Scope of Work and Objectives

The scope of work involved a short site visit to examine stripped outcrops and core intervals to study the controls on the distribution of the gold mineralization.

The purpose of the field investigations was to increase the confidence in the geometry and continuity of the gold mineralization intersected by drilling and guide future exploration work.

The work program involved a 3-day site visit (September 4-7, 2013):

- Examined core from portions of 31 boreholes;
- Visited outcrops on the Rivard property;
- Examined outcrops exposing Quartz-Carbonate rock inside the Newman-Todd Structure and to the northwest; and
- Examined outcrops to the east of the Newman-Todd structure.

The site visit follows an earlier 2-day site visit completed in June 2010.

The deliverables of this assignment include:

- 1. This report; and
- 2. Photographs taken during the site visit
Part 1
Summary and Conclusions
Geological Setting (1)

The Newman Todd Project is located in the Western part of the Red Lake District.

It is underlain by volcano-sedimentary rocks ascribed to the Ball and Balmer Assemblages.

Regional mapping suggests that the property is located on the south limb of a regional E-W F2 Fold (Sanborne-Barry et al., 2000).

Rock units trend northeast and dip steeply to the southeast. Younging to the southeast.

The main foliation (S2) is heterogeneously developed in rock units.

Sanborne-Barry et al., (2000) suggest the existence of an earlier folding event (D1) with NE-trending fold axes.
Geological Setting (2)

The main gold exploration target is the Newman-Todd Structure (NTS).

- A tabular zone of Quartz-Carbonate rock (Qz-Cb Rock) trending northeast and dipping steeply to the southeast.

- In the literature, the NTS is described as a regional discontinuity bounding to distinct litho-structural blocks:
  - To the west: Mostly stratified dacitic tuffs younging to the southeast;
  - To the east: A folded volcanic sequence interbedded with argillite, iron formation and limestone.

Note: the main S2 foliation trends uniformly 075-085 across the entire area. There is no apparent discontinuity across the NTS.
Newman-Todd Structure (1)

The Newman-Todd Structure:

Previous work have described the NTS as a major litho-structural discontinuity.

In the 2012 technical report, two interpretations were proposed:

- (top) A major trust zone with imbricated secondary faults in the hanging wall.

- (bottom) A trust fault juxtaposing folded rock units on top of dacitic tuffs.

The Newman-Todd Structure is in contact with various rock types.

The footwall contact is very sharp.

The hanging wall contact is more irregular.
Newman-Todd Structure (2)

Footwall contact of Newman-Todd Structure:

- Usually very sharp against an unfoliated dacitic lithic tuff. Not strained.

- Very sharp contact with foliated mafic rock heterogeneously altered.

- Sharp contact with altered and foliated mafic rock. The contact is sharp but strong Cb alteration (and Qz-Cb veining) continue several metres into footwall volcanic rock.
Newman-Todd Structure (3)

Footwall contact of the Newman-Todd Structure:

- Heterogeneous tabular zone with a sharp footwall contact with footwall dacitic lithic tuff;
- Not much evidence of strain along this contact;
- Locally slightly foliated parallel to contact;
- Bedding and lithic clasts visible right at contact.
Newman-Todd Structure (4)

Internal texture of the Newman-Todd Structure:

- Qz-Cb rock locally with stromatolite banding (top right, and bottom), parallel to contacts of NTS;
- Very strong silica alteration. Pervasive silica veins at high angle to and parallel to banding (top and middle right);
- Locally “vuggy” sillica texture (bottom right) indicative of pervasive silica replacement;
- Vuggy silica crosscut by foliated felsic dikes (below); and
- Late Qz veins.
Newman-Todd Structure (5)

Internal texture of the Newman-Todd Structure:

• Highly variable internal texture;
• Commonly Qz-Cb-Py banding (middle right);
• Locally crackled breccia with Qz-Py matrix (bottom right);
• Locally heterolithic breccia with polymictic fragments (bottom left) and heavy Py and Mt (bottom); and
• Locally massive Py-Mt breccia.
Porphyritic Mafic Dikes

There is a peculiar porphyritic dike intruded along the footwall of the Qz-Cb rock.

