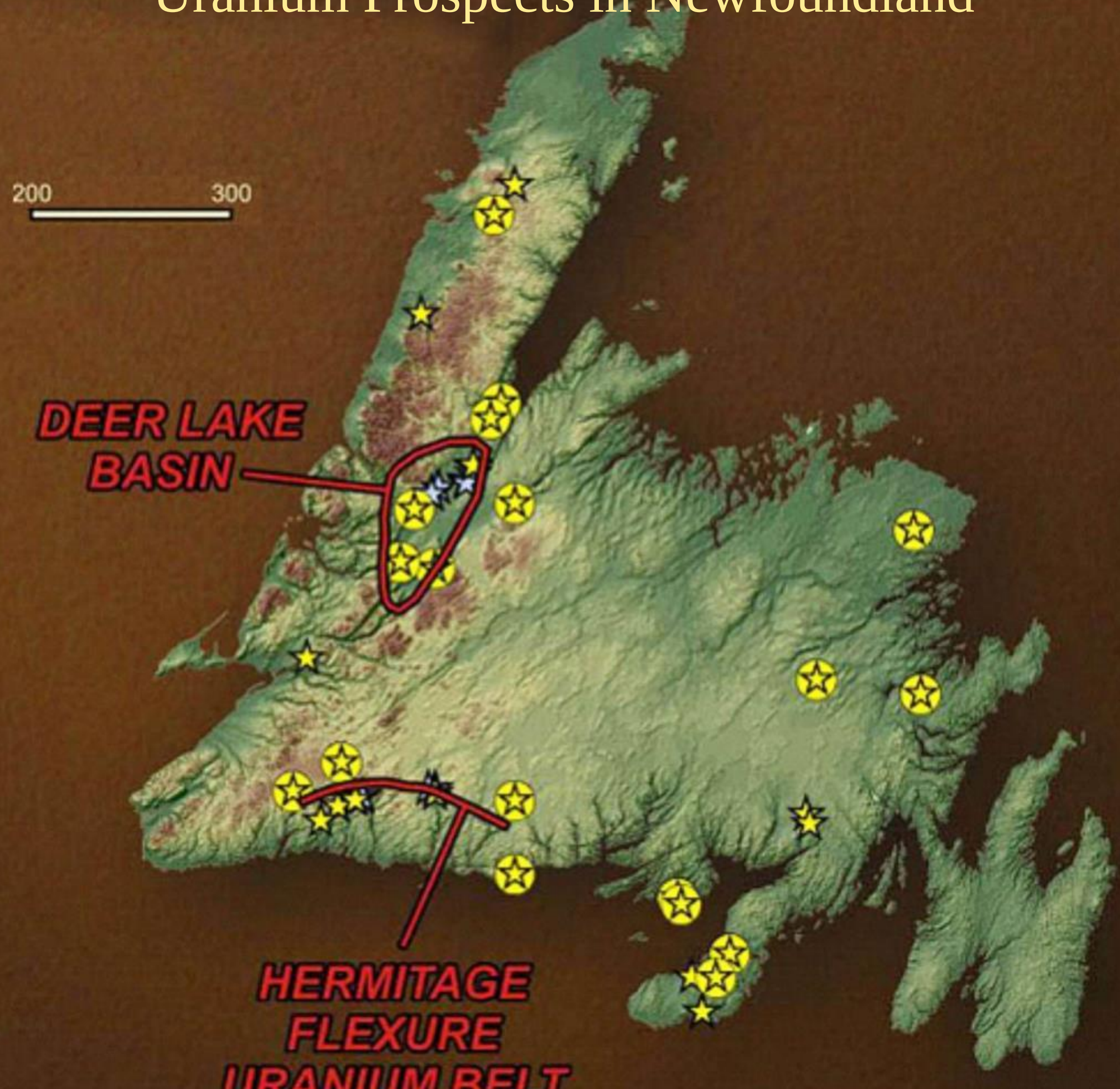
ii) epigenetic mineralization formed in a reducing environment by remobilized uranium along shear zones during the Makkovikian Orogeny, e.g., Kitts-Post Hill deposits.

iii) intrusion-related mineralization... uranium possibly remobilized out of the Upper Aillik Group forming the U-Mo and U-Mo-base-precious metal occurrences of the Aillik-Makkovik belt and the Round Pond zone.

