

# A BEGINNERS GUIDE TO ORE EXPLORATION






## 2009 PRODUCTION NOTES






Rebecca Chouinard has prepared this guide booklet in consultation with representatives from the Wek'eezhii Land and Water Board (WLWB), the Wek'eezhii Renewable Resources Board (WRRB), and the TliCho Government (TCG). It is part of a project that is investigating effective methods to transfer mining knowledge to communities involved in or affected by mining. This research is made possible by the generous commitments by the WLWB, WRRB, TCG, INAC, BC Government, NSERC, and the University of British Columbia (under the supervision of Dr. Marcello Veiga and Dr. Dirk van Zyl). Any questions or comments may be directed to Ms. Chouinard at [Rebchouinard@gmail.com](mailto:Rebchouinard@gmail.com).

## GEOLOGISTS LOVE ROCKS









They identify rocks	They determine how rocks form	They determine the age of rock formation
<p>Rocks are classified as being: <b>Igneous</b>, <b>Sedimentary</b>, or <b>Metamorphic</b> depending on how they form</p>  <div style="border: 1px solid black; border-radius: 50%; padding: 10px; display: inline-block; margin-left: 20px;"> <p style="color: blue; text-align: center;">Granite is Igneous</p> </div>	<p>This is a <b>Sedimentary</b> rock that formed in a marine environment</p>  <p style="text-align: center;">SHALE</p>	<p>NWT has the oldest rock known on earth – it is 4.03 billion years old</p>  <div style="border: 1px solid black; padding: 5px; display: inline-block; margin-left: 20px;"> <p style="color: blue;">The Acasta Gneiss</p> </div>

## GEOLOGISTS LOVE FINDING VALUABLE ROCKS

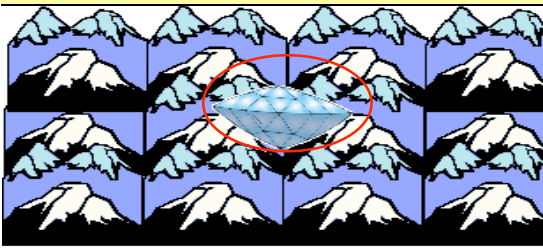
Rocks that have economic value are called **ORE**

 <div style="border: 1px solid black; padding: 5px; display: inline-block; margin-left: 100px;"> <p style="color: purple;">Diamond</p> </div> <div style="border: 1px solid black; padding: 5px; display: inline-block; margin-top: 10px;"> <p>KIMBERLITE ORE</p> </div>	 <div style="border: 1px solid black; padding: 5px; display: inline-block; margin-left: 100px;"> <p style="color: purple;">Gold</p> </div> <div style="border: 1px solid black; padding: 5px; display: inline-block; margin-top: 10px;"> <p>QUARTZ ORE</p> </div>	 <div style="border: 1px solid black; padding: 5px; display: inline-block; margin-left: 100px;"> <p style="color: purple;">Silver</p> </div> <div style="border: 1px solid black; padding: 5px; display: inline-block; margin-top: 10px;"> <p>GALENA ORE</p> </div>
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**ORE** is transformed into products we use everyday.

<p><b>Gemstones</b></p>  <p>Diamond      Emerald</p>	<p><b>Electronics</b></p>  <p>Zinc      Cobalt</p>	<p><b>Construction</b></p>  <p>Gravel      Limestone</p>	<p><b>Energy</b></p>  <p>Coal      Steel</p>
<p><b>Household Products</b></p>  <p>Barite      Quartz</p>	<p><b>Transportation</b></p>  <p>Copper      Aluminium</p>	<p><b>Farming</b></p>  <p>Calcite      Apatite</p>	<p><b>Medicine</b></p>  <p>Carbonate      Kaolinite</p>

There are a lot of rocks - Finding **ORE** in rocks is like finding a needle in a haystack



