Geologic Mapping and Structural Analysis in the North Pit Region, Mackay Mining District

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Endoskarn hosted by Mackay Granite at the opening to the Red Star adit.

Executive Summary

In the North Pit region of Konnex Resource's Empire Mine Project, the magnetite-bearing skarn body known as Red Star formed at the contact of Mackay Granite and White Knob Limestone. Core samples from beneath the Red Star outcrop indicate anomalously high copper and silver concentrations at certain depths. To better characterize the North Pit mineral resource potential, I studied the core recovered from Red Star, created a geologic map of the North Pit region, and proposed a conceptual model of mineralization. Major findings include the following:

(1) At depth beneath Red Star, elevated concentrations of copper are strongly correlated to the presence of magnetite in skarn. Wherever magnetite forms fine-scale veins, forms pesudomorphs after garnet, occurs as inch-scale blebs, or develops into massive patches, assayed copper concentrations are 10x to 100x higher than assayed copper concentrations in non-magnetite bearing samples.
(2) At depth beneath Red Star, elevated concentrations of silver are only found in samples of skarn with magnetite and elevated copper concentrations, AND only in those samples which are friable, low density, and show evidence of partial dissolution by acidic(?) fluids.
(3) After recognizing the correspondence of metal mineralization to skarn and magnetite, I completed a high-resolution geologic map of the North Pit region to locate potential exploration targets beyond Red Star. Granite Porphyry intrudes White Knob Limestone along contacts that are regionally oriented N12E, 90, although significant local variations occur. Therefore, skarn bodies which develop along these intrusive contacts will be more extensive parallel to this orientation and narrower in a perpendicular direction, influencing the three-dimensional shape of mineralized zones.
(4) The primary surface occurrences of magnetite on patented land, other than Red Star, define a 1-3' thick, >700' long vein oriented N9E 80NW. This vein should be investigated northward beyond the Garnet Hill region where it projects into historical mine workings located just beyond patented land. I also observed massive magnetite float in a historical tailings pile located on unpatented land about 340' in a N12E direction from Red Star. It is possible that Red Star sits astride a second magnetite vein oriented parallel to the one that cuts through Garnet Hill.
(5) No significant faults exist in the North Pit region. Minor shear planes oriented N40E, 80SE are locally present, especially southwest of Red Star. They cut across Mackay Granite, Granite Porphyry, and skarn bodies and served as conduits for fluids that altered and/or oxidized skarn.
(6) A conceptual model for mineralization is proposed that invokes the conjunction of three geologic events: (a) skarn formation wherever intrusive rock borders limestone, (b) emplacement of younger magnetite and copper-bearing veins that cut across skarn, and (c) the ascent of even younger silver-bearing fluids into magnetite-bearing skarn, possibly along northeast-striking shear planes.
(7) A literature review of the White Knob Mine Group region, located a few kilometers northwest of Red Star, highlights a number of geologic similarities to the North Pit region. As virtually no modern exploration has occurred in this district, a focused study that includes channel sampling and geologic mapping is highly recommended.
(8) To build upon the results of geologic mapping, my strongest recommendation is to complete a magnetic survey across the region incorporating both the North Pit and White Knob Mine Group. This should be a high-resolution survey using ground or low-altitude (=drone) measurement techniques to accurately locate the relatively narrow, subvertical magnetite veins in the shallow subsurface, as well as larger magnetite bodies derived from these veins.

Introduction

In the North Pit region of Konnex Resource's Empire Mine Project, the magnetite-bearing skarn body known as Red Star has formed at the contact of Mackay Granite and White Knob Limestone. Core drilling beneath the Red Star skarn outcrop indicates the skarn extends well beyond the 40'x40' surface exposure. More importantly, assays of recovered core indicate anomalously high metal concentrations at specific depths.

Konnex shared all core samples, core logs, and assay results from ten drillholes in the North Pit Region. I reviewed these rocks and data to assess the relation between mineralization and rock mineralogy and lithology, and to better characterize the three-dimensional geology and pattern of mineralization beneath the Red Star adit. These studies indicate a strong correlation between mineralization and rock type. To guide future exploration beyond the immediate vicinity of the Red Star skarn, I completed a high-resolution geologic map and structural analysis in the North Pit region. The map emphasizes the distribution of four rock formations (White Knob Limestone, Mackay Granite, Granite Porphyry, and Granite dikes) and massive magnetite, whose patterns exert primary control on skarn development and mineralization potential. Finally, I reviewed the available geologic information for the White Knob Mine Group, located northwest of the North Pit region, to identify any geologic similarities. Altogether these activities yielded three key results: a definition of what rock type is mineralized at Red Star, a map showing potential exploration targets in the North Pit region, and a conceptual model of the spatial and temporal development of North Pit mineralization.