- Contains centimetre-size platy feldspar phenocrysts;
- Contains Qz-Cb-Py veins with strong Cb-Py alteration halo;
- Intruded along the contact between footwall volcanic rocks and NTS; and
- Postdate FW volcanic rock and Qz-Cb rock (NTS).
Felsic Dikes

Dikes are ubiquitous in the area, particularly felsic dikes with muscovite alteration.
• They crosscut all rock types (SRK did not study HW);
• Commonly at high angle to strike of NTS;
• They are cut by Qz veins with gold;
• They are foliated (S2 foliation); and
• S2 foliation buckles Qz veins.

Qz veining thus predates S2 foliation.
Deformation

Rocks in the vicinity of the Newman-Todd Structure are weakly strained.

- Qz-Cb rock inside Newman-Todd Structure is not foliated;
- Weak to moderate S2 foliation in footwall rocks (Rivard Property) at high angle to bedding;
- Within NTS, penetrative S2 foliation only present in felsic dikes;
- S2 foliation folds Qz veins; and
- S2 foliation orientation regular across the NTS.
Gold Mineralization (1)

The Newman-Todd Structure hosts several styles of gold mineralization.
- Highly variable Py-Mt content (low-sulphide to massive Py-Mt).
- Highly variable specific gravity.

Qz-Py breccia at Contact of felsic dike
Crosscutting Qz-Cb rock

Qz-Cb-Py-Mt breccia
Within the Qz-Cb rock
Cut by Qz-Py veins.

Massive Mt-Py rock
Within the Qz-Cb rock
Cut by Qz-Cb veins.

Brittle Fault
Crosscutting the NTS at high angle
Gold Mineralization (2)

- Coarse gold occur in Qz-Py veins crosscutting Qz-Cb rock and also felsic dikes;
- Qz-Py veins with Cb-Py alteration crosscut mafic dikes.
- On Rivard outcrops Qz veins folded by S2 foliation.

Qz veining thus predates S2 foliation.
Gold Mineralization (3)

In the central part of the Newman-Todd Structure, a thick brittle fault (or a series of brittle faults) crosscut the NTS at a high angle (the Hinge Fault Zone).

- This fault was intersected by several boreholes and is logged as a late fault;
- It marks the northern limit of the magnetic high anomaly within the NTS;
- Surface expression of the fault is the small lake over the NTS; and
- The fault is auriferous. Internal texture suggests the fault was active at the time of gold mineralization:
  - Qz-Cb veins crosscutting Qz-Cb banding;
  - Vuggy silica with Py;
  - Fault breccia with Qz-Cb matrix.
Relative Timing Relationships

Qz-Cb rock:
- Pervasive Qz-Cb alteration with vuggy silica;
- Qz-Cb rock is crosscut by a series of foliated dikes;
- Qz-Cb rock is not foliated;
- Qz-Cb rock is crosscut at a high angle by an auriferous brittle fault (relationship with dikes not known).

Quartz veins:
- Ubiquitous inside Qz-Cb rock of Newman-Todd Structure;
- Qz-Py veins crosscut Qz-Cb rock, often at a high angle to strike of NTS and internal layering;
- Qz-Py veins containing gold crosscut felsic dikes;
- Qz-Py breccia containing gold developed at a contact of one felsic dike;
- Qz-Py veins with Cb-Py alteration crosscut mafic dikes;
- Qz veins folded by S2 foliation (Qz veining predates S2 foliation).

Regional S2 foliation:
- Heterogeneously and very locally developed (mostly observed in dikes);
- Strike uniformly ENE across the area (West, inside and East of NTS);
- Fold Qz veins crosscutting felsic dikes.

Felsic dikes:
- Clearly postdate vuggy silica alteration in Qz-Cb rock;
- Exhibit Mu-Py alteration and cut by Qz-Py veins containing gold;
- Are foliated and foliation folds Qz-veins.
Notes from Salient Observations (1)

The Newman-Todd Structure:

- Is an heterolithic tabular zone characterized by a sharp footwall contact, brecciation and pervasive Qz-Cb alteration and stromatolitic banding, parallel to its strike;
- Hanging wall contact is irregular (not studied by SRK);
- Is not foliated although dikes crosscutting it are foliated;
- Is not a high strain zone (not a shear zone);
- Is not a structural discontinuity between 2 litho-structural domains;
- Is sub-parallel (concordant) to bedding in footwall rocks;
- Is at high angle to the regional S2 foliation;
- The S2 foliation in the footwall and hanging wall has the same orientation;
- Is cut by numerous narrow foliated felsic and mafic dikes, many at high angle to stromatolitic banding, containing Qz veins with gold;
- Is cut by “sheeted” Qz veins, Qz-Py veins and Qz-Py dilatational breccias at high angle to stromatolitic banding; and
- Is also cut at high angle by a thick brittle fault zone (Hinge Fault) or a series of brittle faults were active at the time of gold mineralization (pre S2).

