Mineral Character Determination Related to Exchange of Lands Between PolyMet Mining and USFS

Prepared for:
PolyMet Mining, Inc.

Revised December 1, 2011

BARR

332 West Superior Street
Duluth, MN 55802
Phone: (218) 529-8200
Fax: (218) 529-8202

Mineral Character Determination Related to Exchange of Lands Between PolyMet Mining and USFS

Prepared for PolyMet Mining, Inc. by Barr Engineering Co. - Revised December 1, 2011

Introduction

This report presents a review of the geology and potential for exploration and development of bedrock and/or surficial geology resources (such as open pit mines or gravel pits) for five tracts of property assembled by PolyMet Mining Inc. (PolyMet) and offered to the United States Forest Service (USFS) for exchange of USFS surface property. The current USFS owned property is within and adjacent to the proposed PolyMet NorthMet Project mine property. Lists of the owners of surficial and mineral rights for the tracts were not part of the scope of this review and are not included in this report.

The mineral character determination presented in this report is based on a review of available published geologic literature and maps for the region surrounding the five tracts. The resources reviewed in preparing the report are included in the References section at the end of the report.

This report presents the geology and discusses the potential for mineral development for the following five tracts:

- Hay Lake - Referenced as Tract 1 in USFS Scoping Documents
- Lake County Lands - Referenced as Tract 2 in USFS Scoping Documents
- Wolf Lands - Referenced as Tract 3 in USFS Scoping Documents
- Hunting Club Lands - Referenced as Tract 4 in USFS Scoping Documents
- McFarland Lake (previously referred to as Wheaton College) - Referenced as Tract 5 in USFS Scoping Documents

The locations of the tracts are shown on Figure 1. The Wolf Lands and Hunting Club Lands tracts are each composed of multiple noncontiguous segments of property. Each of the five tracts is described in a separate section of this report.

This report was prepared for PolyMet by Barr Engineering Company, under the direct supervision of Mark Hagley (Professional Geologist - Minnesota License Number 30331).

Hay Lake (Tract 1)

Location

The Hay Lake tract is in St. Louis County and includes all or parts of: T59N, R16W, sections 9, 16, 19, 20, 21, 27, 28, 29, 30, 31, 32, and 33. Total area is approximately 4,650 acres. A location map is presented as Figure 1-1.

Land and Mineral Ownership

A public land survey map for the site is presented as Figure 1-2. Determination of the owners of the surface and mineral rights are not included in the scope of this mineral character determination.

Subject Mineral Resource Geology

The bedrock geology at the Hay Lake site north of McKinley and Biwabik in St. Louis County is composed entirely of Archean age rocks (Figure 1-3). The bedrock is dominantly composed of granitic rocks of the Giants Range Batholith. The southwestern-most part of the area is underlain by metamorphosed volcanic rock (greenstone) and meta-sedimentary rock (schist) (Jirsa, et.al, 2005). The mineral potential of the rocks at the site has not been investigated in detail. These rock types are not known as hosts for known mineral deposits in the area.

Subject Mineral Resource Potential

The mineral potential for bedrock at the site appears to be low. The Biwabik Iron Formation (BIF) is present approximately two miles south of the site. Iron ore is mined from the formation. Although the BIF is present in the vicinity of the site, no part of the BIF is known to be present at the site and there is no potential for mining of the BIF at the site. A review of the Minnesota Department of Natural Resources (MDNR) core library index (August 2001 database) and Public Access to Minerals Data indicates no mineral exploration drilling in or near the land exchange area. Published or available exploration, geophysical survey, and mineral potential based studies conducted in the region have been focused on the Biwabik Iron Formation and associated Proterozoic rocks. The Giants Range Batholith is an extensive formation that extends east-west for over 100 miles and has limited mineral exploration due to the expected low mineral potential Rocks of the Giants Range Batholith do not have identified economic mineral deposits and studies do not indicate that the formation is likely to contain economic deposits of minerals. The ArcelorMittal Minorca Mine mines taconite ore from the BIF to the south and west of the Hay Lake site. The Minorca Mine located their tailings basin in an area where the bedrock is Giants Range Batholith, indicating that the Giants Range Batholith does not contain mineral resources that would be developed. The area of the site containing metamorphic schist and greenstone rocks is small. The meta-sedimentary schist is not known to contain economic mineral deposits in the region. Economic mineral deposits have been discovered and developed in greenstone belts in Ontario. Based on that discovery, exploration for gold has been conducted in greenstone formations in northern Minnesota. However, no economic deposits of gold have been found in the greenstone formations in northern Minnesota.