Red Star

Field Observations

Red Star is a magnetite-bearing skarn body hosted by the Mackay Granite at its contact with limestone. In plan view, the exposed outcrop of the Red Star skarn is an irregular square about 40' on a side. The east and west boundaries are abrupt and slightly to strongly sheared, the southern boundary is gradational into granite, and the northern boundary is a roadcut. A T-shaped horizontal adit was cut into the skarn many decades ago and extends a short distance to the margins of the skarn.

Core Analysis

Six drillholes, including RSD20-01, 02, 03, 04, 05, 06, are located in the Red Star region. I studied the core retrieved from these holes and found that lithologic logging by Konnex geologists was thorough and accurate. These logs confirm the surface geology and define a block of limestone flanked by Mackay Granite. The limestone has a western edge that is nearly vertical to a depth of 150', below which the limestone has a more gently dipping base above Mackay Granite (cross-section BB'). Endoskarn exists in Mackay Granite within 100' of the contact, whereas all limestone encountered by drilling was converted to exoskarn. At certain depths, these skarns were injected and altered by iron-rich fluids, as evidenced by an abundance of mm-scale iron oxide veins that disrupt the grain-scale skarn texture. Referred to as "FeOX breccia" by Konnex geologists, the texture reflects fluid pressures high enough to induce brittle fracture. However, the texture does not necessarily define a through-going, planar fault or shear plane. More intense zones of FeOX breccia show skarn minerals (garnet, especially) that are partially to completely replaced by iron oxide minerals, notably magnetite, and at its most intense magnetite forms 30-100% of the core over distances of half a foot.

All six of the drillholes yielded assay results indicative of elevated copper and silver concentrations over certain 5' sample intervals. In comparing metal concentrations to the minerology and textures of core samples, two significant correlations were observed **without exception**:

> (1) Elevated concentrations of copper are strongly correlated to the presence of magnetite. Wherever magnetite forms mm-scale veins, forms pesudomorphs after garnet, occurs as cm-scale blebs, or develops into massive patches 5-20 cm thick - assayed copper concentrations are typically 1,000-

5,000 ppm averaged over 5' sample intervals. This is 10x to 100x higher than assayed copper concentrations in non-magnetite bearing samples.

(2) Assays averaged over certain 5' sample intervals yield silver concentrations of 10 to >100 ppm, about 10x to 100x greater than background levels. These elevated concentrations of silver are only found in samples of skarn (usually exoskarn) with extensive magnetite emplacement and elevated copper concentrations. Furthermore, these elevated silver values are entirely restricted to those samples which are friable, lack internal coherence, display vugs and pits, and have relatively low density. These textural characteristics suggest dissolution of the formerly dense, magnetite-bearing rock by acidic(?), silver-bearing fluids.

To illustrate these relations, consider the core recovered from depths of 104'-143' in drillhole RSD20-02, located in the Red Star region. As shown in figure 1, with increasing depth, the samples transition from unmineralized Mackay Granite, to granite cut by magnetite veins, to endoskarn with extensive magnetite replacement, to exoskarn with extensive magnetite, to exoskarn that was leached of its magnetite, to unmineralized exoskarn. Elevated copper concentrations correspond to the presence (or former presence) of magnetite while elevated silver concentrations are only found in the leached, friable exoskarn.

Core samples from all other Red Star drillholes display the same relation between metal concentrations and rock mineralogy and texture. Wherever copper concentrations are elevated, magnetite is (or was) present. Wherever silver concentrations are elevated, the magnetite-bearing rock is now a friable, low density rock with pits and vugs. Where magnetite is not evident in fine-scale veins, as pseudomorphs after garnet, or as massive patches, the samples are barren of copper and silver mineralization.

These correlations provide guidance for future geologic and geophysical mapping of the North Pit region. Magnetite is relatively easy to identify in outcrop, justifying the need for a high-resolution geologic map to find exploration targets. Such a map was created for this report and the geologic patterns and history are described in the following section. Furthermore, magnetite in the shallow subsurface can be imaged via magnetic surveys. A low resolution (1:250,000) aeromagnetic map of the region exists (McCaffrerty & Abrams, 1991) but high-resolution mapping via a ground-based or drone-based approach is highly recommended.

