



Best Management Practices for Fossils at Yukon Placer Mines

April 2014

Edition 1



Top: Fossil woolly mammoth tooth found at Quartz Creek.
 Centre: A well preserved fossil horse skull from Quartz Creek.
 Photo by Duane Froese.
 Bottom: Gimlex Mine Sluice plant on the Indian River.

DISCLAIMER

Nothing in the Yukon Government Best Management Practices (BMP) for fossils shall be construed as waiving compliance with regulatory requirements imposed by law. In the case of activities undertaken which may have unforeseen impacts on fossils or fossil sites, it remains the responsibility of the proponent to satisfy themselves that the measures adopted in the specific instance are appropriate to the situation and satisfy all legal requirements within the jurisdiction.

Specific best management practices for specific problems cannot be given since solutions will, of necessity, be site and issue specific. Narrative BMPs are given indicating the type of measure which may be useful.

This guide is intended to provide users with up-to-date information about best management practices for fossil objects and fossil sites discovered on the Yukon landscape but these guidelines should not be considered as comprehensive. There are both known and unknown sources of data which have not yet been incorporated and topics which have not yet been treated or addressed. These topics and data will be incorporated and new versions of the documents developed as time and resources permit. By their very nature many specific BMPs soon become obsolete as “better” BMPs become available but the concept and the identified objectives behind the examples remain valid.

Any comments, questions, or suggestions regarding the content of this document may be directed to:

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 Heritage Resources Unit
 Cultural Services Branch
 Department of Tourism & Culture
 P.O. Box 2703
 Government of Yukon
 Whitehorse, Yukon Y1A 2C6
 Phone: (867) 667-8089
 Cell phone: (867) 332-8980
 Fax: (867) 667-5377
 Email: grant.zazula@gov.yk.ca or
 heritage.resources@gov.yk.ca

All photos courtesy of Government of Yukon except as otherwise noted.

Table of Contents

- 1. Objectives 4
- 2. Context 4
- 3. Legislative Context for Protection of Fossils 5
- 4. Fossil Resources at Placer Gold Mines 6
- 5. Potential impacts to Fossil Resources as a Result of Placer Mining Activities 7
- 6. What Happens if Fossils are Uncovered?. 8
- 7. Fossil Woolly Mammoth Ivory 9
- 8. Best Management Practices for Fossils. 10
- 9. Definitions and Terms 12
- 10. Yukon Palaeontology Program 13
- 11. Reporting and Contacts 14
- 12. References: Legislation, Policy and Information on Yukon Palaeontology Research and Resource Management 16



Klondike miners in 1904 with woolly mammoth skull. Photo from Dawson City Museum 1990.54.35.



Placer miner John Flynn with woolly mammoth skull and tusks found at Hawk Mine on Sixtymile River.

1. Objectives

To protect and manage non-renewable palaeontological resources (fossils) and palaeontological sites.

To provide information and assistance to the Yukon placer mining industry to ensure the protection of Yukon's heritage.

2. Context

Palaeontological resources are the fossil remains of ancient plants and animals. Yukon's fossils tell us about past life and environments and are an important part of our heritage.

Yukon is Canada's most important and one of the world's most significant sources of ice age fossils. Fossils from the ice age, the period dating

roughly between 2.5 million to 10,000 years ago is especially relevant to understanding evolution and changes in northern ecosystems. Because much of the central and northern Yukon was not covered by glaciers during the ice age, an incredible record of ancient life is preserved in the region's permafrost.

The relationship between placer gold mining and ice age fossils goes back to the early days of the Klondike gold rush. Still today, most placer miners have encountered fossil bones at their claims. These fossils are a major source of international scientific research. By adopting fossil resource "Best Management Practices", Yukon's placer mining industry can continue to assist in the protection and appreciation of Yukon's rich ancient heritage and ensure compliance with existing placer mining and heritage legislation.

3. Legislative Context for Protection of Fossils

Fossils are protected from disturbance under the Yukon *Historic Resources Act (HRA)*. The Government of Yukon is responsible for managing fossils on non-settlement land and outside of national parks. No one may search for, investigate, excavate, disturb, or otherwise alter a fossil site on Yukon lands except in accordance with a permit under the Yukon *Historic Resources Act*. Under the HRA, all fossils found in Yukon since 1996 are owned and managed by the Government of Yukon. Under the *Umbrella Final Agreement*, fossils found on First Nation Settlement Land are owned and managed by the First Nation Government.

