Appendix 20-D

Paleontology Assessment

HARPER CREEK PROJECT

Application for an Environmental Assessment Certificate / Environmental Impact Statement

Environmental Resources Management

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A PRELIMINARY ASSESSMENT OF THE PALEONTOLOGICAL POTENTIAL OF THE HARPER CREEK PROJECT REGIONAL STUDY AREA

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INTRODUCTION

There are several provincial acts that manage paleontological resources in British Columbia; these include the *Heritage Conservation Act* (1996), *Land Act* (1996), *Park Act* (1996), *Ecological Reserve Act* (1996), *Mineral Tenure Act* (1996), *Ecological Reserve Act* (1996), *Protected Areas of British Columbia Act* (2000), *Wildlife Act* (1996), and *Environmental and Land Use Act* (1996). The Land Tenures Branch of the British Columbia Ministry of Forests, Lands and Natural Resource Operations has implemented a fossil management framework in the province with fossil management principles that recognize the importance of fossils as heritage resources and that makes their scientific value the most important factor when making management decisions about fossils (Deputy Ministers' Committee on Environment and Resource Development 2004). The province has several mechanisms under these acts through which it can protect fossil sites.

This letter provides a preliminary assessment of the potential for fossil resources in the archaeology Regional Study Area (RSA) of the Harper Creek Project (the Project) (see Figure 1). The purpose of the assessment is to identify any fossil resources that may be affected by development of the Project. To achieve this objective, a review of the geological setting of the Project and existing literature pertaining to fossils within the RSA was undertaken to evaluate fossil potential.

REGIONAL SETTING

Paleontological resources have been previously evaluated in the RSA (Figure 1) during previous geological evaluations in the Vavenby area, most notably that of Sciarizza and Prato (1987). Some fossil localities have been identified within this area, even though the rocks have undergone regional metamorphism and local hydrothermal alteration that has modified, obscured, or eliminated much of the original stratigraphic, minerologic, and paleontologic conditions of the original sediments in the local assemblage.

The rocks within the RSA are of the Kootenay terrane of the Omineca Complex. Most of the RSA is underlain by Hadrynian or Lower Cambrian to Mississippian-aged, deformed and metamorphosed sedimentary and igneous rocks of the Eagle

Bay Assemblage. The southern portion of the RSA is underlain by Cretaceous-aged intrusive quartz monzonitic rock that does not have any potential to contain fossils. A geologic section summarizing the lithology of the Eagle Bay Assemblage in the RSA is included in Figure 2.

GEOLOGY

The Eagle Bay Assemblage consists of highly deformed, tectonically emplaced Hadrynian or Early Cambrian to Mississippian sedimentary and igneous rocks that have undergone lower greenschist facies metamorphism on a regional scale. In the Vavenby area, the geology of the unit is generally characterized by a Hadrynian to Early Cambrian succession emplaced over a Devonian-Mississippian succession by thrust faulting interpreted to have occurred during tectonic emplacement of the Kootenay terrane.

The Eagle Bay Assemblage divisions identified within the RSA (Figure 1) and shown on Figure 2 include undifferentiated paragneiss metamorphic rocks (uPrCmEBpg, Hadrynian to Early Cambrian); the Graffunder Lakes Unit (uPrCmEBG, Hadrynian to Early Cambrian); the Johnson Lake Unit (lCMEBJ, Early Cambrian), which includes subunits of undifferentiated andesitic volcanic rocks (lCMEBva) and the Tshinakin limestone (lCMEBlm); the Forest Lake Unit (lPzEBF, Late Cambrian to Ordivician); the Skwaam Bay Unit (DEBSk, Devonian); the Foghorn Mountain Unit (DMEBF, Devonian to Mississippian), which includes the subdivided Rexspar Unit (DMEBR); undifferentiated orthogneiss (DEBOG, Devonian), and the Slate Creek Mudstone (MEBS, Mississippian). A brief description of each unit is included below.

Undifferentiated Paragneiss

This unit consists of metamorphosed intrusive igneous rocks and does not provide fossil potential.

Graffunder Lakes Unit

This is a primarily metasedimentary unit characterized by quartzite and quartz arenitic rocks in the RSA. Schist and phyllite is also found within this unit. No fossils have been identified in this unit.