Surficial Geology

A surficial geology map of the area is presented as Figure 1-4. The surficial geology at the site consists mainly of glacial till associated with the Rainy Lobe that is less than 50 feet thick. Rainy Lobe till in the region is dominantly silty. Peat deposits are present along the Pike River and low areas in the northern portion of the site. Ice contact sediments are present in the southern portion of the site. These deposits

are also expected to be silty due the abundance of silt in the till. Some resedimented and resorted till (likely to be more coarse-grained, with less silt and clay) is present along the Pike River in the northeast portion of the site. Bedrock outcrops are present in the southwest portion of the site.

Surficial Mineral Material Potential

A map showing locations of aggregate pits mapped by the Minnesota Department of Transportation (Mn/DOT) is presented as Figure 1-5. Aggregate sources are scattered throughout the region, but none are mapped by Mn/DOT in the immediate vicinity of the site. The MDNR has prepared maps of aggregate potential in the region, but not for areas in the vicinity of the site location. An irregular-shaped disturbance of the forest can be observed on the air photo of Figure 1-2 in the NE corner of the SE ¼ of the SE ¼ of Section 16 T59 R16. Field reconnaissance indicates that this disturbed area has been used as a source of aggregate. This is within the area mapped as resedimented and sorted till on Figure 1-4. Overall, there is low potential for aggregate mining or extracting other surficial material over the majority of the site due to the predominantly silty composition of the soil at the site, and due to the presence of peat or bedrock outcrops over portions of the site. However, based on the presence of an aggregate borrow area in Section 16, there appears to be potential for aggregate development in the far northeast portion of the site, within the area mapped as resedimented and sorted till.

Conclusion

There appears to be low potential for exploration or development of bedrock or surficial deposits at the Hay Lake tract. The bedrock formations that are present at the site have either not been explored or developed in other parts of the region (due to existing knowledge of the mineralogy of the formations) or have been explored but economic mineralization has not been found. Therefore, there appears to be low potential for exploration or development of the bedrock formations at this site because these formations regionally are not known to have economic mineralization. The placement of a tailings basin over the Giants Range Batholith by an active mining company reinforces the low potential for economic development of the formation.

The predominant surficial sediment deposit types that are present at the site do not appear to contain significant gravel deposits, except for an area along the Pike River in the northeast portion of the site that appears to have some potential to contain coarser-grained surficial materials The surficial deposits over the majority of the site are likely silty, and do not appear to contain economic aggregate deposits or other materials that have typically been extracted in the region (or would be expected to be extracted in the future). However, the presence of an unmapped developed aggregate deposit in the northeast portion of the site, within the area of resedimented and sorted till, indicates the potential for aggregate mining in that part of the site.

Lake County Lands (Tract 2)

Location

The Lake County Lands tract consists of four noncontiguous parcels (Figure 2-1) in Lake County Minnesota. Three of the parcels are in close proximity to one another (Figure 2-1a) and one parcel is located to the southeast (Figure2-1b). Two parcels are located in T57N, R11W, Section 6. One parcel is located in T57N, R11W, Section 5 and partially in Section 6. The fourth parcel is located in T56N, R9W, Section 17. The total area of the tract parcels is approximately 320 acres.

Land and Mineral Ownership and Encumbrances

A public land survey map for the site is presented as Figures 2-2, 2-2a, 2-2b. Determination of the owners of the surface and mineral rights are not included in the scope of this mineral character determination.