Mackay Granite, unmineralized.

Endoskarn cut by magnetite-bearing veins. Elevated Cu values.

Endoskarn with magnetite in veins, disseminated as a replacement after garnet, and in 1-10 cm-scale massive patches. Elevated Cu values.

Exoskarn with magnetite in veins, disseminated as a replacement after garnet and in 1 cm massive bands. Elevated Cu values.

Exoskarn with significant leaching of iron-bearing minerals, leaving a low density, friable rock with vugs. Elevated Ag and Cu values.

Exoskarn, unmineralized.

Figure 1: Core recovered from depths of 104’-143’ in drillhole RSD20-02, located beneath the Red Star adit.

Geologic Mapping in the North Pit Region

Preface: Structural orientations summarized in figure 2 and figure 3. "Strike" azimuths and "Dip" directions are presented using the Quadrant system. No "right-hand rule" is used or implied. Numerical ages of intrusive rocks from Chang (2003). Drill hole logs provided by Keian Moran and Nathan Bishop, Konnex Resources Inc. Locations based on the Idaho State Plane coordinate system (NAD83 / Idaho Central (ftUS) ESPG:2242).

<u>Description of the Geologic Map</u>

A 1:600 scale geologic map and two cross sections (AA', BB') are included in this report. In the northeast part of the study area, the geologic map pattern is suggestive of irregular, N-to NNE-trending Granite Porphyry dikes that intrude White Knob Limestone, with widespread endo- and exoskarn along the intrusive contacts. Shear planes that accommodated fluid flow and skarn alteration are present, but no faults with sufficient slip to juxtapose the two formations were observed. A N9E-striking, vertical magnetite vein from 1-3' wide cuts through Granite Porphyry and is surprisingly persistent from Garnet Hill (1724650E/810000 N) northward for a distance of at least 700'. Where best exposed, the magnetite vein clearly cuts across older endoskarn veins. Because mineralization corresponds to the presence of magnetite, this map-scale magnetite vein should be an exploration target.

In the southwest part of the study area, Mackay Granite is the primary rock formation with minor White Knob Limestone and two narrow Granite dikes also present. Above and southwest of Red Star, the Mackay Granite contains numerous shear planes oriented N41E, 82SE. Offset on these shears appears minimal, but they do show evidence of fluid flow that accommodated oxidation and minor sericitic alteration of the granite.

Granite Porphyry and limestone (to the northeast) and Mackay Granite (to the southwest) are separated by a NW-trending contact. Drill hole data and the regional geologic map by Nelson & Ross (1968) indicates this is a planar intrusive contact oriented N25W 40NE. In the North Pit study area, the contact is everywhere concealed by alluvium but no fault-related brecciation is present. Granite dikes cut across the contact, evidence that younger rocks and structures continue without displacement across the contact.

<u>Geologic history and detailed field relations</u>

While completing the geologic map, a number of outcrop-scale observations were made regarding the composition and texture of rocks, the orientation of contacts and structures, and the cross-cutting relations between different geologic features. Combined with map-scale relations and previous work by other geologists, these results define the sequence of geologic events that created the mineralized rocks in the North Pit Region. That sequence is presented in chronologic order below, along with the detailed observations that support the geologic history.

<u>(1) Deposition of White Knob Limestone (Mississippian)</u>

More than 5,000 feet of thin- to thick-bedded, siliceous to cherty limestone accumulated in a shallow marine depositional environment. These rocks form part of a 30,000' thick sequence of Paleozoic sedimentary rocks distributed throughout east-central Idaho.

<u>(2) Folding of White Knob Limestone (Cretaceous, probably 90-75 Ma)</u>

Limestone bedding in the North Pit region now dips moderately NE or SW, defining angular folds with sub-horizontal, NW-trending fold hinges. Folding records SW-NE shortening during the Sevier Orogeny and regional studies indicate the limestone is in the hanging wall of the Hawley Mountain Thrust, which moved from southwest to northeast during the Sevier Orogeny.