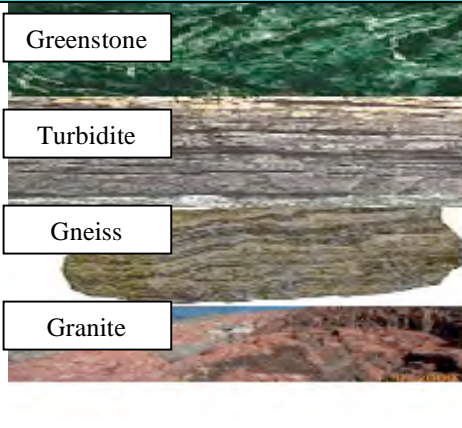
## STAGE 1: DESKTOP STUDY

The first step is to research your area of interest

### 1) Study a map of your region

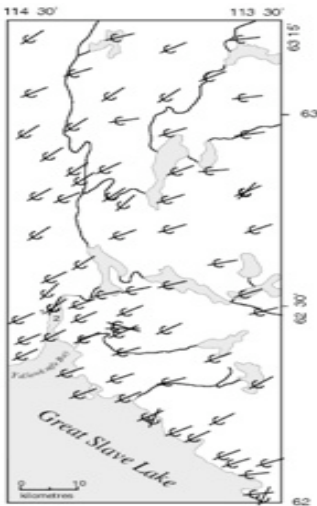
### 2) Study the rocks in the region

### 3) Study the minerals in these rocks



### 4) Study where glaciers existed and the direction they moved

Great Slave Lake Striations



#### DID YOU KNOW?

As glaciers advance, they push rocks away from their origin. When glaciers melt away, they leave behind clues that help us determine the direction they moved. Glaciers scratch rocks along their path – these are called **Striations**. Geologists measure the direction of **Striation** marks and use them to trace back the location of valuable rocks. Glacial landforms also provide us with clues. **Eskers** run parallel to ice flow direction, **Moraines** run perpendicular to ice flow, and **Drumlins** are elongated in the direction of ice flow.

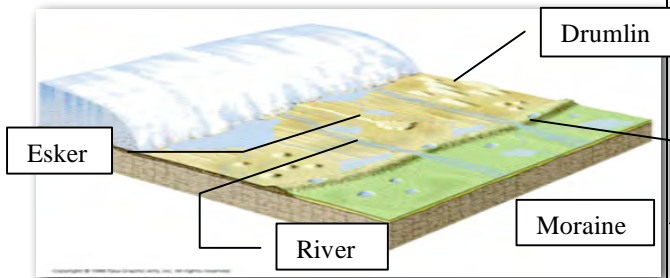
## STAGE 2: FLY CAMPS

Now you are ready to visit the land for the first time

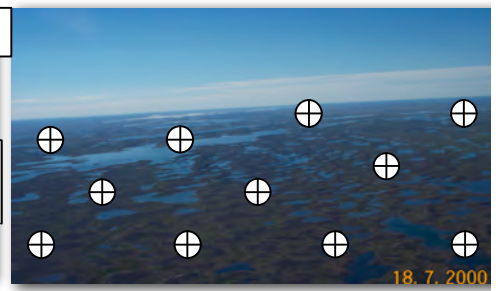
1) You need gear and a helicopter



2) Draw glacial land features onto your map from the air

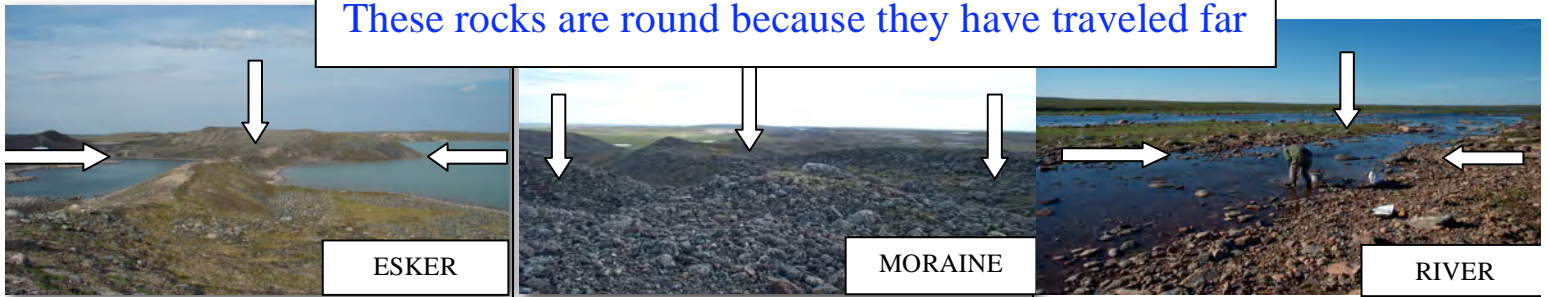


3) Land and take a sample every ~10kms



4) Sample **Eskers**, **Moraines**, and rivers; they collect material from a large area to increase your chances of finding **ORE**