Subject Mineral Resource Geology

The bedrock geology of the Lake County Lands is composed of Keweenawan age igneous intrusive rocks of the Duluth Complex and Beaver Bay Complex (Figure 2-3). The bedrock at the three parcels located near Pine Lake in T57N, R11W is part of the Troctolite series of the Duluth Complex. Troctolite series rocks comprise most of the exposed part of the southern Duluth Complex. The troctolite series of the Duluth Complex as a whole is not associated with sulfide mineralization. The majority of sulfide mineralization within the Duluth Complex occurs in the area of the contact between the complex and older formations in an area generally between the towns of Hoyt Lakes and Ely. The area of sulfide mineralization has been determined by extensive exploration and drilling in the area of the contact. Exploration drilling continues to be conducted in this area of mineralization to better define the formations, but drilling is not conducted extensively outside this area based on the likelihood that economic mineralization is not present away from the contact zone between Duluth Complex rocks and older rock formations. The Duluth Complex is also composed of several different intrusive bodies, such as the Partridge River Intrusion and the South Kawishiwi Intrusion, and areas of differing mineralization, but not all intrusions or areas of the Complex are associated with sulfide mineralization.

Bedrock formations in the area of the southeastern-most parcel in T56N, R9W are part of the Beaver Bay Complex. Rocks of the Beaver Bay Complex are dominantly gabbroic but range in composition from troctolitic to granitic. The Beaver Bay complex is considered a separated intrusion from the Duluth Complex but merges into the Duluth Complex to the north. The Beaver Bay complex is located south and east of areas where sulfide mineralization is present in Duluth Complex rocks.

Subject Mineral Resource Potential

The mineral potential for the bedrock at the site appears to be low, although an exploration district is present within Duluth Complex rocks elsewhere in the region. A review of the MDNR Public Access to Minerals Data indicates that no exploration drilling or reporting has been conducted at the Lake County Lands parcels or the immediate region around the parcels. Extensive exploration and drilling has been conducted 10 to 20 miles to the west and northwest of the parcels, in areas where sulfide mineralization is present in the basal zone of the Duluth Complex. The type of rock of the Duluth Complex and Beaver Bay Complex present in the area of the Lake County Lands parcels are not considered to have economic mineralization because these rocks are not at the basal contact of the complex and the older rocks and are separate intrusions or have different mineralogy from areas where sulfide mineralization has been found.

Surficial Geology

The surficial geology of the Lake County Lands consists of glacial deposits of two different glaciations (Figure 2-4). Deposits in the area of the three northwestern-most parcels in T 57N, R11W are associated with the Rainy Lobe and all of the parcels are partially to nearly completely covered by peat . Ground moraine till of the Rainy Lobe in the region is described as brown silty till to sandy and stony to bouldery till. The thickness of the till in the region is up to 100 feet. Drumlins are present regionally but not in the near vicinity of the properties.

Deposits in the area of the southeastern-most parcel in T 56N, R 9W are associated with the Superior Lobe. The Highland end moraine and ground moraine deposits in the area are described as unstratified till composed of clay, silt, sand, and gravel, and as sandy and stoney till. The deposits in the area are less than 50 feet thick. Gravel deposits can be associated with former beach sands of Glacial Lake Duluth in Highland Moraine deposits; however, beach landforms are not present in the vicinity of the site.

Surficial Mineral Material Potential

There is a low potential for aggregate development at the parcels. No aggregate pits or prospects are located near the parcels (Figure 2-5). Drumlin formations in the region can be associated with economic aggregate deposits; however, no drumlin landforms are present at the sites. The northwestern-most parcels also have extensive peat cover. Peat or wetland deposits also appear to be present in the southeastern-most parcel based on the topographic map (Figure 2-1b). The presence of peat and/or wetlands in these areas indicates that soils are poorly drained and may indicate that fine-grained material may be present. Additionally, peat or wetland areas are generally not associated with aggregate or gravel pits.

Conclusion

There appears to be low potential for exploration or development of bedrock or surficial deposits at the Lake County Lands tract. The bedrock formations that are present at the sites have not been explored or developed, likely because of existing knowledge of the formations. The bedrock at the sites is not at the basal contact of the Duluth Complex (where sulfide mineralization is present elsewhere), and the bedrock at the sites is composed of separate intrusions or mineralogy from those areas of the Complex that have sulfide mineralization. The surficial sediment deposit types that are present at the sites do not appear to be composed of gravel and do not appear to contain economic aggregate deposits or other materials that have typically been extracted in the region (or would be expected to be extracted in the future).

