Geology and Mineral Potential of the Keezhik Lake Area

Fort Hope Greenstone Belt, Eastern Uchi Subprovince, Northwestern Ontario

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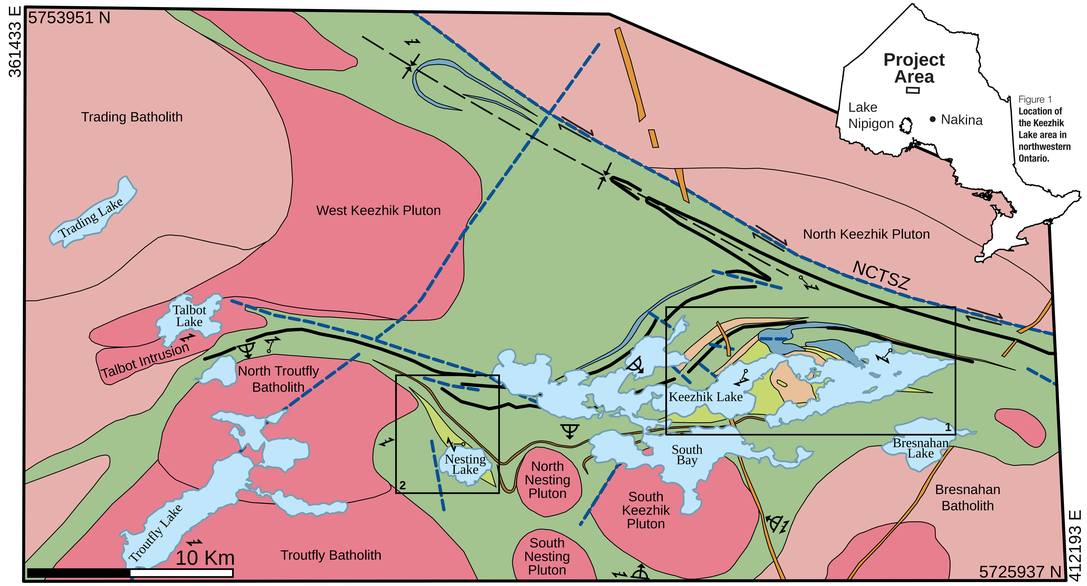


Figure 1 **Location of the Keezhik Lake area in northwestern Ontario.**

Foliation
Lineation
Pillow top direction
Fault
Iron Formation
Syncline Axis
Dextral Shear Sense
NCTSZ North Caribou Totogan Shear Zone

Proterozoic Diabase Dyke
Syn to Post Tectonic Granodiorite to Granite Biotite + Hornblende ± Magnetite Bearing, Massive to Weakly Foliated (part of the South Keezhik Volcanic Complex)
Syn to Post Tectonic Granodiorite to Tonalite, Biotite ± Magnetite Bearing, Weakly foliated to Gneissic
Syn to Postectonic Mafic Intrusions
Synvolcanic Felsic Intrusions
Metasedimentary Rocks - Conglomerate
Felsic Metavolcanic Rock
Intermediate Metavolcanic Rock
Mafic to Intermediate Metavolcanic Rock
1 Keezhik Volcanic Centre
2 Nesting Volcanic Centre

Figure 2 **Simplified geology map of the Keezhik Lake area.**

Introduction and Regional Geology

The Keezhik Lake area was mapped in 2010 as part of a multi-year bedrock mapping project by the author, designed to map the entire eastern Uchi Subprovince, including the Fort Hope greenstone belt, the surrounding granitoid rocks to the north and English River metasedimentary basins to the south. The project commenced with the Keezhik Lake area, which had not been mapped since the 1930's.

The Fort Hope greenstone belt is located in the eastern portion of the Uchi Subprovince, and 215 km northwest of the Town of Nakina, (Figure 1). The Keezhik Lake area was interpreted to be the Mesoarchean discontinuous extension of the Pickle Lake greenstone belt. Based on the 2010 mapping (Figure 2), the volcanic and sedimentary stratigraphy can be broken into two stages (Figure 3).