Planar Feature	Strike	Dip	Evidence
Limestone Bedding	N45W	SW or NE	10 folded LS beds
LS/Gp intrusive contact	N12E	84 NW	8 flow foliations along contacts
Skarn Veins	N25W	62 SW	4 veins @ two locations
Mg/Gp intrusive contact	N25W	40 SW	3-point problem on regional contact
Granite intrusive contact	N35E	85 SE	8 flow foliations along contacts
Magnetite vein	N9E	80 NW	one outcrop + map pattern
Shear Planes	N41E	82 SE	33 shear planes widespread
Joints	N35W	85 NE	14 joints widespread

Figure 2: Summary of planar geologic features and their average orientations as measured in the North Pit Region. Listed in chronologic order of formation. Abbreviations: LS=limestone, Gp=Granite Porphyry, Mg=Mackay Granite. See text for discussion.

(3) Emplacement of Granite Porphyry (Eocene, 48.2±0.7 Ma)

Granite Porphyry is an early intrusive phase of the Challis Magmatic event. In most places in the North Pit study area, the rock has been partially to completely metamorphosed to endoskarn. Unaltered Granite Porphyry has phenocrysts of feldspar and vermicular quartz, with uncommon megacrysts of feldspar, in a fine-grained matrix of quartz, potassium feldspar, plagioclase, and rare mafic minerals including biotite and hornblende. Granite Porphyry and Granodiorite Porphyry are two names applied to this lithology but it was not possible to map the two units separately in this project. The rock is relatively resistant in road cuts. In the North Pit region the Granite Porphyry is exposed to the northeast where it is intermixed with White Knob Limestone (see geologic map). Southwards, the intermixed Granite Porphyry and limestone are separated from the Mackay Granite by a NW-trending contact (described below).

Where observed in roadcuts, the contact between Granite Porphyry and limestone is sharp and curviplanar. Contact-parallel flow foliation is locally developed in Granite Porphyry and rarely in the adjacent limestone, and skarn development is widespread along the contact (figure 4). These textures are evidence that the contacts are everywhere intrusive rather than faulted, despite the presence of minor shear planes cutting through some skarn bodies. At the outcrop scale, contacts and flow foliation have an average orientation of N12E 84NW, although strike variations of ±20° are common (figure 3a). In the northwestern part of the study area, the map pattern of Granite Porphyry defines two irregular N15E-trending dikes 100-200' wide and at least 600' long that cut through limestone. In the northeastern part of the study area, there is a wider expanse of Granite Porphyry that may or may not define a dike-shaped body (see geologic map, cross-sections AA', BB').