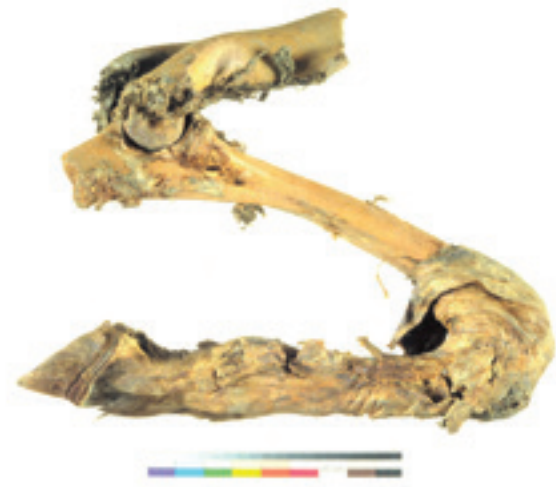
Placer mining activities in Yukon are regulated under the *Placer Mining Act* and the *Placer Mining Land Use Regulation* and are reviewed under the *Yukon Environmental and Socioeconomic Assessment Act (YESAA)*. For the review, the proponent may be required to provide adequate information to allow for the evaluation of the likelihood and significance of adverse effects of the project on fossil resources, and identify mitigation measures. Contact the Government of Yukon – Palaeontology Program office for assistance in determining any impacts to fossils as a result of your project.

The removal of all fossils, including woolly mammoth tusks and ivory, from Canada is regulated by the Canada *Cultural Properties Export and Import Act*. Contact the Government of Canada – Canada Border Services Agency for assistance on obtaining a *Cultural Properties Export Permit* if you intend to remove any fossils from Canada.

Palaeontologist Elizabeth Hall with fossil horse foot bone. Photo by David Neufeld.



Palaeontologist Grant Zazula with an American mastodon shoulder blade bone at the Yukon Palaeontology Program Collections in Whitehorse.



4. Fossil Resources at Placer Gold Mines

As many placer gold miners know, the bones of ice age mammals are regularly encountered in the Klondike and other areas of central and northern Yukon. These include bones of long extinct species such as woolly mammoths, ice age horses and most commonly steppe bison, which inhabited Yukon over 10,000 years ago. Sometimes fossils of rare species like the western camel, the Jefferson's ground sloth, or American mastodon are found too. Although it is most common to find bones, tusks, teeth and skulls, the Klondike is remarkable because ancient mummified soft tissues such as hair, skin and muscle can be found. This is because of the exceptional preservation conditions in permafrost. The permafrost preserved fossils of Yukon are an renowned internationally because they often contain genetic material – DNA – of extinct animals preserved for 100's of thousands of years.



Top right: Complete fossil forelimb from the Last Chance Horse with mummified muscle and skin found by miners Lee Olynyk and Ron Toews. Photo by Canadian Museum of Nature.

Top left: Bones from steppe bison are amongst the most common Klondike fossils. Here is a nearly complete skull.

Centre left: Palaeontologist Elizabeth Hall with collection of fossil bones.

Bottom left: 40,000 year old mummified carcass of a black footed ferret found at Sixtymile by McDougall family and housed at the Canadian Museum of Nature.



Bulldozer used to strip ground in the Klondike Goldfields.

5. Potential Impacts to Fossil Resources as a Result of Placer Mining Activities

Many placer mines in Yukon face the problem of removing the thick, frozen black muck overburden that overlies the gold bearing gravel at many creeks. This black muck and other sediment accumulated in valleys during the ice age, and is of great interest to scientists. Many of the ice age bones found at placer mines are recovered near the contact between the black muck and underlying stream gravel. Stripping with heavy machinery or hydraulic "monitoring" are still the principal ways to remove the frozen overburden to recover gold bearing gravel for sluicing. Stripping, trenching or any other method that disturbs the black muck and gravel has a high potential to disturb ice age fossils. By far, hydraulic monitoring is the best method to ensure the recovery of ice age fossils during placer mining activity.



Hydraulic monitoring to remove black muck at Quartz Creek.