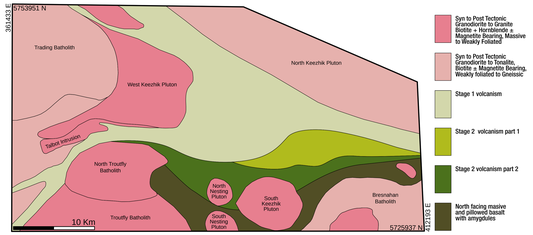


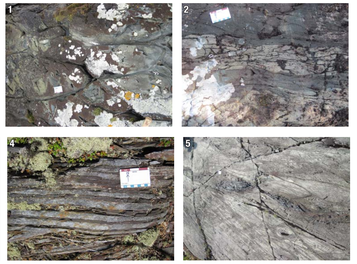
Figure 2 **Spatial extent of the different stages of volcanism in the Keezhik Lake area.**

Geology of the Keezhik Lake Area

Stage One Volcanism

The first stage of volcanism includes the northern most portion of the Keezhik Lake area (Figure 3). It includes:

- Extrusion of thick packages of massive and pillowed mafic metavolcanic rocks (Photo 1) building a stable platform in an oceanic environment.
- There are at least two thin felsic tuffaceous units found within these volcanic rocks (Photo 2). They are interpreted to be from a distal source.
- There was then a shift to dacitic volcanism, represented by the extrusion of dacitic pillows as well as some tuffaceous dacitic material such as tuff breccia (Photo 3).
- The latter part of this stage of volcanism includes the eruption of a felsic tuffaceous unit that extends along the eastern side of Keezhik Lake.
- Overlying the tuff and interbedded with some of the dacitic units is magnetite iron formation and chert (Photo 4). Evidence for slumping of chert and iron formation beds is interpreted by the presence of chert clasts within the dacitic tuffaceous units directly north of Keezhik Lake (Photo 5).



Stage Two Volcanism: Part One

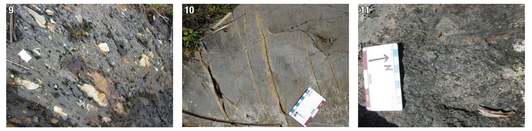
Stage two volcanism is divided into two parts (Figure 3). Part One of this volcanism involves:

- Directly below the succession of rocks that represent the Keezhik volcanic centre is a layer of mafic volcanic rocks, less than a kilometre thick.
- The Keezhik volcanic centre then erupted minor, thinly bedded felsic tuff (Photo 6) followed by voluminous, massive dacite with autobrecciation (Photo 7) and, more commonly, massive, vesiculated dacite (Photo 8).
- The top of the volcanic pile, marking the end of Part One, is represented by a felsic metavolcanic unit, which was deposited as volcanism at the Keezhik centre began to wane.
- The volcanic rocks from the Keezhik volcano are interpreted to have erupted from a chamber that is represented by the syn-volcanic intrusion preserved in the core of the dacitic rocks (see Intrusive Rocks Section).

Stage Two Volcanism: Part Two

Part two of stage two volcanism involves the waning of the intermediate and felsic volcanism from the Keezhik volcano as the conglomerate units were deposited:

- The conglomerate is preserved as at least 2 sheet-like, tabular units overlying each other and separated by thin mafic volcanic units. These conglomerates are likely the result of dominantly westward mass wasting off of the slope of the Keezhik volcanic centre and the sheets of conglomerate entrained chert and dacite clasts (Photo 9).
- Following the deposition of the conglomerate a smaller volcanic centre deposited massive dacite and tuffaceous rhyolite creating the Nesting volcanic centre (Photo 10). The waning of volcanism at this centre, represents the end of stage two volcanism.
- Massive to pillowed mafic volcanic rocks south of the Nesting volcanic centre face to the north and often have amygdules (Photo 11). These volcanic rocks are part of a separate stratigraphic succession and their contact with the northern rocks is unknown.



Intrusive Rocks

There are three groups of felsic intrusions in the Keezhik Lake area, separated based on their estimated time of intrusion as well as mafic intrusions and sills:

- Synvolcanic Intrusions and Sills: These are associated with the Keezhik volcanic centre (Figure 2). The intrusion in the centre of the Keezhik volcanic centre is a plagioclase phyric tonalite intrusion (Photo 12).
- Syn-Tectonic to Post-Tectonic Tonalite and Granodiorite: These intrusions are weakly foliated to gneissic and are comprised of biotite ± magnetite (Photo 13).
- Syn-Tectonic to Post-Tectonic Granodiorite and Granite: This group of intrusions is represented by the South Keezhik Plutonic Complex (Figure 2). They are massive to weakly foliated and contain biotite ± hornblende ± magnetite (Photo 14).
- Mafic Intrusions and Sills: These are interpreted to be syn-tectonic to post-tectonic. The largest intrusion, located on the north side of Keezhik Lake, has multiple phases and ranges from gabbro to melanogabbro in composition (Photo 15), with pegmatitic dykes and pods. These intrusions were sampled for Cu-Ni-PGE potential.