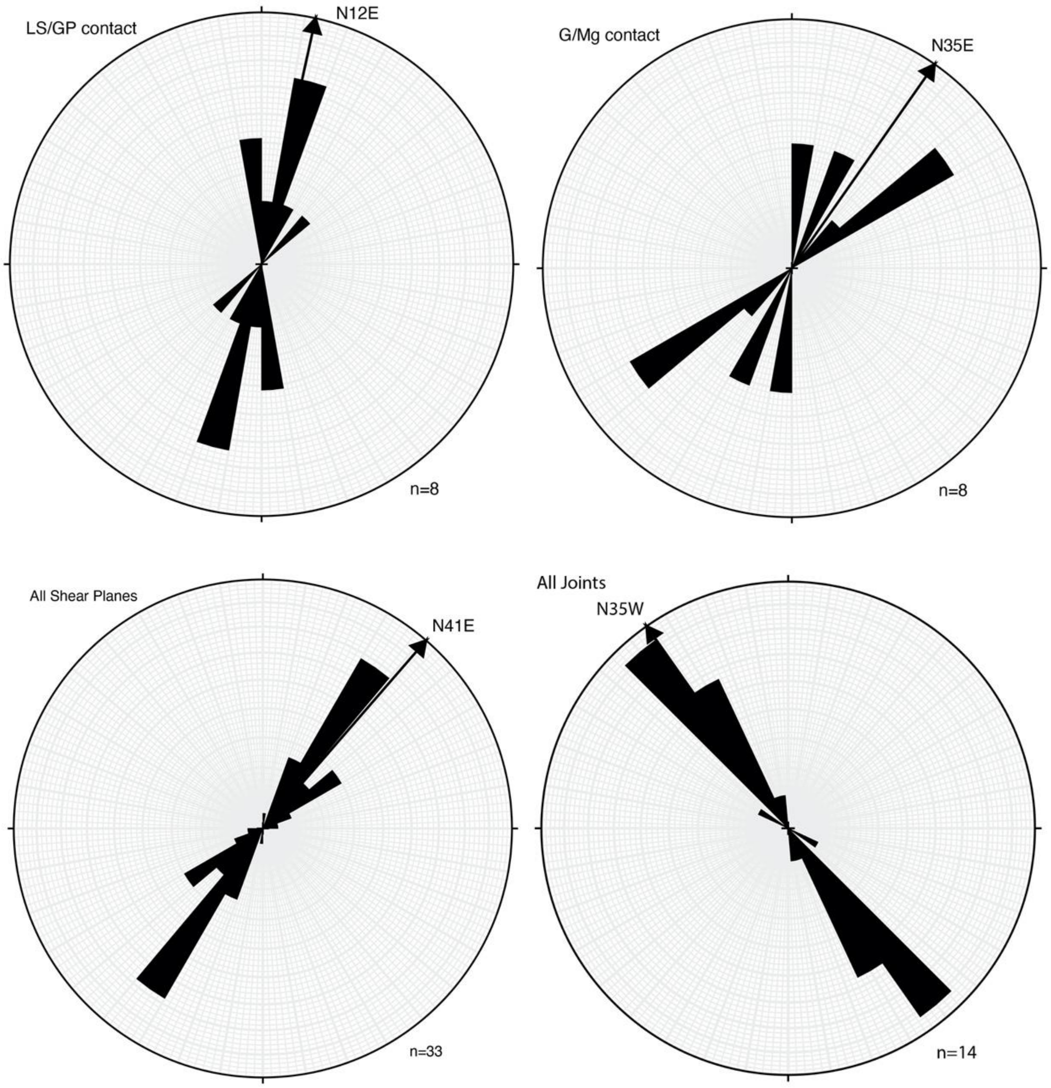

Figure 3: Rose diagrams showing the measured strikes (=azimuths) of outcrop-scale, planar geologic features in the North Pit region including (a) the contact between limestone (LS) and Granite Porphyry (GP), (b) the contact between a Granite dike (G) and Mackay Granite (Mg), (c) Shear Planes, and (d) Joints.

Figure 4: Sharp, curviplanar contact between calc-silicate White Knob Limestone (left) and endoskarn hosted by Granite Porphyry (right). Both units are foliated parallel to the contact. Approximate location is 1724777E/811118N.

(4) Skarn development (Eocene, syn-Granite Porphyry emplacement)

Skarn is widely developed in the North Pit region. Wherever Granite Porphyry is in contact with limestone, endoskarn and exoskarn occur within 1' to more commonly 10' to rarely 100' of the contact. As shown in roadcuts, endoskarn is almost everywhere more widely developed than exoskarn. Garnet and pyroxene are major constituents while other minerals include calcite, quartz, plagioclase, wollastonite, idocrase, and fluorite. The skarn appears massive in outcrop, but when inspected more closely, veins can rarely be discerned. One endoskarn outcrop (1724747E/811110N) contains well-preserved planar veins oriented N25W 62SW (figure 5).

Figure 5: Fine veins of garnet and pyroxene creating endoskarn hosted by Granite Porphyry. Approximate location is 1724747E/811110N.

From a field perspective, skarn in the North Pit region may be one of three types. In type I skarn, minerals may be fresh and unaltered, yielding light-gray, relatively resistant rock which upon closer inspection contains green pyroxene, yellow to brown garnet, white to gray calcite, gray quartz, actinolite, wollastonite, and other typical skarn minerals. In contrast, type II skarn may be altered and appear as an orange to brown, commonly brecciated rock in which formerly fresh skarn minerals have been partially cut by, and replaced by iron oxide minerals. When shear planes are present, the alteration is spatially associated with the shear planes. Either of these two types of skarn may also include magnetite, creating type III skarn defined by the presence of disseminated to rarely massive magnetite. Altered and magnetite-bearing skarn (types II and III) reflect superimposed events that are described in more detail below.

(5) Emplacement of Mackay Granite (Eocene, 47.3±0.9 Ma)

The Mackay Granite is the main phase of the intrusive suite associated with the Challis Magmatic event. In the North Pit region, it has a crystal-rich, coarse-grained, equigranular texture defined by quartz, kspar, and plagioclase with minor mafic minerals including biotite and hornblende. Locally the rock is porphyritic with a medium-grained matrix. The formation is relatively non-resistant in roadcuts and forms contacts with Granite Porphyry and White Knob Limestone (defining the Red Star skarn).

In the North Pit region, the NW-trending contact between Mackay Granite and Granite Porphyry is everywhere concealed by alluvium so that its orientation cannot be directly measured. The contact was encountered at depth in drill holes KX18-37 and S047 (cross-section BB') and was mapped beyond the North Pit region by Nelson & Ross (1968); these data provide evidence for a planar contact oriented N25W 40NE.