These rocks are round because they have traveled far



Every few days you pack up your camp and fly to a new area = FLY CAMPS

Sampling crews work in the summer



Crews consist of about 10 people

Crews sleep, work, and eat in temporary tents



# SAMPLING PROCEDURES

## 1) Dig



Fill hole up afterwards so caribou don't trip

## 2) Screen



1 inch mesh screen and describe the rocks that are too big

## 3) Bag



Fill 10-20 Litre sample bags with material

## 4) Tag



Record the location (GPS) and describe the sample

## 5) Describe



Describe bedrock and measure the direction of **Striation** marks

## 4) Ship

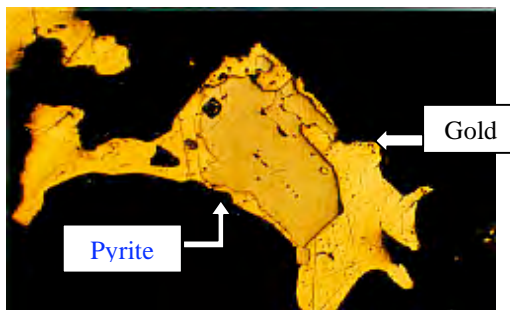


Send hundreds of samples to the lab for analysis

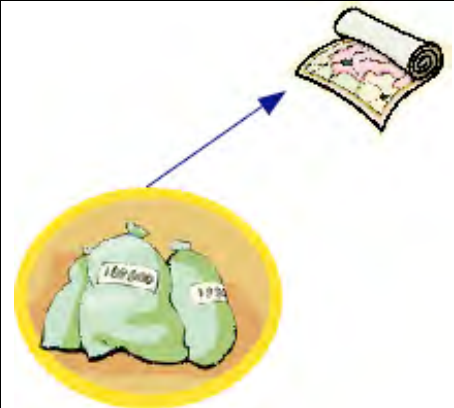
**If an ORE clue is found, more detailed sampling will take place**



OBSERVATION



LAB RESULTS



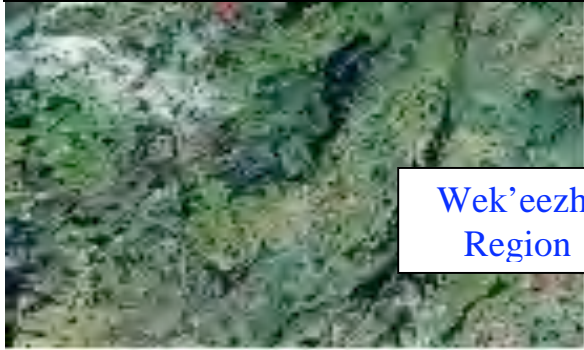
RETURN TO SITE

# STAGE 3: PRELIMINARY STAGE



You return to the region where clues were found

**You focus on a smaller area**

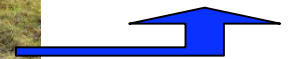


Wek'eezhi Region

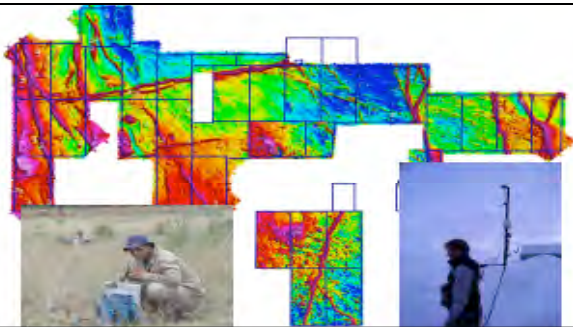
**1) Sample Till every ~100 Meters**  
**Till** has not traveled far and has angular grains