Wolf Lands (Tract 3)

Location

The Wolf Lands tract is composed of four noncontiguous parcels (Figure 3-1) in Lake County Minnesota. The total area of the tract is approximately 1,560 acres. The parcels, in order from southwest to northeast, are located in:

- T 57N, R 11W, Section 8 (Figure 3-1a)
- T 58N, R 10W, Sections 15, 22 (Figure 3-1b)
- T 59N, R 9W, Sections 30, 31 (Figure 3-1c)
- T 59N, R 9W, Sections 7, 8, 17, and 18 (Figure 3-1d)

Land and Mineral Ownership and Encumbrances

Public land survey maps for the site are presented as Figures 3-2, 3-2a, 3-2b, 3-2c, 3-2d. Determination of the owners of the surface and mineral rights are not included in the scope of this mineral character determination.

Subject Mineral Resource Geology

The bedrock geology of the Wolf Lands is composed of Keweenawan age igneous intrusive rocks of the Duluth Complex (Figure 3-3). Bedrock at each of the four parcels is composed of one or more series of rock types consisting of the Troctolite series, the Anorthosite Series, and/or the Felsic Series of the Duluth Complex. Troctolite series rocks comprise most of the exposed part of the southern Duluth Complex. These series of the Duluth Complex as a whole are not associated with sulfide mineralization. The majority of sulfide mineralization within Duluth Complex rocks occurs in the area of the contact of the complex with older bedrock formations, in an area generally between the towns of Hoyt Lakes and Ely. The known extent of sulfide mineralization has been determined by extensive exploration and drilling in the area. Exploration drilling continues to be conducted in this area of mineralization to better define the formations, but drilling is not conducted extensively outside this area based on the likelihood that mineralization is not present away from the contact zone between Duluth Complex rocks and older rock formations. The Duluth Complex is also composed of several different intrusive bodies and areas of differing mineralogy and not all intrusions or areas of the complex are associated with sulfide mineralization.

Subject Mineral Resource Potential

The mineral potential for the bedrock at the site appears to be low, although an exploration district is present within Duluth Complex rocks elsewhere in the region. A review of the MDNR Public Access to Minerals Data indicates no exploration drilling or reporting has been conducted at the Wolf Lands parcels or the immediate region around the parcels. Extensive exploration and drilling has been conducted 10 to 20 miles to the west and northwest of the sites in areas where sulfide mineralization is present in the basal zone of the Duluth Complex. The types of rock of the Duluth Complex that are present in the area of the Wolf Lands sites are not considered to have economic mineralization within the complexes because these rocks are not at the basal contact of the complex and are separate intrusions or have different mineralogy within the complex from areas where sulfide mineralization have been found.

Surficial Geology

The surficial geology of the Wolf Lands consists of glacial deposits associated with the Rainy Lobe. Peat and/or wetland deposits are present at the surface in parts of nearly all of the parcels. No peat is mapped for the parcel in the vicinity of Greenwood Lake and Mary Ann Creek (T 58N, R10W); however the USGS topographic map does indicate that wetlands are present across much of the parcel (Figure 3-1c). Ground moraine till is mapped in the area of all parcels. Outwash is also mapped for most of the area of the parcel in the vicinity of Greenwood Lake and MaryAnn Creek (T58N, R10W).

Ground moraine till of the Rainy Lobe in the region is described as brown silty till to sandy and stony to bouldery till. The thickness of the till in the region is generally less than 50 feet and is laterally discontinuous. Drumlins are present regionally but drumlin landforms are not identified at the Wolf Lands tract parcels.

Outwash deposits are generally sandy and stony and are generally 10 to 30 feet thick in the region. The topography in the outwash area is relatively flat, surrounded by streams and wetlands.

Surficial Mineral Material Potential

There is a low potential for aggregate mining at three of the Wolf Lands tract sites, and a moderate potential at the parcel in the vicinity of Greenwood Lake and Mary Ann Creek (T 58N, R10W). Aggregate pits or prospects are located near Greenwood Lake and the area along Highway 1 north of the sites (Figure 3-5). The aggregate pits or prospects to the north appear to be in different glacial deposits than those present at the sites themselves. Drumlin formations in the region can be associated with economic aggregate deposits; however, no drumlin landforms are present at the sites. Three of the parcels also have extensive peat and/or wetland cover (Figures 3-1, 3-1a, 3-1b, 3-1c, 3-1d). Peat or wetland areas are generally not associated with aggregate or gravel pits. Outwash deposits such as those near Greenwood Lake may be an aggregate source, and a prospected aggregate pit is present to the southwest of Greenwood Lake, indicating that there may be potential for aggregate at the parcel near Greenwood Lake and Mary Ann Creek (T58N, R10W). However, wetland areas and limited access to the parcel may reduce the potential for development at that parcel.