6. What Happens if Fossils are Uncovered?

The following guidelines apply if and when fossils are discovered during placer mining activity:

- 1) In order to comply with the *Historic Resources Act* and *Placer Mining Act*, all fossils and remains of ice age mammals must be reported to the Yukon Palaeontology Program and Chief of Mining Land Use;
- 2) The finder will put the fossils aside, keep them protected from exposure to the weather (i.e. under a tarp, inside a shed);
- 3) The finder will contact the Yukon Palaeontology Program and the Chief of Mining Land Use to report their findings;
- 4) Based on this information, the Yukon Palaeontology Program will make arrangements to visit the placer mine, investigate the site for additional scientific evidence and information, and collect all fossils. In addition to the fossils, the Yukon Palaeontology Program may be interested in examining the black muck or gravel sediment to obtain further information of interest to scientific research.

In the event that a single intact skeleton or mummified soft tissues like skin or hair are found, immediately avoid further disturbance of the area. Protect and remove these remains along with any adhering or surrounding sediment to the best of your ability and contact the Yukon Palaeontology Program.

- Top: A fossil horse jaw emerges from frozen gravel.
- Centre: Collection of fossil bones at Johnson family mine on Eldorado Creek.
- Bottom: Remains of a woolly mammoth skeleton recovered at while stripping overburden at Gold Run Creek in 1992.



7. Fossil Woolly Mammoth Ivory

Possibly the most iconic ice age fossils to be found at Yukon placer mines are the tusks of woolly mammoths. These tusks are long (up to 3.5 m long), heavy (up to 100 kg) modified incisor teeth that grew continuously throughout the life of a woolly mammoth. Mammoths had two tusks and these fossils can sometimes be found as pairs.

The scientific study of woolly mammoth teeth can provide important insight into past environments that an animal faced as well as enable the reconstruction of the health and life history of an individual mammoth.

Some fossil woolly mammoth ivory has limited scientific significance and can be made available for commercial sale.

If you recover fossil mammoth tusks or ivory please contact the Yukon Palaeontology Program. If you are interested in selling fossil mammoth ivory recovered at your placer mine, the following guidelines apply:

- 1) All fossil woolly mammoth tusks and ivory must be inspected by the Yukon Palaeontology Program to determine it's scientific significance;
- 2) If the tusk or ivory is determined to not be scientifically significant, the Government of Yukon may transfer ownership of the fossil to an individual and enable the person to sell the fossil ivory;
- 3) If the intention is to sell the tusk or ivory internationally, the exporter must obtain a *Canada Cultural Properties Export Permit* from the Canada Border Services Agency.



- Top: Palaeontologist Tyler Kuhn with a woolly mammoth tusk.
- Bottom: Reconstruction of woolly mammoth by George Teichmann.

8. Best Management Practices for Fossils

Activity	Recommended Action
Stripping frozen overburden during placer mining	<p>Prior to work, obtain information on the location of known fossil sites and what types of fossils to look out for in the area.</p> <p>Inform crews of laws regulating Yukon fossils – fossils bones, teeth, and skulls are not to be kept by crew workers as souvenirs or sold commercially.</p> <p>If you know in advance that you will be stripping frozen black muck and anticipate recovering fossils, contact the Yukon Palaeontology Program so they can prepare to conduct a site visit.</p> <p>If you recover fossils at your placer mine, place the fossils aside and protect them, then contact the Yukon Palaeontology Program to arrange a site visit for fossil collection.</p> <p>To comply with the <i>Placer Mining Land Use Regulation</i>, newly discovered fossils and fossil sites must be reported to the Chief of Mining Land Use.</p> <p>If you recover ancient mummified animal remains such as hair, skin or muscle, avoid further disturbance to the immediate area and contact the Yukon Palaeontology Program.</p>

Activity	Recommended Action
Recovery of fossil mammoth tusks and ivory	<p>If you recover any fossil woolly mammoth tusks or ivory, put it aside and protect it.</p> <p>Contact the Yukon Palaeontology Program to arrange for an inspection of the tusks or ivory either in the field or at the Whitehorse office.</p> <p>Contact Canada Border Services Agency to apply for a <i>Canada Cultural Properties Export Permit</i> if you intend to transport the tusks or ivory internationally.</p>