Collectively the observations suggest that the gold mineralization associated with the NTS predates the D2 deformation.
Notes from Salient Observations (2)

If the Newman-Todd Structure is not a shear zone, what is it?

- It is a heterolitic zone of strong silica alteration, brecciation with locally stromatolitic banding and banded iron formations sub-parallel to the strike of NTS;
- The “vuggy silica” alteration inside the NTS is associated with “sheeted silica veins” perpendicular to the stromatolitic banding and the strike of NTS;
- The “vuggy silica” predates (or is contemporaneous with) the intrusion of felsic and mafic dikes crosscutting the NTS at high angle;
- The gold mineralization associated with Qz-Py veining postdates the intrusions of felsic and mafic dikes but predates S2 foliation; and
- The Hinge Fault is auriferous, crosscuts the NTS at a high angle and was active at the time of the gold mineralization.
Notes from Salient Observations (3)

Hypothesis:
• The Qz-Cb rock and the NTS is an early pervasive silica alteration developed on the paleosurface above a volcanic edifice, prior to the D2 deformation;
• The gold mineralization is associated with Qz-Py mineralization developed on top of the early silica alteration driven by brittle structures (e.g. Hinge Fault) at high angle to NTS;
• These syn-mineralization faults could have been also used by dikes;
• Gold deposition was enhanced by interaction with magnetite inside NTS, in proximity to faults; and
• It is possible that some gold was remobilized during D2.

Conclusions:
• The Newman-Todd Structure represents a paleosurface of an epithermal system developed prior to D2;
• The epithermal system was tilted during D2;
• The present day surface geology presents a section through the epithermal system; and
• The roots of the system would be located to the NW outside the Newman-Todd property.

Other General Conclusion:
• The Py and Mt content of the gold mineralization is highly variable;
• Specific gravity of the gold mineralization is thus highly variable;
• Use of an average specific gravity to convert volumes into tonnages is not appropriate; and
• This should be incorporated into the geology and mineral resource model.
Recommendations

This hypothesis can be tested.

Relogging more boreholes to:
- Map the distribution of rock types in FW and HW of the NTS, particularly the distribution of dikes (all dikes) and their relationship with gold mineralization;
- Study the hanging wall contact of the NTS to characterize contact relationships with hanging wall rocks; and
- Study occurrences of brittle faults in the vicinity of the Hinge Zone, document their character, and crosscutting relationships with rock types, dikes and gold mineralization.

Exploration Drilling:
- Test the lateral and depth extensions of the Hinge Fault with inclined core boreholes drilled perpendicular to its interpreted strike (North or South azimuths); and
- Drill exploration boreholes along the FW of the NTS, parallel to NTS to target other brittle faults at high angle to NTS.

Review the geological model to:
- Take into account the existence of auriferous brittle faults at high angle to the NTS; and
- Study the spatial distribution and character of gold mineralization in vicinity of brittle faults.

Collect additional specific gravity data to:
- Characterize variability between gold mineralization types (low Py and high Py-Mt); and
- Assign variable specific gravity to each mineralization type.
Part 2
Salient Core Observations
NT-058 (260.0 - 310.0m)

Relationship between Cb veins, Py and Qz veining inside Qz-Cb rock.

Qz-Cb rock with clear banded texture;
Qz-Cb rock cut by Cb veins;
Cb veins are cut by wavy Py veins (below)
Wavy Py veins and Cb veins cut by Qz-Py and Qz-Py-Mu veins.
NT-148 (171.0 - 205.0m)

Felsic dike with Qz-Py breccia along both contacts inside Qz-Cb rock. The dike and the Qz breccia are crosscut by auriferous Qz-Py veins.

The felsic dike is intruding the Qz-Cb rock.