Within 100' of the contact between Mackay Granite and Granite Porphyry, no cross-cutting intrusive textures nor fault-related brecciation is present. Beyond the North Pit region on the ridge above the AP pit (1724847E/807935N), I observed this contact to be marked by an abrupt change from coarse-grained Mackay Granite to a fine-grained, weakly porphyritic granite that I called Granite Porphyry. If correct, this is evidence for an intrusive contact such that Granite Porphyry, to the northeast, forms a chilled margin against the older Mackay Granite, to the southwest. However, this contradicts the timing sequence proposed by Chang & Meinert (2004) who described textures and radiometric ages that indicate the Mackay Granite cuts across, and is therefore younger than, the Granite Porphyry. In any event, no evidence of a fault was observed so the contact is interpreted as intrusive, such that younger rocks and structures on one side of the contact should continue to the other side.

(6) *Skarn formation (Eocene, syn-Mackay Granite)*

Skarn also exists where Mackay Granite is in contact with limestone. In the study area, Red Star is the only example of this juxtaposition, since everywhere else Mackay Granite is in contact with Granite Porphyry. As before, garnet and pyroxene are major mineral constituents.

(7) Granite Dike emplacement (Eocene, probably 47.3-47 Ma)

Two Granite dikes are present in the study area. Granite has fine-grained phenocrysts of quartz, kspar, and plagioclase with rare mafic minerals. Feldspar is uncommonly medium- to coarse-grained yielding a slightly porphyritic texture. The rock is light-colored with common Liesegang banding and is moderately resistant to weathering. Where observed in roadcuts, the contact between Granite and Mackay Granite is sharp and curviplanar. Contact-parallel flow foliation is commonly developed in the Granite. At the outcrop scale, contacts and flow foliation have a typical orientation of N35E 85NW, although strike variations of ±20° are common (figure 3b). Exposures along EW roadcuts are ~35' wide and the map patterns define two N40E-trending Granite dikes (see geologic map).

The eastern dike, which has a distinctive light-green color due to chlorite-epidote alteration, crops out not only in the Mackay Granite but also appears in subcrop to the north within the Granite Porphyry. The western dike is well exposed near the Red Star skarn and projects northeastward beyond the granite and into limestone (cross-section AA').

(8) Magnetite veins (post-skarn, post-Mackay Granite, post-Granite)

Outcrops of massive magnetite are rare in the North Pit region. Nearly all surface exposures are found in a series of roadcuts northward from Garnet Hill where outcrop, float, and one excellent exposure define a planar magnetite vein 1-3' wide that is oriented N9E, 80 NW (see geologic map). The vein is almost everywhere flanked by Granite Porphyry that was converted to endoskarn. Where best exposed (1724747E/ 811110N) the magnetite vein clearly cuts across older endoskarn veins (figure

6). The vein can be traced at least 700' northward from Garnet Hill and projects just beyond patented land into historical mine workings, where a 2018 Konnex assay (sample #458509) yielded elevated copper, silver, and gold concentrations.

Figure 6: Massive magnetite vein about 3' wide cutting through endoskarn hosted by Granite Porphyry, with contacts oriented N9E 80NW. Approximate location is 1724747E/ 811110N.

At the Red Star location, magnetite is disseminated through the skarn. Significantly, massive magnetite also occurs in the small tailings pile of an historical prospect pit located at 1723990E/811260N, which is ~340' in a N12E direction from Red Star (see geologic map). Given the existence, continuity, and trend of the Garnet Hill magnetite vein, it is possible that a separate but parallel magnetite vein extends southwards from this prospect pit to beneath Red Star.

Another single exposure of massive magnetite occurs in an endoskarn at 1724920E/810840N, but other outcrops colinear with this one were not found.

(9) Shear Planes (post-Mackay Granite)

Minor shear planes with indiscernible slip are present throughout the field area and are especially prevalent in the Mackay Granite immediately south of the Red Star skarn. Shear planes are defined by a thin (<1cm) planar zone of gouge and have a clustered mean orientation of N41E, 82SE (figure 3c). Where they cut the Mackay Granite, shear planes are not flanked by significant brecciation but are commonly marked by brown alteration and oxidation of the granite, with rare development of copper oxide minerals along the fractures (figure 7). Where they cut skarn bodies, the shear planes may be flanked by breccia zones a few inches to a few feet in width (figure 8). Alteration and oxidation are widespread with obvious color changes parallel to the shear planes, indicating fluid transport along the planes. Copper oxide minerals may be present.