Johnson Lake Unit

The Johnson Lake Unit consists of a mixture of schist, dolostone, phyllite, recrystallized limestone, and quartzite derived from sedimentary and volcanic rocks. There are two subunits in the RSA: Tshinakin Limestone and undifferentiated andesitic volcanic rocks. No fossils are associated with the volcanic rocks. Archaeocyathid fossils have been reported in the early Cambrian Tshinakin Limestone in the RSA approximately 4.5 kilometers northwest of Vavenby (51°36′28″N, 119°46′27″W) at the location shown on Figure 1. The fossils at this locality are present in recrystallized limestone and several genera of achaeocyathids have been identified.

Forest Lake Unit

The Forest Lake Unit in the RSA consists of greenstone and greenschist metamorphic rocks derived from sedimentary and volcanic rocks. No fossils have been identified in this unit.

Skwaam Bay Unit

This unit consists of phyllite and schist derived from calc-alkaline volcanic rocks. No fossils have been identified in this unit.

Foghorn Mountain Unit/Rexspar Unit

The Foghorn Mountain Unit consists of a metamorphosed assemblage of andesitic volcanic rocks that are associated with the Rexspar Unit that is composed of metamorphosed calc-alkalic volcanic rocks. No fossils have been identified in this unit.

Undifferentiated Orthogneiss

The Devonian undifferentiated orthogneiss has been developed from an intrusive igneous granites and granodiorites. No fossils have been identified in this unit.

Slate Creek Mudstone

The Slate Creek Mudstone consists of dark phyllite and slate with interbedded siltstone and sandstone and minor amounts of limestone, dolostone, schist, quartzite, and tuff. Although no fossils are reported from the Slate Creek Mudstone in the RSA, both Early- and Late-Mississippian conodont microfossils have been identified in age-correlated rocks over 20 kilometers south of the RSA.

FOSSIL POTENTIAL

There is a paucity of fossils in the rock units in the RSA, although some archaeocyathids have been recorded in the Johnson Lake Unit in the RSA and conodonts recorded in Slate Creek Mudstone outside of the RSA. Categories of fossils range from the very common to the very rare, with conodonts and archaeocyathids being relatively common fossils within rocks from their indexed ages. These fossils are not specifically protected by legislation in British Columbia.

For important fossil areas in British Columbia, the Land Act authorizes the Ministry of Forests, Lands, and Natural Resource Operations to establish fossil protection areas within which restrictions on fossil collection or disruption. No such reserve area has been established in or near the RSA.

Conodont fossils are abundant and widespread in rocks from the late Cambrian to the late Triassic periods (495 to 199.6 million years ago), are usually less than 1 millimeter in the longest dimension, and are not readily discernible to the naked eye. Even if encountered during industrial operations, it is unlikely that these fossils would be noticed. Although these fossils have utility in evaluating paleotemperatures of rocks, the importance of individual specimens is very low, especially in metamorphosed rocks such as those found in the Eagle Bay Assemblage.

Archaeocyathids are abundantly distributed in Cambrian carbonate units from approximately 525 to 480 million years ago. Invertebrate fossils such as archaeocyathids, where found, are usually abundant and widespread, and are therefore common. It is very unlikely that well preserved specimens would be present in the RSA because of the degree of metamorphism that the original rocks have endured. The archaeocyathid specimens recorded at the location shown on Figure 1 were found in recrystallized limestone, with all but the most conspicuous structural details of the organisms obliterated (Schiarizza and Preto 1987). Invertebrate fossil specimens are typically very easy to collect and involve no real issues for mining operations. It is not practical for mining operations or museums to deal with all reports of this category of specimens. With a small amount of training to increase awareness, mine staff can have discretion about whether it is worth reporting such finds. Fossil discoveries of importance, such as extremely well-preserved invertebrate specimens or any vertebrate fossils, should be reported to the Royal British Columbia Museum, local museum, the local paleontological society or appropriate staff at the nearest university or college.

Not all fossils that are encountered need to be managed. In the case of common and widespread fossils such as conodonts and archaeocyathids, there is no specific compelling regulatory requirement for active fossil management in British Columbia, except in cases of exceptional preservation of specimens. These conditions are not expected in the rocks in the RSA.

CONCLUSION

Fossils are uncommon in the metasedimentary rocks in the RSA, owing to the modification of original rock conditions from pervasive metamorphism in the region, as well as the provenance of many of the original rocks from ages and/or depositional environments where fossils are not commonly preserved. Lower

Cambrian archaeocyathid fossils have been identified in a single locality within the Johnson Lake Unit, and conodont fossils in four localities in Slate Creek Mudstone.

