Geology, Geophysics & Gold in the St. Alban’s map area

01M/13
Regional Geology south coast of Newfoundland

Avalon Zone
Avalonia microcontinent, dominant late Proterozoic

Gander Zone
Ganderia, Proterozoic or Early Paleozoic basement?

Dunnage Zone (Exploits)
Remnants of Iapetus Ocean
Cambrian-Ordovician metasediments and volcanic rocks

Colman-Sadd et al., 1990 and GSNL geoscience atlas
Orogenic Events

• Penobscot Orogeny (Early Ordovician): ophiolite obduction

• Back-arc rifting + sedimentation

• Salinic Orogeny (Late Ordovician to Early Silurian): closure of Exploits back-arc basin, accretion of Ganderia to Laurentia

• Acadian orogeny (Early Devonian): collision of Ganderia and Avalonia
St. Alban’s map area

- new bedrock mapping project
- based on detailed geophysics
- geochemistry
- isotope geochemistry and geochronology (not yet...)
- mineral potential
  - Some exciting Au values
01M/13 – East and Central
Residual magnetic field & MODS

Dunnage Zone
metasedimentary layering
well visible
magnetic highs often
graphitic schist/black shale
known Au showings align
along Little River area

Gander Zone
complex relationship
between gneiss (rel. high)
and intrusion (rel. low) visible
in geophysical signature
Overview of geological units

- Little Passage Gneiss, Neoproterozoic to Ordovician (Gander) separated by Day Cove thrust from
- Baie d’Espoir Group, Ordovician (Dunnage)
  - Salmon River Dam Fm.
  - St. Joseph’s Cove Fm.
  - Riches Island Fm.
  - Isle Galet Fm.
- Intrusive rocks, post Ordovician

amphibolite facies

Increasing deformation, greenschist to epidote-amphibole facies
Geological map – East & Centre

**LEGEND**

**Post Ordovician intrusive Rocks**

- Late Silurian or younger
  - 14: Mesorecotic non foliated biotite-biobreite-pyrite granite
  - 13: Late Silurian
    - Northwest Brook Complex: pink to buff, variably foliated, medium grained biotite-muscovite-rutile granite to granite-gneiss
    - Gaulois granite suite: Leucocratic, coarse grained, well foliated (titlare) muscovite-biotite granite and gneiss, often containing K-feldspar and tourmaline

**Dunnage Zone**

Ordovician

- Base of Ellis Group
  - Thin to medium bedded dark grey weathering shale and thin bedded coarse grained sandstone, locally includes beds of siderite
  - Medium to thick bedded light brown to grey sandstone and minor conglomerates

- Riches Island Formation
  - Thin to medium bedded laminated greenish-grey shale with interbeds of siltstone, commonly metamorphosed to pyrite and schist, locally contains beds rich in gneid pyrite nodules

- Thin to medium bedded yellow-brown sandstone and mudstones

**Gander Zone**

- Late Precambrian: K-feldspar muscovite-biotite-quartz-rutile garnet, chlorite paragneiss with well-developed compositional banding, reddish brown to rusty weathering, commonly completely foliated, locally includes amphibolite

**SYMBOLS**

- Geological contact (defined, approximate, assumed)
- Fault (defined, assumed)
- Thrust fault (defined, assumed)
- Limit of mapping
- Bedding (tops known, unknown)
- Rotation or cleavage (1.5-2.0 generation)
- Detrital foliation
- Linear fabric (1.5-2.0 generation)
- Stations

Westhues (2017, in press)
St. Joseph’s Cove Fm.

- Dominantly interbedded shale and siltstone (turbidite)
- Two generations of cleavage and related folding
- Large recumbent folds ($F_2$)
- Few sandstone channels
Riches Island Fm.

- Shales & siltstone, phyllite and schists
- Garnet-rich layers
- Black shales and graphitic schists
- Few intermediate volcanic layers

Ordovician brachiopods
Trilobite pygidium (Boyce et al. 1993): Late Arenig (Dapingian 470 to 467 Ma)
Isle Galet Fm.

mostly schists, strongly deformed

metavolcanic layers common, felsic composition dominant

graphitic schists as marker horizons
St. Joseph’s Cove Formation

- shale + siltstone: high residual magnetic intensity
- sandstone: intermediate magnetic intensity
Riches Island & Isle Galet formations

- **black shales and graphitic schists:**
- **high magnetic intensity**
- **shale, sandstone, metavolcanic rocks:**
- **medium to low magnetic intensity**
Gander Zone

- Little Passage Gneiss
  - mainly paragneiss in St. Alban’s map area
  - metamorphic peak at 423 Ma, protolith?

- Gaultois Granite
  - mainly intermediate composition
  - intrusive age 421 Ma (syntectonic, Salinic Orogeny)

- Northwest Brook Complex

- Pegmatite and aplite

Age constraints from Dunning et al. (1990)
Little Passage Gneiss

semipelitic to psammitic paragneiss
Kfs-msc-bt(chl)-qz ± grt
compositional layering on macro- and microscale
characteristic rusty weathering
Gaultois Granite

feldspar-megacrystic, lineated and foliated intrusions
granodiorite, monzodiorite, tonalite
rare diorite + gabbro
alignment of bt, elongated qz
define regional SW foliation
Northwest Brook Granite + pegmatite/aplite

Northwest Brook Granite: two-mica granite to syenite weakly foliated intrusions regional SW foliation, subparallel to Gaultois Granite

tourmaline-garnet bearing granitic pegmatite + aplite locally up to 150 m wide dykes
Radiometric and magnetic data combination helps to separate granitic from intermediate intrusions and gneiss.
Younger (?) Intrusion – magnetic high

Gaultois
Preliminary geochemistry

Isle Galet fm.
- felsic volcanic
- intermediate volcanic
- mafic volcanic

Riches Island fm.
- intermediate volcanic

Pearce 1996 after Winchester and Floyd, 1977

Modified from Cox et al. 1980
Day Cove Thrust – Zone boundary in southern NL

Contrast in magnetic intensity along thrust & detailed documentation of mylonite (Piasecki, 1988)

- argue for a major shear zone/thrust

Different intrusions in Gander (Silurian Gaultois, NWB) vs. Dunnage zone (Devonian North Bay Suite?)

- separate histories until Salinic orogeny?
Mineralization

See Westhues (2017) Open File 001M/13/0872 for locations of assays
High Au in St. Joseph’s Cove fm.

Trend between True Grit and Southeast Brook!

- lower magnetic intensity
- sandstone: easier pathway for metal-bearing fluids?
Little River Au

linear trend within Isle Galet formation mostly staked, drilled in several places
Au related to lower magnetic intensities (volcanic rocks and phyllites)

Little River 2
2020 ppb Au
2900 ppm As

Little River 3
84 ppb Au
53 ppm As

119 ppb Au
274 ppm As
Future work

• Continue mapping – west half of map sheet
  – North Bay granite
  – Salmon River Dam formation
• Follow up some mineralisation trends
• Detailed petrography
• Incorporate 3D visualization into mapping?
• Geochronology (volcanic units, intrusions)
• Sm-Nd isotope geochemistry
Thank you!!!!