Conclusion

There appears to be low potential for exploration or development of bedrock or surficial deposits at the Wolf Lands tract. The bedrock formations that are present at the sites have not been explored or developed, likely because of existing knowledge of the formations. The bedrock in the area is not at the basal contact of the formation (where sulfide mineralization is present elsewhere), and the bedrock appears to be separate intrusions or have different mineralogy from those areas of the Duluth Complex that have sulfide mineralization. In general, the surficial sediment deposit types that are present at the sites do not appear to be composed of gravel and do not appear to contain economic aggregate deposits or other materials that have typically been extracted in the region (or would be expected to be extracted in the future).There is a moderate potential for aggregate development at the parcel near Greenwood Lake and Mary Ann Creek (T58N, R10W), due the known presence of a prospected aggregate pit in the area. However, wetland areas and limited access to the parcel may reduce the potential for aggregate development at that parcel.

Hunting Club Lands (Tract 4)

Location

The Hunting Club Lands tract is in St. Louis County and is in T 66N, R 17W, Section 17. The area of the tract is approximately 160 acres. A location map is presented as Figure 4-1.

Land and Mineral Ownership and Encumbrances

A public land survey map for the site is presented as Figures 4-2. Determination of the owners of the surface and mineral rights are not included in the scope of this mineral character determination.

Subject Mineral Resource Geology

The bedrock geology of the Hunting Club Lands is composed of granite-rich migmatite rock of the Archean age Vermilion Complex (Figure 4-3). The Vermilion Complex consists of a series of intrusive rocks. Older metasedimentary rocks are present regionally, but, not in the area of the Hunting Club Lands. These rock types are not known as hosts for mineral deposits in the area.

Subject Mineral Resource Potential

The mineral potential for the bedrock at the site appears to be low. A review of the MDNR Public Access to Minerals Data indicates that exploration and drilling has not been conducted at or near the Hunting Club Lands. Some limited prospecting for gold had been conducted at other properties in the area in the 1930s and 1940s, but no economic deposits were found. In general, the mineral potential of the Vermilion Complex is expected to be low, based on knowledge of the formation.

Surficial Geology

The surficial geology of the Hunting Club Lands area consists of glacial deposits associated with the Rainy Lobe (Figure 4-4). Wetland deposits are present at the surface in much of the northern half of the site. Ground moraine deposits of the Rainy Lobe in the region are described as sandy and stony. The till is thin and bedrock outcrops are present over more than 40 percent of the area.

Surficial Mineral Material Potential

There is a low potential for aggregate development at the site. No mapped aggregate pits or prospects are located near the site based on MDNR and Mn/DOT databases. The high ridges at the site around the wetland may be composed of bedrock.

Conclusion

There appears to be low potential for exploration or development of bedrock or surficial deposits at the Hunting Club Lands tract. The bedrock formations that are present at the site have not been explored or developed at the site or in other parts of the region, likely due to existing knowledge of the formations. These formations are not known or expected to contain economic mineralization based on the known mineralogy of the formations. The surficial geologic materials at the site appear to be wetland deposits and bedrock, with little glacial till. No gravel deposits appear to be present. Therefore, economic aggregate deposits do not appear to be present.

McFarland Lake (Tract 5)

Location

The McFarland Lake tract is in Cook County, Minnesota, T64N, R3E, Section 9. A site location map is presented as Figure 5-1. The area of the tract is approximately 32 acres.

Land and Mineral Ownership and Encumbrances

A public land survey map for the site is presented as Figure 5-2. Determination of the owners of the surface and mineral rights are not included in the scope of this mineral character determination.

Subject Mineral Resource Geology

The bedrock at the McFarland Lake site in Cook County is composed of Proterozoic age sedimentary rocks of the Rove Formation (Figure 5-3). The Rove formation is composed mostly of argillite, interbedded with siltstone and sandstone. Keweenawan age Logan Sills diabase rock has intruded the Rove formation in the area. The Rove Formation and diabase intrusions are not known to contain economic mineralization.