Sample **frost boils**: freeze-thaw cycles push deep rocks to the earth's surface



**2) Do geophysics surveys to learn what rocks are deep in the ground**



Gravity & Magnetic surveys tell you about the rocks underground

**3) Drill to collect rock core for analyses**

Small diamond drills recover rock samples



**4) Describe rock and send to lab for analysis**



Rock is extracted from the ground in cylinders called "rock core"

**Camps are more permanent**

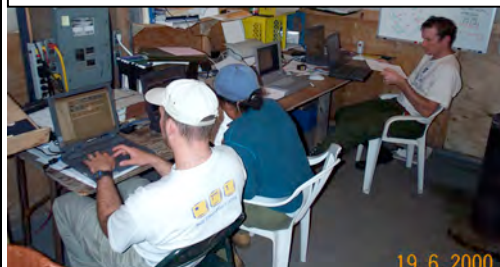
Sleep/work in canvas/wood tents with stoves



29. 6. 2000

**There are more people working**

Camps have ~50-100 people



19. 6. 2000

**You explore in all seasons**

Sample **Till** in summer  
 Drill/Geophysics in winter



## STAGE 4: ADVANCED STAGE

You choose a target to drill for **ORE** based on your analyses

You focus on a defined area

Your camps are larger



McKay Lake Region



Snap Lake

Exploration occurs in all seasons

There are more people, equipment, and buildings

Collect 1 **Tonne** drill samples

Determine the **Grade** of the **ORE**



Large diameter drills grind rocks that are then collected for analyses in 1 **tonne** bags



The **Ore Grade** refers to the concentration of saleable material compared to the concentration of the surrounding rock  
 Example: Diamond **GRADE** =  $\frac{\text{carats}}{\text{tonne of rock}}$   
 1 **carat** = 200 mg

## STAGE 5: FEASIBILITY STAGE

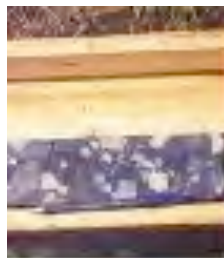
You weigh the financial costs and benefits

1) Determine the value of your **ORE**

- a) Size of deposit  
 b) Quality of **ORE**  
 Diamonds
- Cut
  - Clarity
  - **Carat**
  - Colour

### Examples

0.2 **carats per tonne**  
 a large diamond deposit



Kimberlite  
 ← **ORE**

Fort-a-la-corne, SK

0.3 **carats per tonne**  
 a high quality diamond deposit



Victor, ON

## 2) Determine the cost and time required to build the mine

- a) Proximity to City Centers
- b) Community Acceptance
- c) Technology to Recover **ORE**
- d) Environmental Surroundings

North > 1 **carat/tonne**

The **ORE Grade** must be high in the remote north to develop a mine due to the high expenses

### Additional Mine Costs



Reagents



Equipment



Buildings



Power



Salaries



Reclamation

If the benefits outweigh the costs, you decide to build a mine

... then the regulatory process begins



Remember – the regulatory process is expensive and time consuming and at this point you still haven't produced or sold any **ORE**

## DEFINITION OF TERMS

Bedrock	Firm foundation/ground layer of unbroken solid rock
Carat	A unit of weight in gemstones equal to 200 milligrams
Drumlin	An elongated hill or ridge of material deposited by a glacier
Esker	A ridge of gravel and other sediment; deposited by meltwater from glaciers or ice sheets
Frost Boil	A circular uplift in soil caused by the freezing and thawing of moisture below ground
Moraine	An accumulation of boulders, stones, or other debris carried and deposited by a glacier
Ore	A mineral or rock that can be mined for profit
Ore Grade	A measure that describes the concentration of a valuable natural material in its surrounding <b>ore</b>
Striations	Scratches or parallel grooves on the surface of a rock, resulting from a moving glacier
Till	Glacial material consisting of an unsorted mixture of clay, sand, gravel, and boulders
Tonne	A unit weight equal to 1,000 kilograms