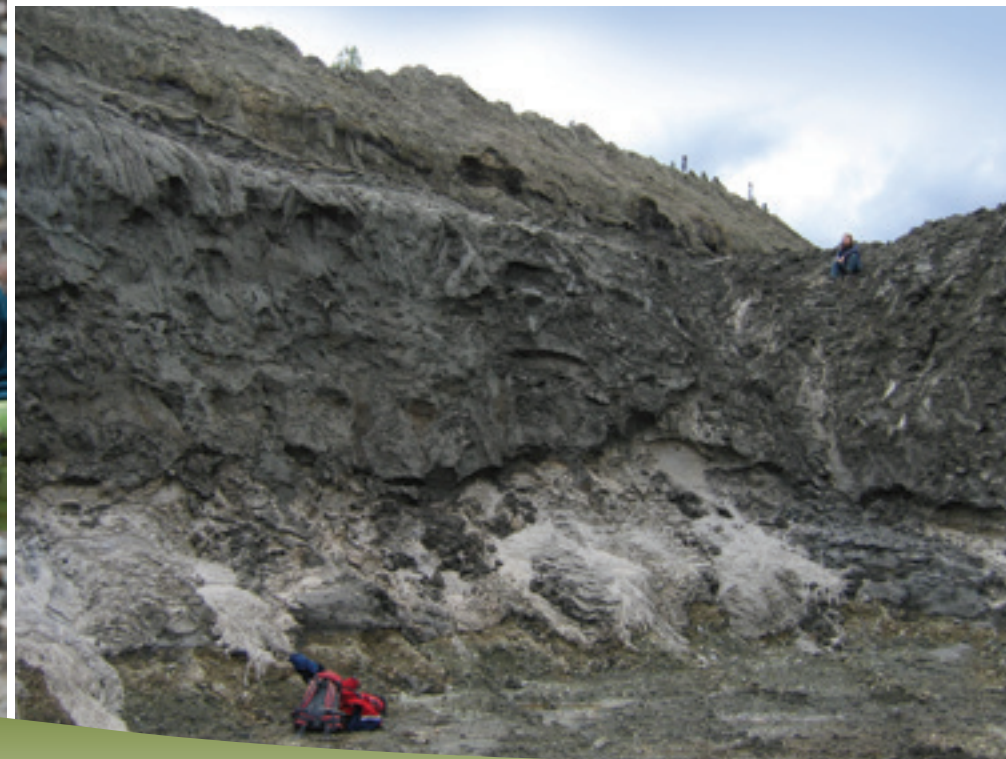
Right: Fossil woolly mammoth skull and tusks found at Hawk Mine on Sixtymile River.

Bottom: Collection of woolly mammoth tusks presented for inspection at the Yukon Palaeontology Program office in Whitehorse.



Left: Palaeontologist Susan Hewitson after discovering a rare lion forelimb bone.

Right: Black muck with volcanic ash (tephra) at the base (white) at Goldbottom Creek.



9. Definitions and Terms

FOSSIL

Ancient remains for plants, animals or other life in the past. These include, but are not limited to bones, teeth, skulls, impressions in rock, mummified soft tissue, mineralized shells. A fossil is a *Palaeontological Object* as identified in the *Historic Resources Act 61(1)*.

PALAEONTOLOGY

The study of ancient life, including plants, animals and other organisms, other than humans and human made artifacts.

ICE AGE

The geological time period called the Pleistocene epoch which spans the period between 2.5 million and 10,000 years ago. Most of the sediment accumulated in valleys of central and northern Yukon was laid down during this time.

BLACK MUCK

Black muck is the organic rich, frozen sediment found in many valleys that often contains fossils and other scientific evidence of the ice age. Volcanic ash layers or tephra are common in the black muck and help scientists determine the age of the ice age fossils.

TUSK

Tusks are the modified incisors of elephants and their extinct relatives. They are composed of dentine or more commonly called ivory. Fossil woolly mammoth tusks and ivory are *Palaeontological Objects* as per the *Historic Resources Act 61(1)*. It is recognized there is both scientific and commercial interest in fossil tusks and ivory.

