MADRID-BOSTON PROJECT
FINAL ENVIRONMENTAL IMPACT STATEMENT

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1. Paleontology

This document provides a preliminary assessment of the potential for fossil resources within the Project area of the Hope Bay Project (the Project). The purpose of this 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 at the Project was completed to evaluate fossil potential.

Paleontological resources in Nunavut are managed under the Nunavut Archaeological and Paleontological Sites Regulations (NAPSR, SOR/2001-220) established pursuant to Section 51 of the Nunavut Act. Under this regulation, the Nunavut Archaeology Program administers a permitting process for those completing field paleontological research and fossil collection.

1.1 INCORPORATION OF TRADITIONAL KNOWLEDGE

The *Inuit Traditional Knowledge for TMAC Resources Inc. Proposed Hope Bay Project, Naonaiyaotit Traditional Knowledge Project (NTKP)* report (TK report; Banci and Spicker 2016) was reviewed for information related to paleontological resources. There were no direct references relevant to paleontological resources in the TK report.

1.2 EXISTING ENVIRONMENT AND BASELINE INFORMATION

1.2.1 Regional Overview

The Project lies within the Hope Bay volcanic belt, which is an Archean-age greenstone belt within the Slave Structural Province. The Slave Structural Province is a granite-greenstone terrane covering approximately 190,000 square kilometres (km^2). The Hope Bay volcanic belt is located in the Bathurst Block, which covers approximately 16,000 km^2 in the northeast portion of the Slave Structural Province and is isolated from the rest of the Slave Province by the Proterozoic cover of the Kilohigok Basin. Proterozoic sedimentary rocks associated with this basin are not present within the Project area (Campbell and Cecile 1976).

1.2.2 Data Sources and Methods

Due to the low potential for the presence of paleontological resources, no previous field studies have been carried out in the Project area. The characterization of baseline conditions are inferred from the geology of the Project area and the general literature from the region.

1.2.3 Characterization of Baseline Conditions

The rocks within the Project area are composed of the Hope Bay volcanic belt and surrounding Archean granitoid and gneissic rocks (Hebel 1999). The Hope Bay volcanic belt within the Project area is predominantly composed of mafic volcanic and intrusive rocks with some felsic volcanic, volcanoclastic, and intrusive rocks; metasedimentary rocks; and minor iron formation and ultramafic sills. The grade of metamorphism of belt rocks ranges from greenschist to amphibolite facies (Gebert 1992). The age of the deposition of the rocks is estimated at approximately 2.66 to 2.70 billion years (Sherlock et al. 2012). The Hope Bay volcanic belt rocks extend over 80 kilometres (km) in a north-south orientation over an area ranging from 7 to 20 km wide.

The rocks of the Hope Bay volcanic belt are subdivided into two cycles of rocks, the older rocks associated with rift-type volcanism, and the younger rocks associated with arc volcanism. Sediments incorporated within the rocks of the belt are characterized as conglomerates composed of locally-derived clasts.

Geologic structure in the Hope Bay volcanic belt is complex, reflecting several periods of shearing, faulting, and folding. In areas where metamorphism and deformation are limited, rock conditions indicate that the rocks of the belt were folded into north-trending anticlines and synclines, then later cut by north-trending shear zones and faults. Two separate periods of gold mineralization within Hope Bay rocks are associated with the primary periods of rock deformation (Gebert 1992).

No fossils are reported associated with the rocks of the Hope Bay volcanic belt.

1.2.3.1 Archean Fossils

Life in the Archean (more than 2.5 billion years ago) was limited to solitary and colonial single-celled organisms. Colonial algae formed the predominant fossils from this time period, known as stromatolites. Stromatolites are developed as sedimentation slowly buries areas of active algal colonies in shallow water. Less commonly, microscopic fossils of solitary single-celled organisms have also been identified in Archean rocks.

Archean fossils are typically found in sedimentary rocks from relatively low-energy environments (e.g., siltstones and mudstones) that have undergone little to no metamorphism.

No fossiliferous Archean rock units are reported in the province of Nunavut (Fossilworks 2015).

1.2.3.2 Pleistocene Fossils

Remains of extinct Pleistocene megafauna (for example, woolly mammoths [*Mammuthus primigenius*]) are not reported in Nunavut, but specimens have been identified in surficial sediment deposits in some areas of the Canadian Arctic. The nearest such finds to the Project area are at localities on Banks Island and Melville Island in the Northwest Territories, over 700 km and 800 km from the Project area, respectively (Harington 2005).

The Project area was covered by a contiguous continental ice sheet throughout the last glacial maximum between approximately 9,000 years ago to greater than 18,000 years ago, so no local megafaunal habitat was available (Dyke and Prest 1987). No Pleistocene megafauna fossil localities have been identified within 100 km of the Project area.

1.2.3.3 Conclusions

Based on available published information, fossils are not present in the rocks of the Project area. It is highly unlikely that fossils would be encountered in the rocks and sediments of the Project area for the following reasons:

- Fossils are not typically found in the predominant rock types in the Project area (metamorphic and igneous).
- Fossils from the Archean are limited to single-celled organisms that thrived in low-energy shallow marine environments, which are not expressed in the rock types in the Project area.
- The sedimentary rocks in the Project area are conglomerates deposited in a high-energy environment unsuitable for the fossil preservation of organisms, if any, present during

deposition. Subsequent metamorphism and mineralization would have eliminated any fossil traces in Project area rocks.

- Regional ice coverage during the late Pleistocene limits the probability of occurrence of megafaunal remains from that period in the Project area.

1.3 VALUED COMPONENTS

1.3.1 Potential Valued Components and Scoping

Paleontological resources were included in the scoping and refining process with all other potential VECs/VSECs (see Volume 2, Section 4). Based on TMAC-led public consultation, the TK report (Banci and Spicker 2016), consultation with regulatory agencies, and regulatory considerations, paleontological resources were classified as a Subject of Note.

1.3.2 Valued Components Included in the Assessment

Paleontological effects have been scoped out as there are no known paleontological sites protected by legislation that may be affected by development of the Project (Volume 2, Section 4.3.3). There is no additional information requested in the NIRB-issued EIS guidelines on paleontology.

1.4 REFERENCES

Nunavut Archaeological and Paleontological Sites Regulations, SOR/2001-220

Banci, V. and R. Spicker. 2016. *Inuit Traditional Knowledge for TMAC Resources Inc. Proposed Hope Bay Project, Naonaiyaotit Traditional Knowledge Project (NTKP)*. Final Report, January 2016. Prepared for TMAC Resources Inc. by Kitikmeot Inuit Association Lands and Environment Department: Kugluktuk, NU.

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