The Qz-Py breccia contains Qz-Cb rock clasts and is cut by Qz-Py veins.
NT-147 (164.5 - 193.5m)

Hole drilled above NT-148. Intersected felsic dike, but no breccia along contacts. Weak Au zone along downhole contact.
NT-134 (100.0 - 140.0m)

Mt-Py rock (Iron Formation ?) broken and cut by Cb veins inside Qz-Cb rock.

Both cut by late mafic dike with sharp contact and chilled margins.

Mt-Py rock also occurs as fragments in a Qz-Cb breccia.

Note: Heavy Mt and Py: -> High specific gravity
NT-135 (99.0 - 141.0m)

Auriferous zone mostly associated with a Mt-Py rock (Iron Formation) inside Qz-Cb rock and cut by Cb veins.

**Note:** Heavy Mt and Py: -> High specific gravity

Qz pebble or clast inside Mt-Py rock.

Back side of piece at 126.3m
NT-116 (220.0 - 293.0 m)

Auriferous zone mostly associated with brecciated Qz-Cb rock and cut by Cb veins. Qz-Cb rock fragments with Qz-Py-Chlorite matrix
NT-074 (74.6 - 96.0m)

FW contact of Newman Todd Structure

Very sharp contact between Qz-Cb rock and FW volcanic rock.

A small felsic dike crosscuts the Qz-Cb rock near the contact
NT-128 (27.7- 42.5m)

Sharp contact between Qz-Cb rock and FW volcanic rock.  
Note thin conglomerate bed right at contact (erosion surface ???)
NT-096 (97.2 - 118.9m)

Very sharp contact between Qz-Cb rock and FW volcanic rock. (is this an intrusive contact surface ???)

Note: small felsic dike crosscutting Qz-Cb rock.
NT-115 (178.9 - 196.2m)

Contact between Qz-Cb rock and FW foliated and altered volcanic rock?

Note the typical dacitic tuff with Muscovite alteration.
NT-115 (145.9 - 147.9m)

Mafic dike with platy feldspar phenocrysts. Quite distinctive texture.
NT-116 (123.8 - 140.8m)

Contact between Qz-Cb rock and FW volcanic rock. FW rocks are foliated and altered, not the typical dacitic tuff.

The contact is intruded by a porphyritic mafic dike
Note: the dike is cut by Qz-Py veins with Cb-Py alteration selvages (below)

Foliated and altered FW rock

Mafic dike cut by Qz-Py veins
NT-117 (127.2 - 144.5m)

Contact between Qz-Cb rock and FW volcanic rock. The contact is intruded by a porphyritic mafic dike. The mafic dike shows Py-Cb alteration right at contact.
NT-118 (57.6 - 70.3m)

Contact between Qz-Cb rock and FW volcanic rock. The contact marked by a strain zone (?). FW rocks are somewhat foliated and heterogeneously altered (Cb).
NT-132 (132.0 - 145.2m)

Sharp contact between Qz-Cb rock and FW volcanic rock. The contact marked by 2cm thick foliated zone (narrow fault?) cut by Qz-Cb veins with bleaching alteration (Cb?). Uncertain contact relationship.
NT-095 (86.8 - 95.2m)

Sharp contact between “cherty” Qz-Cb rock and FW dacitic lithic tuff.
The contact is very sharp.
The bedding in the lithic tuff is folded (?).
NT-097 (113.3 - 125.7m)

Sharp FW contact of Qz-Cb rock with a massive felsic rock. (a dike crosscutting the Qz-Cb rock?)
NT-098 (355.0 - 367.8m)

Sharp FW contact of Qz-Cb rock with a massive rock. The contact is broken but distinctively foliated (minor shear zone ?)
NT-099 (377.4 - 390.0m)

Sharp FW contact of Qz-Cb rock with a Mu-altered dacitic tuff containing small lithic fragments. The contact razor sharp and dacitic tuff slightly foliated.
NT-101 (288.4 - 297.0m)

Sharp FW contact of Qz-Cb rock with a more mafic rock strongly altered (not the dacitic tuff).
The mafic rock is altered and cut by Qz veins and small Mu-altered dikes. One small dike marks the contact between Qz-Cb rock and FW volcanic rocks.