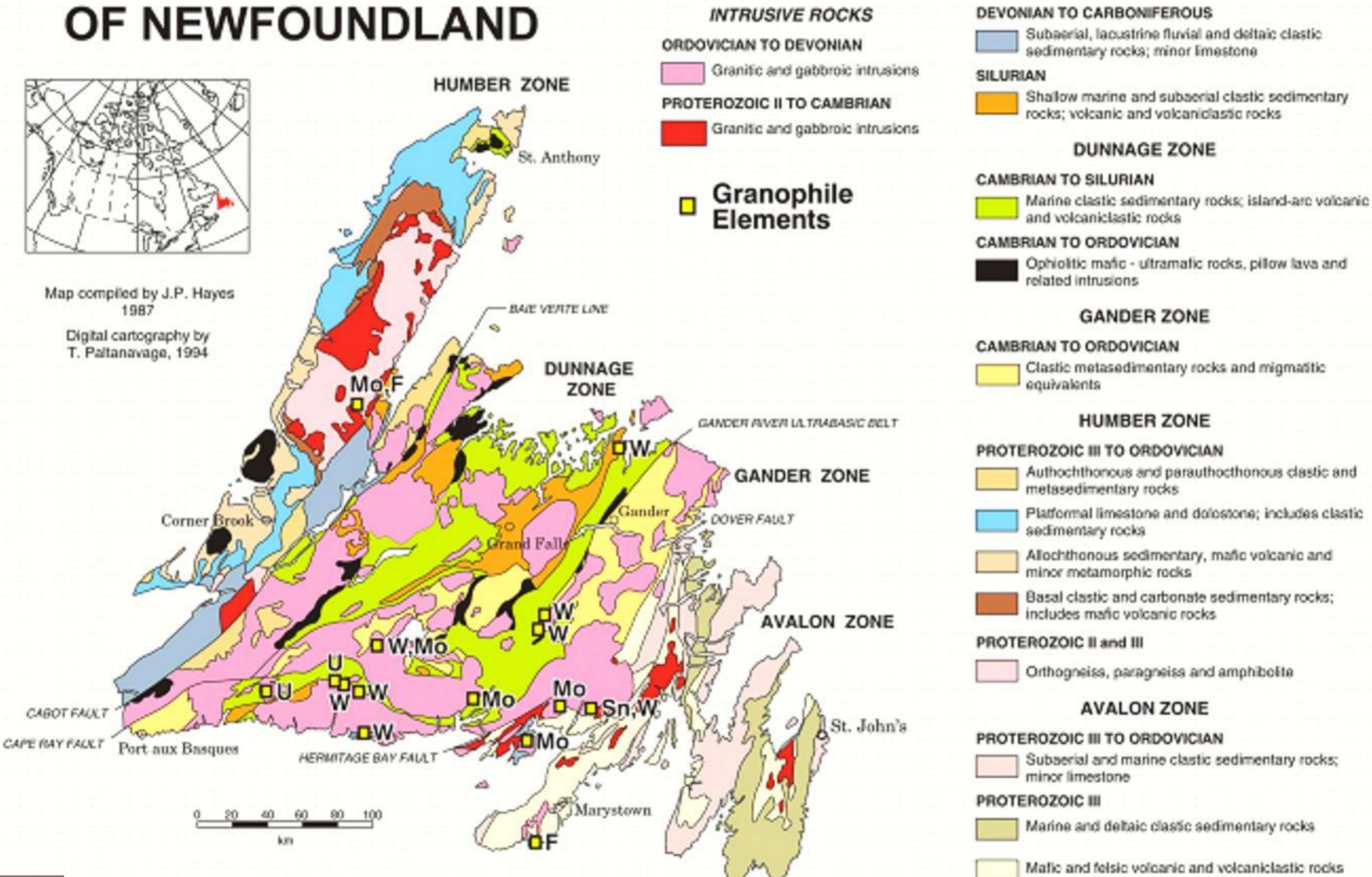
iv) unconformity-related mineralization ... uranium occurs within fractures and quartz veins in conglomerate and sandstone of the basal Seal Lake Group directly above the unconformity with the Bruce River Group, but generally following the unconformity surface, e.g.,Stormy Lake