Figure 7: Shear Plane cutting through Mackay Granite with copper oxide minerals precipitated on the surface. Shear plane orientation is N39E 87SE. Approximate location is 1723760E/810850N

Figure 8: Shear Planes cutting through exoskarn hosted by White Knob Limestone. Orange and red alteration parallel to the shear planes indicates they served as fluid conduits after the skarn developed. Approximate location is 1724650E/811910N.

Slip direction was evident on only one of 33 shear planes: the eastern shear plane that borders Red Star (oriented N30E, 85SE) has striations preserved inside the adit that trend S23W, indicating oblique slip with components of both normal and dextral shear. The slip amount could not be measured on any shear plane, except that displacement never juxtaposes two different rock formations or contrasting lithologies within one rock formation. For this reason, displacement is interpreted to be <30' and likely <3' on individual shear planes.

Both Shear Planes and Magnetite Veins are structures that accommodated extension but because their strikes are 40° different from one another, it seems certain that they did not form at the same time. Because the pattern of disseminated magnetite in skarn shows no spatial relation to shear planes or related alteration of the skarn, shear planes are interpreted to be younger than magnetite veins.

(10) Joints (post-Eocene)

A systematic set of joints is present throughout the North Pit region. They are spaced every 1'-5', rarely spaced <1', and exert significant control on rock strength and stability (figure 9). Only a few joints were measured for this study and their clustered average orientation is N35W 85NE (figure 3d). Because joints cut across all rocks and structures, they are interpreted to be the last geologic structure to form in the North Pit region. Some copper oxide minerals are locally present on joint surfaces but in most places, these joints are barren and appear unrelated to initial skarn, magnetite, and metal emplacement.

Figure 9: Shear Plane (parallel to pencil) and closely-spaced Joints in the Mackay granite. Joints are oriented N29W 90 and the shear plane is oriented N26E 90, defining a ~55° angle of intersection. Approximate location is 1723830E/810820N.

(11) Regional tilting (Miocene-Quaternary, 10-0 Ma)

The Mackay mining district and entire White Knob Mountains are located several miles west of and above the Lost River normal fault. This active Basin & Range fault is characterized by domino-style behavior, such that slip on the SW-dipping fault is accompanied by NE-tilting of adjacent rocks. Based on regional observations, all features within the Mackay mining district have uniformly tilted ~5-10° NE during the past 10 million years.

Conceptual Model of Mineralization

Geologic mapping, structural analysis, and study of core recovered in the North Pit region provides new constraints on the pattern and processes of mineralization. Three key stages of development are envisioned, as explained below. Interestingly, this model (primarily based on textural, structural, and map-scale relations) supports key elements of the paragenetic model presented by Maund (2019b), whose report is a well-supported petrologic analysis of the same rocks and region.

Copper and silver mineralization is restricted to regions where skarn is present. In the North Pit region, skarn formed along the contact between White Knob Limestone and intrusive rock. Where the intrusive rock is Granite Porphyry, skarn is ubiquitously present along the subvertical, N12E-striking contact whereas perpendicular to this contact, surface exposures suggest endoskarn is more extensive (thicker) than exoskarn. However, at the one location where limestone is in contact with Mackay Granite (Red Star), core samples suggest a considerable thickness of exoskarn.

Copper and silver mineralization is further restricted to regions where skarn was injected by iron-bearing fluids such that iron oxide minerals, notably magnetite, formed in mm-scale veins, as pseudomorphs after garnet, or as massive patches. Everywhere magnetite is present, copper is present in elevated concentrations. In the North Pit region, one map-scale magnetite vein is exposed and another may underlie Red Star. These vertical, N9E-oriented structures are proposed to be deep-seated conduits along which iron- and copper-enriched fluids ascended through intrusive rock until encountering skarn, especially exoskarn, at which point the fluids dispersed beyond the narrow vein to create more widely distributed, mineralized zones such as observed at Red Star.