There is a small breccia in volcanic rock near the contact. Is this a regolith?
**NT-102 (100.4 - 117.7m)**

Sharp FW contact of Qz-Cb rock with FW volcanic rock. Approaching the contact the FW volcanic rock is increasingly altered from 105m. Altered mafic rock cut by Qz-Cb veins at low and high core angles.
NT-103 (235.9 - 244.6m)

Contact between Qz-Cb rock and FW dacitic lithic tuff (slightly foliated at contact).
NT-104 (207.2 - 220.6m)

Sharp FW contact of Qz-Cb rock with a more mafic and altered rock. The Qz-Cb contact is marked by a breccia zone and a small fault. That sample returned 2.5 gpt Au.
NT-105 (244.4 - 297.0m)

Thick fault zone at the contact between Qz-Cb rock and dacite tuff. Qz vein breccia, Qz-Cb rock fragment in a hydrothermal matrix with Py. This fault is auriferous.
NT-083 (at 252m)

Gold flecks inside narrow Qz vein parallel to core inside Mu-altered felsic dike. Between 245-284m, there is a zone of felsic dikes. The dikes are at low core angles and are cut by narrow Qz veins sneaking down the core and containing flecks of gold.
NT-042 (258.4 - 294.0m)

This hole ends in the same fault intersected by NT-105. Good fault breccia between 265 and 294m.
NT-053 (230.0 - 276.5m)

This hole was drilled from the N to the S, at low angle to the Newman Todd structure.

Intersected the same auriferous fault zone characterized by fault breccia with hydrothermal Qz-Py matrix.

Below: close up of banded Qz-Cb rock cut by Qz-Py veins at high angle to banding. Note how Py in veins branches off into veins parallel to banding.
NT-146 (89.9 - 160.0m)

Thick fault zone with strong oxidation, nice fault breccias with Qz-Cb matrix.

The fault lower contact is against a mafic dike.
NT-133 (206.8 - 222.0m)

Hole lost into the brittle fault.

Locally vuggy Qz with galena and sphalerite.
**NT-078 (224.9 - 265.5m)**

Very thick fault zone, several metres of loss core. 2 boxes of sand.

Locally Qz breccia with vuggy texture near the top contact of the fault.
NT-113 (360.5 - 369.0m)

Zone of sheared Mu-altered dikes at low angle to core. Not really a fault.
NT-131 (57.8 - 94.1m)

Fault breccia with Qz-Cb matrix.
Part 3
Salient Outcrop Observations
Stripped Outcrop FW of NTS

Qz-Cb rock with stromatolitic banding. Very strong silica alteration. Cut by Qz veins, mostly perpendicular to banding (a few parallel to banding).
Stripped Outcrop FW of NTS

Texture of the Qz-Cb rock with stromatolitic banding (parallel to magnet). Narrow composite silica veins crosscutting banding at high angle and forming a corridor of silica alteration. Note silica veins are cut by white Qz veins.
Stripped Outcrop FW of NTS

Delicate vuggy silica texture locally developed inside the Qz-Cb rock with stromatolitic banding. The vuggy silica is cut by younger Qz vein.
Stripped Outcrop FW of NTS

Narrow foliated felsic dikes crosscutting vuggy silica with stromatolitic banding. Foliation trends approximately 075 - 080°.

Note. The foliation is orthogonal to the stromatolitic banding (magnet).

Interestingly, the orientation of the foliation, where observed (Rivard property to the west, this outcrop, the newly stripped outcrop near the camp, and outcrops to the west of the lake) is constantly 075 - 080°.
Stripped Outcrop FW of NTS

Close up of the contact between the felsic dike and the vuggy silica alteration. The vuggy silica alteration is cut sharply by the dike. The dike is not altered. No evidence it suffered the silica alteration. The felsic dike postdates the vuggy silica.
New NTS Stripped Outcrop

This newly stripped outcrop expose Qz-Cb rock with stromatolitic banding and heavy silica-pyrite alteration. The Qz-Cb rock is cut by a felsic dike trending 115-120°. Its North contact is marked by Qz veining (right). Elsewhere there are abundant Qz veins, at high angle to banding (left). Very similar to the previous outcrop (west of the Newman Todd structure).
Rivard Property Outcrops

On the Rivard Property Outcrops foliated felsic dikes contain folded quartz veins;

The regional S2 foliation (magnet) is axial planar to folds;

The folded Qz veins crosscut the dike contacts. Outside dike veins are significantly less buckled;

This suggest that Qz veining predate S2 foliation.