LAND MANAGER

Agency responsible for the administration of the land on which fossils were discovered. For example, Settlement Land is administered by the First Nation; Quartz and Placer leases are administered by the Chief of Mining Land Use; Land Use Permits by Inspectors identified in the permit; private land is administered by the land owner even though fossils recovered from private land are owned by Government of Yukon.

Top: A fossil American mastodon skeleton at the Yukon Government Palaeontology Program collections in Whitehorse.

Middle: Geologist Duane Froese extracting a core of frozen black muck for research.

Bottom: Organizing and cleaning fossil bones at Klondike palaeontology field office.



10. Yukon Palaeontology Program

The Government of Yukon established the Palaeontology Program in 1996 to meet its obligations under the *Historic Resources Act* and the *Umbrella Final Agreement*. The Program conducts and facilitates research on Yukon's fossils and ancient past. All fossils collected in Yukon become accessioned into the territorial fossil collection in Whitehorse which includes over 20,000 fossils. These fossils are an important archive for scientific researchers from all over the world and for Yukoner's to learn more about our shared ancient history.

The Palaeontology Program operates a field program to visit fossil sites, conduct research and collect fossils during the summer months – May to October. A field office is present in the Dawson City area to provide close access to fossil sites in the Klondike Goldfields for resource management and research.

Information on fossils in Yukon and the location of known fossils sites can be obtained from the Government of Yukon – Palaeontology Program.



Left: Palaeontologist Mathias Stiller with a fossil woolly mammoth tusk emerging from the frozen muck.

Top right: Archaeologist Christian Thomas collecting bones left by water pipeline along Hunker Creek.

Bottom right: Fossil tooth of a baby woolly mammoth.



Left: Fossil ice age wolf skull in the Government of Yukon Palaeontology Collections.

Opposite page: Walking the creeks to collect fossil bones after a day of hydraulic monitoring. Photo by David Neufeld.

11. Reporting and Contacts

Report all fossils uncovered at placer mines to:

PALAEONTOLOGY PROGRAM WHITEHORSE OFFICE:

Yukon Palaeontology Program
Heritage Resources Unit
Cultural Services Branch
Department of Tourism & Culture
Government of Yukon
P.O. Box 2703
Whitehorse, Yukon Y1A 2C6
Phone: (867) 667-8089 or
Toll-free: 1-800-661-0408
Cell phone: (867) 332-8089
Email: grant.zazula@gov.yk.ca or
heritage.resources@gov.yk.ca

YUKON PALAEONTOLOGY PROGRAM KLONDIKE FIELD OFFICE:

Cell phone: (867) 332-8981
Email: elizabeth.hall@gov.yk.ca or
heritage.resources@gov.yk.ca

COMPLIANCE, MONITORING AND INSPECTIONS OFFICES

Department of Energy, Mines and Resources

DAWSON MINING INSPECTIONS OFFICE

1242 Front Street
P.O. Box 334
Dawson City, Yukon Y0B 1G0
Phone: (867) 993-7300
Fax: (867) 993-6349

MAYO MINING INSPECTIONS OFFICE

6th Avenue and Centre Street
P.O. Box 96
Mayo, Yukon Y0B 1M0
Phone: (867) 996-2568
Fax: (867) 996-2567

For international export of fossils:

CANADA BORDER SERVICES AGENCY

Suite 110 – 300 Main Street
Whitehorse, Yukon Y1A 2B5
Phone: (867) 667-3944





Reconstruction of Ice Age Yukon
by George Teichmann.

12. References: Legislation, Policy and Information on Yukon Palaeontology Research and Resource Management

GOVERNMENT OF YUKON

Heritage Resources Unit – Palaeontology Program:

<http://www.tc.gov.yk.ca/palaeontology.html>

Ice Age Klondike: fossil treasures from the frozen ground:

http://www.tc.gov.yk.ca/publications/ice_age_klondike_2011.pdf

Yukon Beringia Interpretive Centre:

<http://beringia.com>

LEGISLATION

Yukon Historic Resources Act

http://www.tc.gov.yk.ca/pdf/historic_resources_act.pdf

Placer Mining Land Use Regulation

http://www.gov.yk.ca/legislation/regs/oic2003_059.pdf

GOVERNMENT OF CANADA

Canada Heritage – Cultural Properties Export and Import Act:

<http://www.pch.gc.ca/eng/1358364893642/1358365043241>