Note: Mineralization like Moran Lake 'C' are interpreted by some as possibly IOCG type.

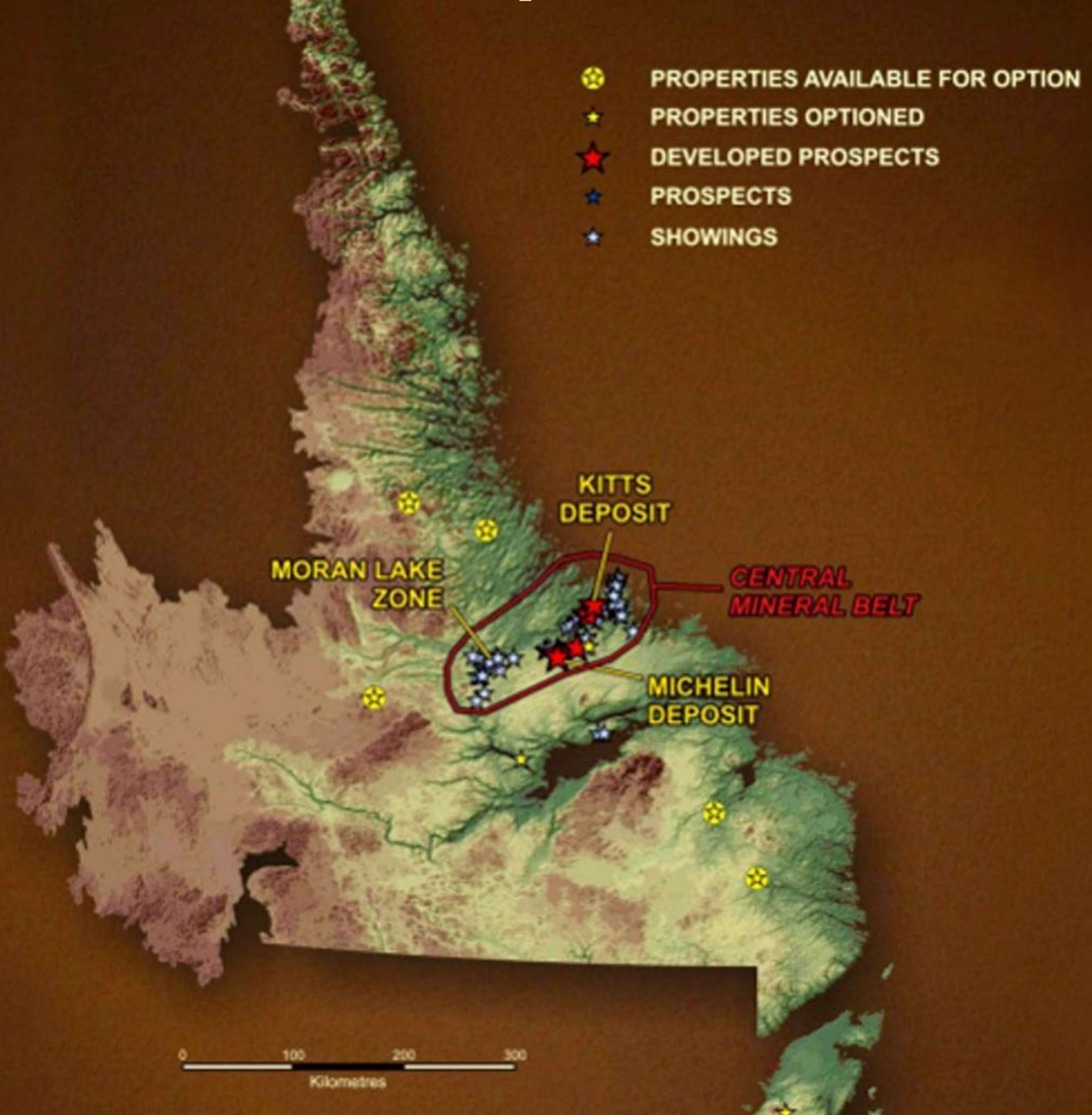
Uranium Prospects in Newfoundland



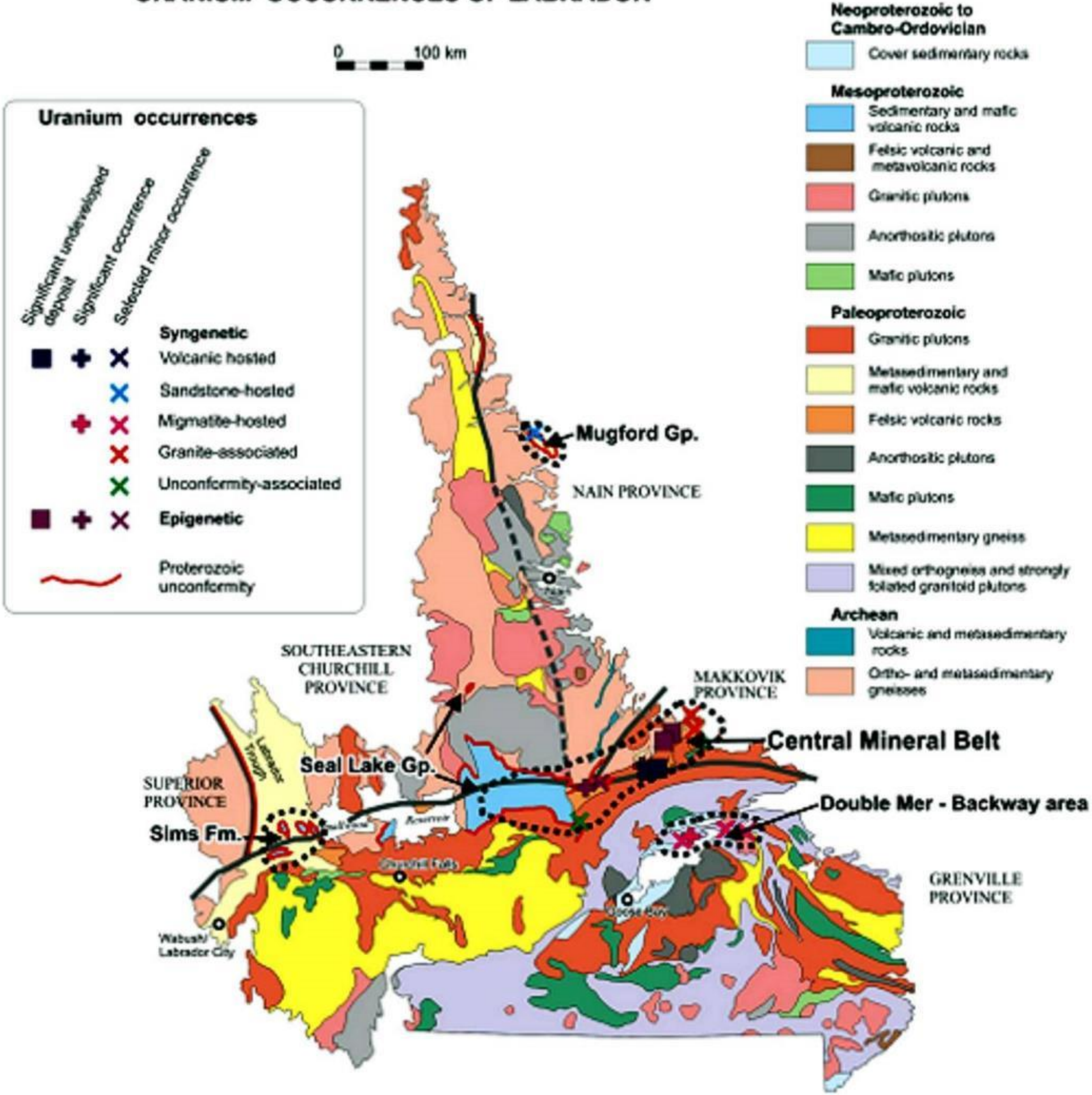
GEOLOGY OF THE ISLAND OF NEWFOUNDLAND

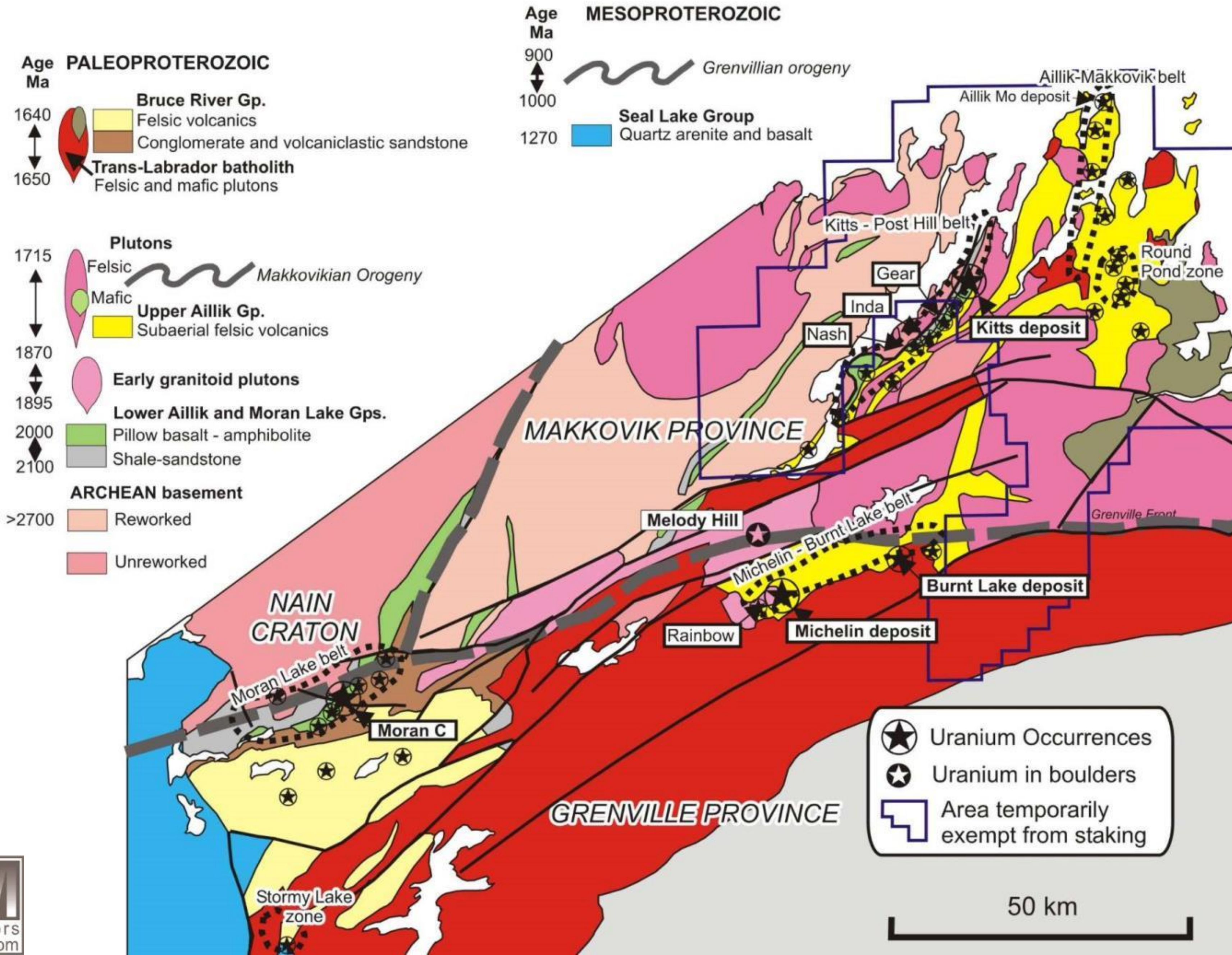


Uranium Prospects in Labrador

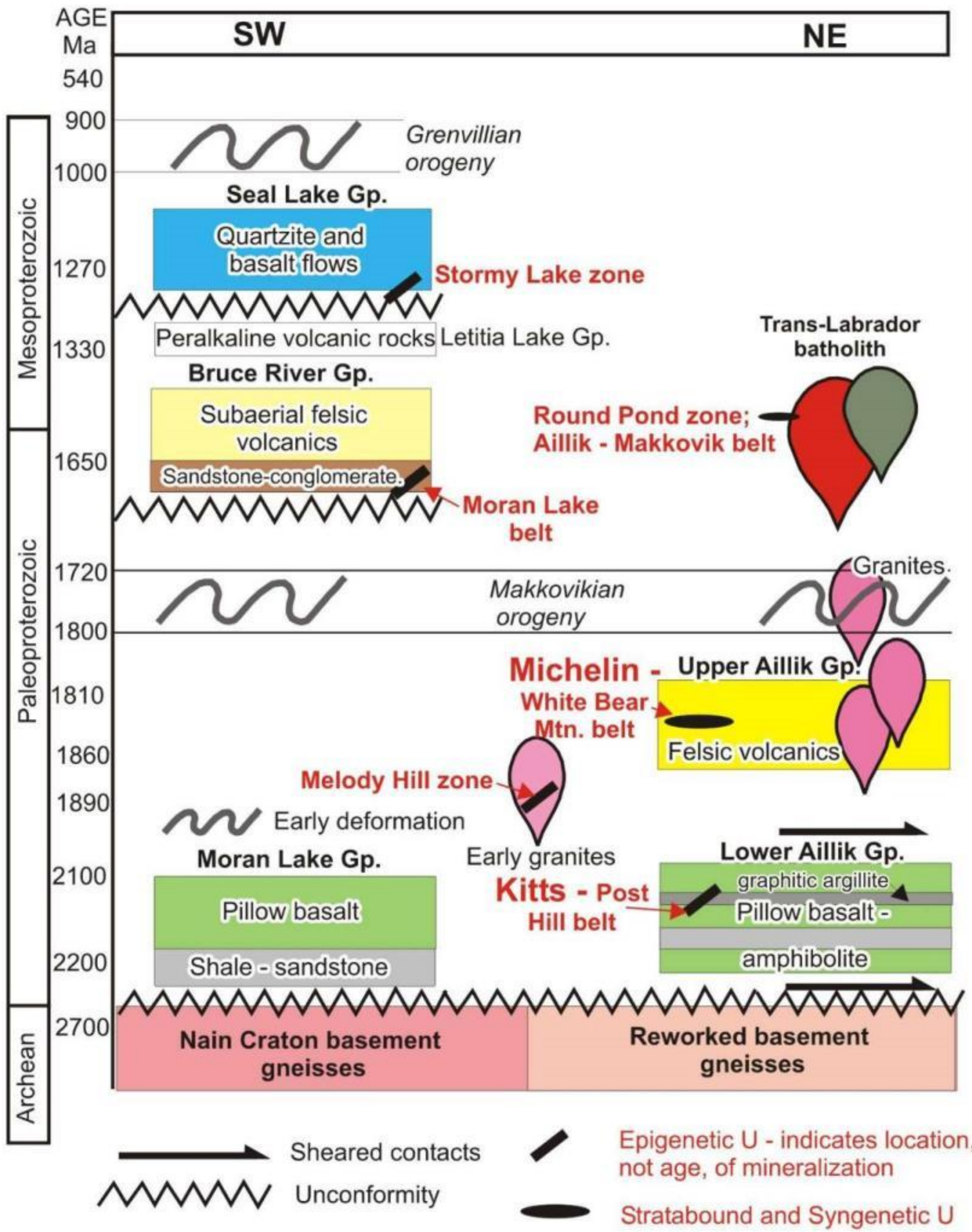


URANIUM OCCURRENCES OF LABRADOR





Age Ma
PALEOPROTEROZOIC
1640
1650
Bruce River Gp.
Felsic volcanics
Conglomerate and volcaniclastic sandstone
Trans-Labrador batholith