The Project proposes powerline development and use of existing roads in the Slate Creek Mudstone Unit and the Johnson Lake Unit. It is unlikely that the proposed Project would encounter significant fossils, although some potential to uncover paleontological resources may occur during powerline and road construction in the Tshinakin Limestone (lCMEBlm, Figure 1).

The massive sulphide deposit targeted for mining at the Project site is hosted within the metamorphosed volcanic rocks of the Devonian Skwaam Bay Unit of the Eagle Bay Assemblage (DEBSk, Figure 1), which does not provide fossil potential. The fossil-bearing Tshinakin Limestone is not present within the planned mining area, and macrofossils are not reported in the other rock units present in the mining area. Conodont fossils are reported in rocks associated with the Slate Creek Mudstone adjacent to the Devonian Skwaam Bay Unit, although microfossils are difficult to see without magnification and are typically very common, so no special considerations for identification or preservation of these fossils is recommended.

It is recommended that potential for interactions with fossils during construction and operation of the Project be managed using the chance find procedures included in the Archaeology Management Plan.

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Figures

Figure 1

Geologic Setting for Harper Creek Project

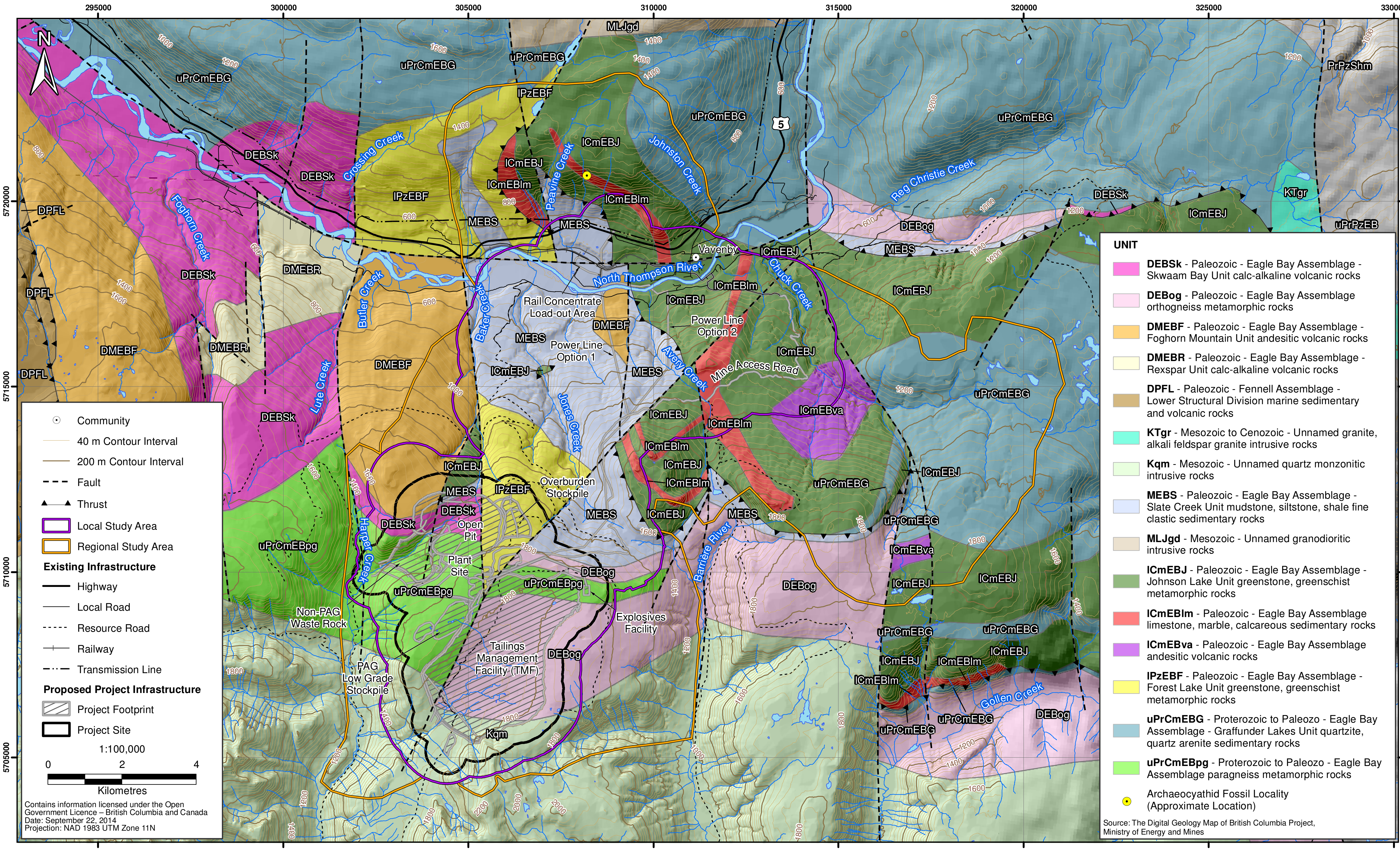
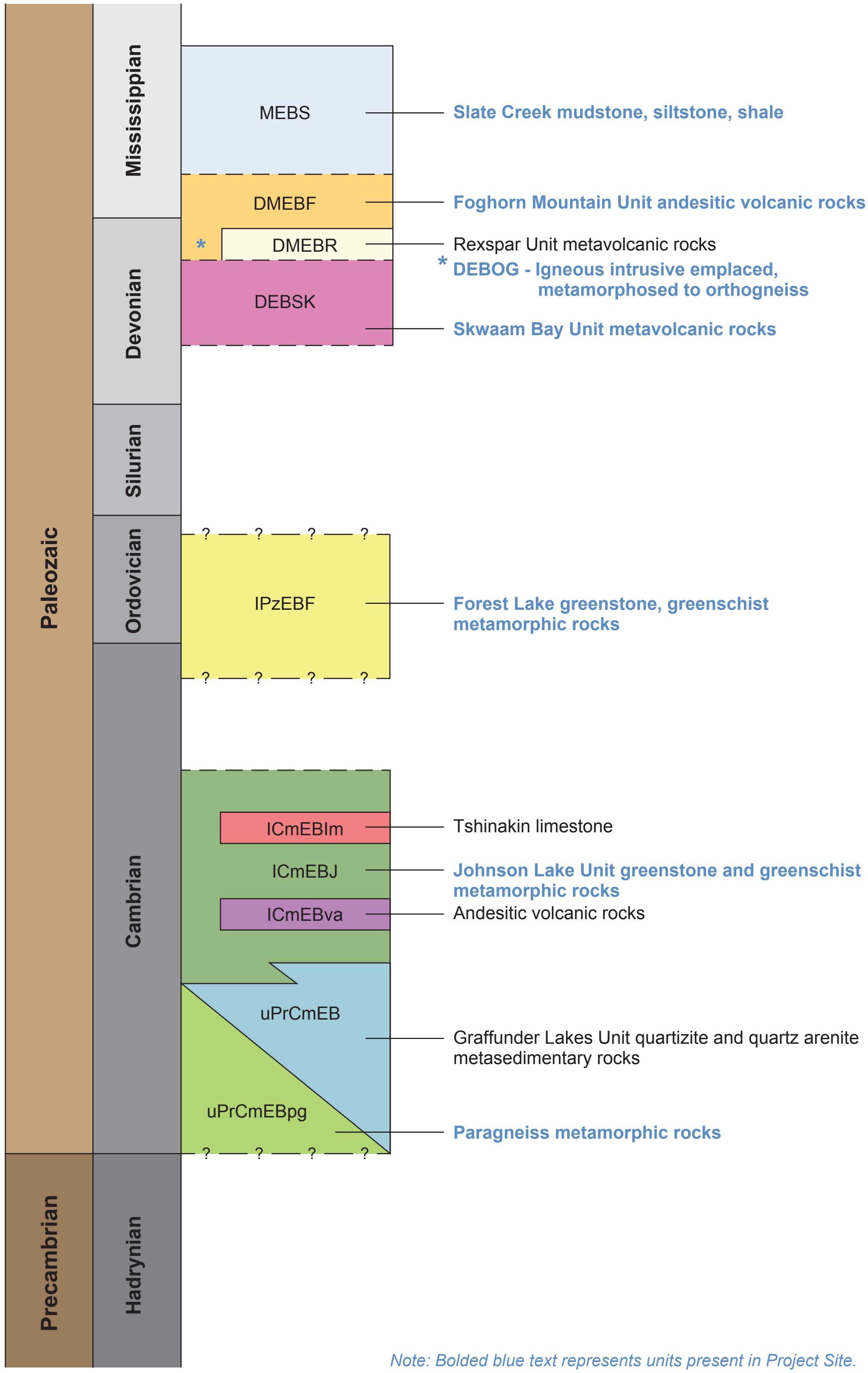


Figure 2
Eagle Bay Assemblage Geological Section in the Regional Study Area



Note: Bolded blue text represents units present in Project Site.

Source: Revised from Schiarizza and Preto 1987.