The Rice Lake greenstone belt: geology overview and update of MGS activities

Scott Anderson
Manitoba Geological Survey

Sunrise, Gem Lake
Presentation outline

• Regional setting
• Local geology; lithotectonic assemblages
• Structural evolution
• Metallogeny and exploration potential
• Recent exploration
• Ongoing MGS activities
Western Superior Province: regional setting

- > 2.8 Ga continental terranes and isotopic influence
  - 3.5-2.81 Ga Northern Superior superterrane
  - 3.0-2.87 Ga North Caribou terrane
  - 3.17-2.81 Ga Winnipeg River terrane

Greenstone belts
- Mainly continental affinity
- Mainly oceanic affinity

Meta-sedimentary belt
- Granitoid rocks

*** Western Superior Province ***
- Prolific host to Orogenic Au
- Also hosts:
  - VHMS Cu-Pb-Zn(Au,Ag)
  - Magmatic Ni-Cu-PGE
  - Pegmatite Li-Cs-Ta

NCT
- north-verging subduction accretion complex along south margin of NCT

Rice Lake belt: general geology

- North Caribou
- English River
- Uchi

- Paleozoic:
  - Limestone

- English River Subprovince:
  - Paragneiss
  - Granite, orthogneiss

- Uchi Subprovince:
  - San Antonio assemblage
  - Edmunds assemblage
  - Gem assemblage
  - Quartz diorite
  - Bidou assemblage
  - Garner assemblage

- Rice Lake belt:
  - Wallace assemblage
  - Granitoid rocks

- Gold deposit
- Geological contact
- Wanipigow Shear Zone
- Manigotagan Shear Zone
- Shear zone, fault

Manitoba
Wallace assemblage
- quartzite, conglomerate, iron formation, carbonate, komatiite
- <2.99 Ga (Davis, 1994; Percival et al., 2006)
- >2.92 Ga (Davis, 1994; Sasseville et al., 2006)
- shallow subaqueous continental platform
Garner assemblage
- CA dacite, layered ultramafic intrusion, iron formation, komatiite to Mg-THOL basalt
- ca. 2.87-2.90 Ga (Davis, 1994; Anderson, unpubl.)
- subaqueous continental arc to intra-arc basin
**Bidou assemblage**
- Mg-THOL basalt, epiclastic rocks, gabbro
- 2.724-2.745 Ga (Anderson, unpubl.)
- CA dacite, andesite, basalt; epiclastic rocks, gabbro
- 2.715-2.73 Ga (Turek et al., 1989; Anderson, unpubl.)
- subaqueous marginal-arc and back-arc basin

Andesite-dacite breccia

Manitoba

Arc – back-arc complex; northward subduction beneath NCT margin

Red Lake equivalent: Confederation
Gem assemblage
• trans. CA-THOL rhyolite, dacite, basaltic andesite; epiclastic rocks
• ca. 2.72 Ga (Davis, 1994; Anderson, unpubl.)
• subaerial to shallow-subaqueous arc-rift setting

Rhyolite flow-lobe breccia

Uchi equivalent: St. Joseph(?)
Edmunds assemblage
• proximal equivalent to ERB metasedimentary rocks
• turbiditic greywacke, mudstone, conglomerate, iron formation
• <2.705 Ga (Davis, 1994; Anderson, unpubl.)
• >2.696 Ga (McNicoll and Rogers, unpubl.)
• marine-deltaic setting
San Antonio assemblage
- quartz greywacke, quartzite, conglomerate, turbiditic greywacke
- <2.705 Ga (Percival et al., 2006; Anderson, unpubl.)
- fluvial- to marine-deltaic setting

Uchi equivalent: none known? (Temiskaming-type basins)

Post-accretion, pre-orogenic denudation of NCT margin; fault-controlled basins
Structural evolution: central Rice Lake belt

Protracted (ca. 300 Ma) magmatic and depositional history + Complex structural evolution = Favourable metallogenic setting
Significant gold endowment:
- over 200 occurrences
- 5 significant producers (>50k ounces);
  over 1.7 million ounces total production
- Rice Lake deposit (~2.3 million ounces)
- multiple styles of mineralization

Favourable setting:
- accretionary plate-margin
- crustal scale faults
- regional greenschist-facies metamorphism
- extensive CO2 alteration
- chemically favourable rock-types
- complex stratigraphy and structure
**Magmatic Ni-Cu-PGE**
- English L., Jeep, Garner intrusions
- mafic to ultramafic layered intrusions or complex intrusion breccias
- Jeep and English Lake occurrences

**Komatiite Ni**
- Wallace and Garner assemblages
- ultramafic (komatiitic) flow complexes with interlayered sulphidic sedimentary rocks
- no known occurrences

**Volcanic-hosted massive sulphide**
- Bidou and Gem assemblages
- restricted back-arc or arc-rift basins
- evidence of synvolcanic alteration, exhalites, sulphide occurrences (in-situ or clasts)

**Base metals**

**VHMS-style mineralization (Bidou)**

**SiO2 high silica rhyolite dome (Gem)**
Rice Lake belt: ongoing exploration

- English L.
- Goldridge
- Red Rice L.
- Miami Metals Corp.
- MARUM Resources Inc.
- Rio-Saxton
- Mike Power
- Poundmaker
- Jeep
- WILDCAT Exploration Ltd.
- Magmatic Ni-PGE
- Orogenetic gold
- Angelina
- Banksian
- Grandview Gold
- Gabriele Greenbelt
- Oro Grande-Gunnar
- Lesavage N.
- Moore L.
- Central MB

Diagram showing locations and geological features in the Rice Lake belt.
Principal results:

- **Distinctive stratigraphic affiliation:**
  - quartz-greywacke turbidites
  - iron formation
  - polymictic conglomerate
  - mafic intrusive/extrusive

- **Spatial association with zones of structural complexity**

- **Three styles of mineralization:**
  - shear-hosted quartz veins
  - STWK / BX / wall-rock dissem.
  - sulphidized iron formation

- **Analogous gold districts:**
  - Beardmore-Geraldton, ON
  - Eleonore, QC
  - Meliadine trend, NU

**see Report GS-11 **
R of A 2007
Unresolved questions:
1) Relationship of the 38- and 16-type veins?
2) Controls on vein emplacement?
3) Timing of vein-emplacement relative to the regional deformations?
Rice Lake greenstone belt:

- ca. 300 million year history
- north-verging subduction / accretion complex
- continental-arc / marginal oceanic-arc to back-arc / arc-rift settings
- complex deformational history associated with ca. 2.69 Ga continent-continent collision
- demonstrated potential for major orogenic lode-gold deposits
- indications of significant potential for magmatic Ni-Cu-PGE, komatiite Ni, VHMS Cu-Pb-Zn(Au,Ag)
- minimal systematic modern exploration