

## **K4.13 GEOLOGY**

This appendix contains supplemental information on impacts to paleontological resources.

### **K4.13.1 Paleontological Resources**

Ground- and bedrock-disturbing actions have the potential to directly impact fossil-bearing deposits through physical disturbance, fragmentation, or destruction of fossil material. The potential impacts to paleontological resources by project component are described below.

#### **K4.13.1.1 Alternative 1a**

##### **Mine Site**

Due to the type of geological formations present, it is unlikely that paleontological resources are present in the mine site.

##### **Transportation Corridor**

Because of the prevalence of igneous rock type in the transportation corridor (including the Iliamna Lake ferry terminals), paleontological findings along the transportation corridor outside the port area are unlikely (see “Amakdedori Port” below). However, depending on the depth of paleontological resources beneath the surface Quaternary (2.6 million years ago to present) beach deposits, 20 acres in the vicinity of the port facility have the potential to impact paleontological resources.

In the vicinity of Amakdedori port, the transportation corridor footprint would cover about 20 acres of the fossil-bearing Quaternary beach deposits. The corridor near the port also comes within about 800 feet of the Talkeetna and Naknek formations (Wilson et al. 2012), which have produced vertebrate paleontological resources, as previously described. Further, there would be potential for indirect impact to paleontological resources present in the nearby Naknek Formation and Talkeetna Formation exposures from increased access to the area resulting from the development of the transportation corridor.

##### **Amakdedori Port**

Indirect impacts may be caused by increased erosion or other landscape changes, or from increased accessibility to paleontological resources, resulting in an increased likelihood of vandalism or unauthorized collection. Increased access to the area from project development could result in unauthorized collection, removal, excavation, or casting of fossils (including dinosaur tracks), which could result in the damage or destruction of paleontological resources.

Potential paleontological resources that could be removed would likely be common, widespread invertebrate fossils found in sedimentary rocks. It is possible that rare or unique fossils could be removed or destroyed, such as dinosaur fossils or tracks in Jurassic age rock, or Pleistocene age vertebrate/mammal fossils/remains in surficial glacial deposits.

The Amakdedori port construction footprint would cover roughly 32 acres, all in Quaternary age beach deposits that have locally produced fossils considered to be significant paleontological resources (Sandy and Blodgett 2000; Wilson et al. 2012). Additionally, the Talkeetna and Naknek formations are exposed in outcrops in the immediate vicinity of the port facility. These formations are highly fossiliferous, with the Naknek Formation in the vicinity producing a vertebrate specimen of an extremely rare Jurassic age marine reptile, *Megalneusaurus*, which represents the only find of this species in Alaska, and one of only two occurrences of this genus in North America (Blodgett

et al. 1995; Weems and Blodgett 1996). Because the subsurface geology of the port site has not been mapped in detail, it is possible that bedrock underlying the port site footprint is the Naknek and/or Talkeetna formations, with the potential presence of paleontological resources.

Port facility construction, operations, and maintenance have the potential to directly impact paleontological resources (if present) over the entire 250-acre port site footprint. The potential also exists for indirect impacts to paleontological resources present in the nearby Naknek and Talkeetna Formation exposures, due to increased access to the area from port site development.

### **Natural Gas Pipeline Corridor**

Although there is a possibility of the occurrence of paleontological resources in the pipeline corridor outside the port area, potential impacts to paleontological resources along most of the pipeline corridor are unlikely. The pipeline corridor in the vicinity of the Amakdedori port has a footprint that covers roughly 12 to 15 acres of the fossil-bearing Quaternary age beach deposits. The natural gas pipeline corridor would be within 820 feet of the Talkeetna and Naknek formations (Wilson et al. 2012). Accordingly, 12 to 15 acres of the pipeline corridor have the potential to impact paleontological resources. If ground-disturbing activities from pipeline construction, operations, or maintenance activities extend outside these 12 to 15 acres, there would be additional potential for impacts.

### **K4.13.1.2 Alternative 1**

#### **Mine Site**

The potential for paleontological resources under this alternative would be the same as under Alternative 1a.

#### **Transportation Corridor**

The potential for paleontological resources under this alternative would be the same as for the Alternative 1a port access road, and similar to Alternative 1a for the mine access road. Although the mine access road under Alternative 1 follows a different route, the geologic conditions, and therefore the potential for paleontological resources, would be similar to the mine access road under Alternative 1a.

#### **Amakdedori Port**

The potential for paleontological resources under this alternative is the same as that for Alternative 1a.

### **Natural Gas Pipeline Corridor**

The potential for paleontological resources under this alternative would be the same as under Alternative 1a.

### **K4.13.1.3 Alternative 1—Summer-Only Ferry Operations Variant**

The potential for paleontological resources under this variant would be the same as Alternative 1.

### **K4.13.1.4 Alternative 1—Kokhanok East Ferry Terminal**

The potential for paleontological resources under this variant would be the same as Alternative 1, based on similar geology at the Kokhanok east ferry terminal site.

#### **K4.13.1.5 Alternative 1—Pile-Supported Dock Variant**

The potential for paleontological resources under this variant would be the same as described for Alternative 1.

#### **K4.13.1.6 Alternative 2—North Road and Ferry with Downstream Dams, and Alternative 3—North Road Only**

The potential for paleontological resources under Alternative 2 and Alternative 3 would be comparable to Alternative 1a for the mine site. There would be a reduced potential for paleontological resources at the Diamond Point port site under either Alternative, transportation corridor, and natural gas pipeline corridor because of the absence of fossil-bearing Quaternary beach deposits. The coastal margin footprints under Alternative 2 consist of coarse alluvium outwash derived from igneous bedrock. These beach deposits are not considered amenable for fossil preservation and formation. The footprint of Alternative 3 is essentially the same as Alternative 2, except at the port site north of Diamond Point. This location is entirely in bedrock with rocky beaches composed of Cretaceous and Jurassic igneous rock.