Subject Mineral Resource Potential

The mineral potential of the bedrock appears to be low. The MDNR core library index (August 2001 database) shows no drilling in or near the land exchange area. A review of data listed with the MDNR Public Access to Minerals Data indicates exploration has been conducted to the south within Duluth Complex rocks. Regionally, rocks of the Rove formation and Logan Sills intrusion are not know to contain economic mineral deposits.

Surficial Geology

A surficial geology map is presented as Figure 5-4. Ground moraine till of the Rainy Lobe is present in the area. The till in this region is described as sandy and stony. The layer of till is thin and patchy over hilly terrain of scoured bedrock. Information in the Hydrologic Investigation Atlas HA-582 (USGS, 1978) indicates that the till in the McFarland Lake region is less than 6 feet thick and that bedrock outcrops are present in much of the area. Thin clayey deposits, less than 6 feet thick, are present to the southeast of the site.

Surficial Mineral Potential

No gravel or aggregate pits are mapped in the region. There appears to be a low potential for aggregate mining at the site or in the region because the surficial soils are very thin and/or clayey, and bedrock outcrops are present across much of the area.

Conclusions

There appears to be low potential for exploration or development of bedrock or surficial deposits at the McFarland Lake tract. The bedrock formations that are present at the site have not been explored or developed in other parts of the region due to existing knowledge of the formations. These formations are not known or expected to contain economic mineralization based on the known mineralogy of the formations. The surficial sediment deposit types that are present at the site are thin and do not appear to

be composed of material that would be considered economic aggregate deposits or other materials that have typically been extracted in the region (or would be expected to be extracted in the future).

References

Ericson, D.W., Lindholm, G.F., and Helgesen, J.O., 1976, Water Resources of the Rainy Lake Watershed, Northeastern Minnesota, Hydrologic Investigations Atlas HA-556, United States Geological Survey.

Hobbs, H.C., and Goebel, J.E., 1982, Geologic Map of Minnesota, Quaternary Geology, Minnesota Geological Survey State Map Series S-1.

Jennings, C.E., and Reynolds, W.K., 2005, Surficial Geology of the Mesabi Iron Range, Minnesota, Minnesota Geological Survey Miscellaneous Map 164.

Jirsa, M.A., and Miller, J.D., 2004, Bedrock Geology of the Mesabi Iron Range, Minnesota, Minnesota Geological Survey Miscellaneous Map 163.

Lindholm, G.F., Ericson, D.W., Broussard, W.L., and Hult, M.F., 1979, Water Resources of the St. Louis River Watershed, Northeastern Minnesota, Hydrologic Investigations Atlas HA-586, United States Geological Survey.

Miller, J.D., Jr., Green, J.C., Severson, M.J., Chandler, V.W., and Peterson, D.M., 2001, Geologic Map of the Duluth Complex and related rocks, northeastern Minnesota, Minnesota Geological Survey Miscellaneous Map 119.

Miller, J.D., Jr., Green, J.C., Severson, M.J., Chandler, V.W., Hauck, S.A., Peterson, D.M., and Wahl, T.E., 2002, Geology and Mineral Potential of the Duluth Complex and related rocks of northeastern Minnesota, Minnesota Geological Survey Report of Investigations 58, 207p.

Minnesota Department of Natural Resources, Aggregate Resource Mapping: http://www.dnr.state.mn.us/lands_minerals/aggregate_maps/index.html

Minnesota Department of Natural Resources, digital copy of exploration drillhole database, from 2001. Contact Rick Ruhanen at MDNR Lands and Minerals, Hibbing, for further information.

Minnesota Department of Natural Resources, Public Access to Minerals Data: http://minarchive.dnr.state.mn.us/

Minnesota Department of Transportation, Aggregate Source Information System Map: http://www.dot.state.mn.us/materials/asismap.html

Morey, G.B., and Meints, Joyce, compilers, 2000, Geologic map of Minnesota, bedrock geology(3rd edition): Minnesota Geological Survey State Map Series S-20

Olcott, P.G., Ericson, D.W., Felsheim, P.E., and Broussard, W.L., 1978, Water Resources of the Lake Superior Watershed, Northeastern Minnesota, Hydrologic Investigations Atlas HA-582, United States Geological Survey.

Sims, P.K. and Morey, G.B, editors, 1972, Geology of Minnesota: A Centennial Volume, Minnesota Geological Survey, 632p.