Felsic and mafic plutons
Plutons
1715
Felsic
Mafic
Makkovikian Orogeny
Upper Aillik Gp.
Subaerial felsic volcanics
1870
1895
Early granitoid plutons
Lower Aillik and Moran Lake Gps.
2000
2100
Pillow basalt - amphibolite
Shale-sandstone
ARCHEAN basement
>2700
Reworked
Unreworked
Age Ma
MESOPROTEROZOIC
900
1000
Grenvillian orogeny
1270
Seal Lake Group
Quartz arenite and basalt
Aillik-Makkovik belt
Aillik Mo deposit
Kitts - Post Hill belt
Round Pond zone
Gear
Inda
Nash
Kitts deposit
MAKKOVIK PROVINCE
Grenville Front
Melody Hill
Michelin - Burnt Lake belt
Burnt Lake deposit
Rainbow
Michelin deposit
NAIN CRATON
Moran Lake belt
Moran C
GRENVILLE PROVINCE
Stormy Lake zone
Uranium Occurrences
Uranium in boulders
Area temporarily exempt from staking
50 km



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PROSPECTING METHODS for URANIUM:

***Geological:** Gossans formed by oxidization of Uraninite and associated sulphides; oxidation/reduction fronts; geological environment*

***Geophysical:** Scintillometer - U, K and Th radiometric surveys (radioactivity); gravity in some cases*

***Geochemical:** Stream anomalies, soil for U, Ag and associated elements*

Pitchblende

U Stain,
Burnt Emben Prospect, Labrador
(Courtesy of Altius Minerals)

Moran Lake 'C' Zone Breccia with Pitchblende
(Courtesy of Crosshair Exploration)

Carbonate-Hematite

Altered Breccia,

Moran 'C',

Bruce River Group

Pitchblende Veins, Moran 'C'

Kitts Deposit, Labrador *(Courtesy of Altius Minerals)*

Michelin Deposit, Labrador
(Courtesy of Altius Minerals)

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White Bear River, S. Nfld. - 0.43 g/t U.

GOOD PROSPECTING

Remember the size of your prospect is not everything at the prospecting stage. Your prospect may only be small, but many important deposits do not even come to surface, and are completely covered by glacial drift or 'dead-looking' rocks (these are called 'blind' deposits). As most of the obvious outcropping deposits have been found, 'blind' deposits, or those showing just a small area of altered rock or mineralization at surface are the deposits of the future.

And remember, mineralization is where you find it!