Silver mineralization is further restricted to regions where magnetite-bearing skarn was altered to a friable, low density, pitted rock with very fine-grained galena. This texture is interpreted to reflect a superimposed event, in which acidic(?), silver-bearing fluids leached the magnetite-bearing skarn. An alternative theory, that silver mineralization was coincident with copper and magnetite emplacement, is less favored because the silver-bearing rock appears texturally to be an alteration of magnetite-bearing rock, and is much more spatially restricted than magnetite/copper-bearing rock. Conduits for the silver-bearing fluids were not documented in this study but the steeply dipping, N41E-oriented shear planes may have served this purpose, since surface exposures show oxidation and alteration of host rock (Mackay Granite, Granite Porphyry, exoskarn) adjacent to these shear planes.

Nearly all published studies and contract reports on the Alder Creek mining district focus on skarn development (±magnetite bearing) at the contact of Granite Porphyry and White Knob Limestone. North Pit is geologically different because (a) the Red Star skarn is hosted by Mackay Granite and (b) one (or more) narrow, laterally continuous magnetite veins are developed. As mentioned by Maund (2019b), a conceptual model for mineralization in North Pit (and regions further north such as the White Knob Mine Group) must involve new concepts that were not invoked to the south.

White Knob Mine Group

A few miles north and west of the North Pit region is the White Knob Mine Group (WKMG) which includes the historic Blue Bird, White Knob, and Horseshoe Mines. In 2018, Konnex Resources collected surface samples in this region that showed moderate silver concentrations and by early 2019, they acquired the mineral permits for this region. Maund (2019b) assessed the resource potential of the WKMG by compiling maps, assays, and reports from the previous century, concluding that:

this northern part of the system remains unexplored with indications of substantial ore potential within medium to high grade polymetallic base & precious metal systems offering significant collective potential tonnage.

Based on the available information from Red Star (3 reverse circulation drill holes), Maund also wrote:

Recent drilling undertaken by PXC plus the geology of the Red Star prospect, and underground mine and stope plans from the historic Horseshoe and Bluebird Mines, suggest mineable widths of between 2m to 16m are achievable at medium to high base metal + silver grades.

A re-evaluation of the resource potential of the WKMG, incorporating new knowledge from North Pit provided in this current report, agrees with Maund's (2019b) conclusions. Geologic mapping by Farwell & Full (1944, plates 2 and 4) and Nelson & Ross (1968, plate 1) shows limestone, Granite Porphyry, and Granite dikes are exposed at the surface, with two mines (White Knob, Horseshoe) located at the surface contact of limestone and Granite Porphyry. These small-scale maps and one large scale map of the Horseshoe Mine (Fowler, 1926) show geologic contacts strike from N30W to N30E. Nelson & Ross (1968, pg. 27) describe the Horseshoe Mine in more detail:

The principal workings trend about N. 30° W., and the main ore bodies are along these workings... Some of the numerous minor mineralized slips at various angles to the main ore bodies are approximately perpendicular to the general trend...Ore deposition has been effected mainly by replacement rather than by fissure fillings.

In 2018, Konnex Resources assayed about twenty surface samples across the WKMG region (samples 458503-458523), of which twelve yielded moderately elevated silver concentrations. Like Red Star, 75% of these silver-bearing samples were also enriched in copper.

Important geologic details (such as the distribution of skarn and magnetite) are missing from WKMG historical reports but the available information provides an enticing analogue to the geology of Red Star and the North Pit region. I concur with Maund and recommend that Konnex invest in additional exploration of the region, commencing with a high-resolution geologic map, additional sampling, and magnetic survey (described below).

Conclusions and recommendations

The clear and constant correlation of copper and silver mineralization with magnetite in the Red Star skarn provides an extremely useful exploration tool. Where outcrops and roadcuts are sufficient, geologic mapping similar to that described in this report can discern the surface distribution of skarn and magnetite. In particular, other locations in the North Pit region beyond Red Star show a similar geologic coincidence of rocks and structures, providing several recommended drilling targets. And a few miles beyond the North Pit region, the White Knob Mine Group is an underexplored region where limited previous work indicates silver mineralization amongst an assemblage of limestone, intrusive rock, and fractures -- the same geologic framework as North Pit.

For both the North Pit and White Knob Mine Group regions, I strongly recommend the completion of a high resolution magnetic survey using ground- or drone-based measurement techniques, which has great potential in locating magnetite-bearing rocks of this scale in the shallow subsurface, even when obscured by vegetation and colluvium. Knowing that skarn bodies and magnetite veins are elongated in a ~N10E direction provides a significant advantage in interpreting the magnetic data -- knowledge that was unavailable in previous exploration efforts. And knowing that a set of ~N40E shear fractures exists will also guide exploration, especially if additional study shows that silver-bearing fluids traveled along this fracture system.

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