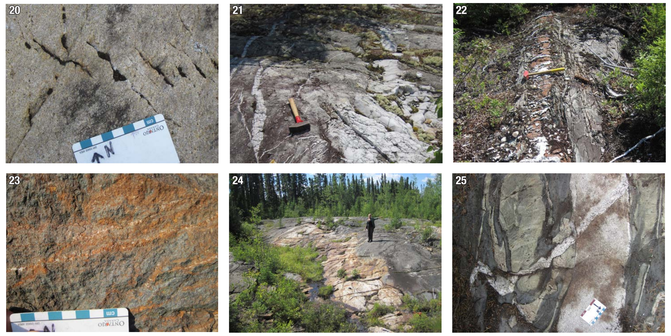
Mineralization and Alteration

There are several mineral occurrences within the Keezhik Lake area, but due to poor outcrop exposure, the majority of these are from diamond-drill holes. Claims in the area cover the northern portion of Keezhik Lake as well as the Talbot Lake area.

In the vicinity of Keezhik Lake, there are two main styles of mineralization and alteration:

- The first is associated with the syn-volcanic intrusion in the centre of the Keezhik volcanic complex. The syn-volcanic intrusion exhibits weak sericite and ankerite alteration (Photo 20) as well as local quartz veining (Photo 21). Sericite alteration is typically fine-grained and anhedral and ankerite alteration is a local fine-grained patchy alteration. Locally in the altered zones, pyrite occurs from 1% to 5%, is generally euhedral and disseminated.
- The second type of alteration, quartz-ankerite veining, is found in the vicinity of Keezhik Lake and typically occurs in localized shear zones. They are dominated by ankerite and contain small extensional quartz veins (Photo 22). Many of these veins appear to be barren, but disseminated, fine-grained pyrite and chalcopyrite is observed locally. There are also other local areas where mafic metavolcanic rocks are strongly alkerite altered (Photo 23).

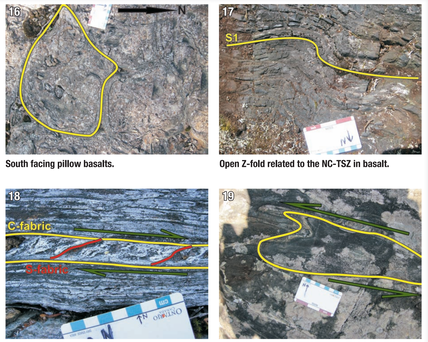
The Talbot Lake area, held by Abbastar Resources, has a gold mineral occurrence (Photo 24) associated with a large west-trending quartz vein containing pyrite, chalcopyrite, sphalerite and visible gold. This area also shows pervasive syn-volcanic quartz-epidote-garnet alteration (Photo 25) that is typically associated with hydrothermal volcanogenic massive sulfide environments.



Structural Geology

The structural geology of the Keezhik Lake area is related to two main deformational events, regional scale flattening followed by dextral transpression. The following is a summary of the key structural elements:

- Homoclinal successions of volcanic rock that strike predominantly to the west, dip moderately to steeply to the north (Figure 2) and top to the south (Photo 16).
- The west trending fabric is the result of a regional flattening but is often warped due to the intrusion of the syn-tectonic to post-tectonic SKPC plutons (Figure 2).
- Lineations in the area consistently plunge moderately toward the northeast.
- The North Caribou - Totogan Shear Zone (NCTSZ) (Figure 2) is a large dextral transpressional shear zone (Photo 17 and 18) observed along the northern margin of the greenstone belt. It trends to the northwest and dips steeply to the northeast with moderate, east plunging lineations.
- Other faults in the area are interpreted to be late brittle faults that range in extent and have unknown sense of displacement.
- In the Talbot Lake area, the structural geology is heavily influenced by the intrusion of the surrounding plutons, suggesting that the timing of plutonism is synchronous with the tectonism in the area. Both vertical and horizontal movement is observed at the closing of this tectonism (Photo 19), which is responsible for minor folding. Foliations in this area trend to the east and dip steeply to the south and lineations vary, but they are most commonly recorded plunging moderately to the south.



South facing pillow basalts.

Open Z-fold related to the NC-TSZ in basalt.

C-S fabric related to the NC-TSZ in rhyolite.

inistral shearing in pillow basalts in the Talbot Lake area.

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