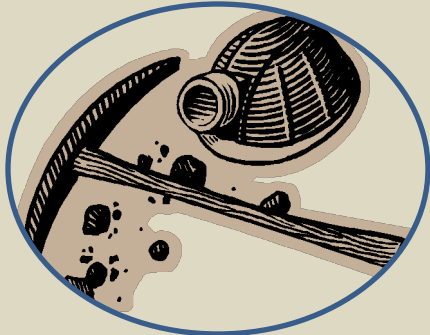


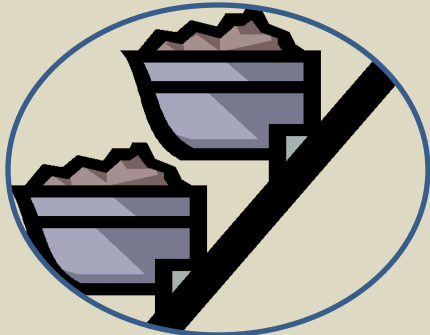
# MINING



ORE



EXPLORATION



MINE CYCLE

# WHAT IS ORE?



ORE is Rocks & Rocks with Minerals of Value

# Rocks and Minerals of the Slave Province



Iron



Copper



Nickel



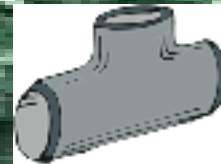
Silver



Zinc



Gold



Lead



Tungsten



Cobalt



Lithium

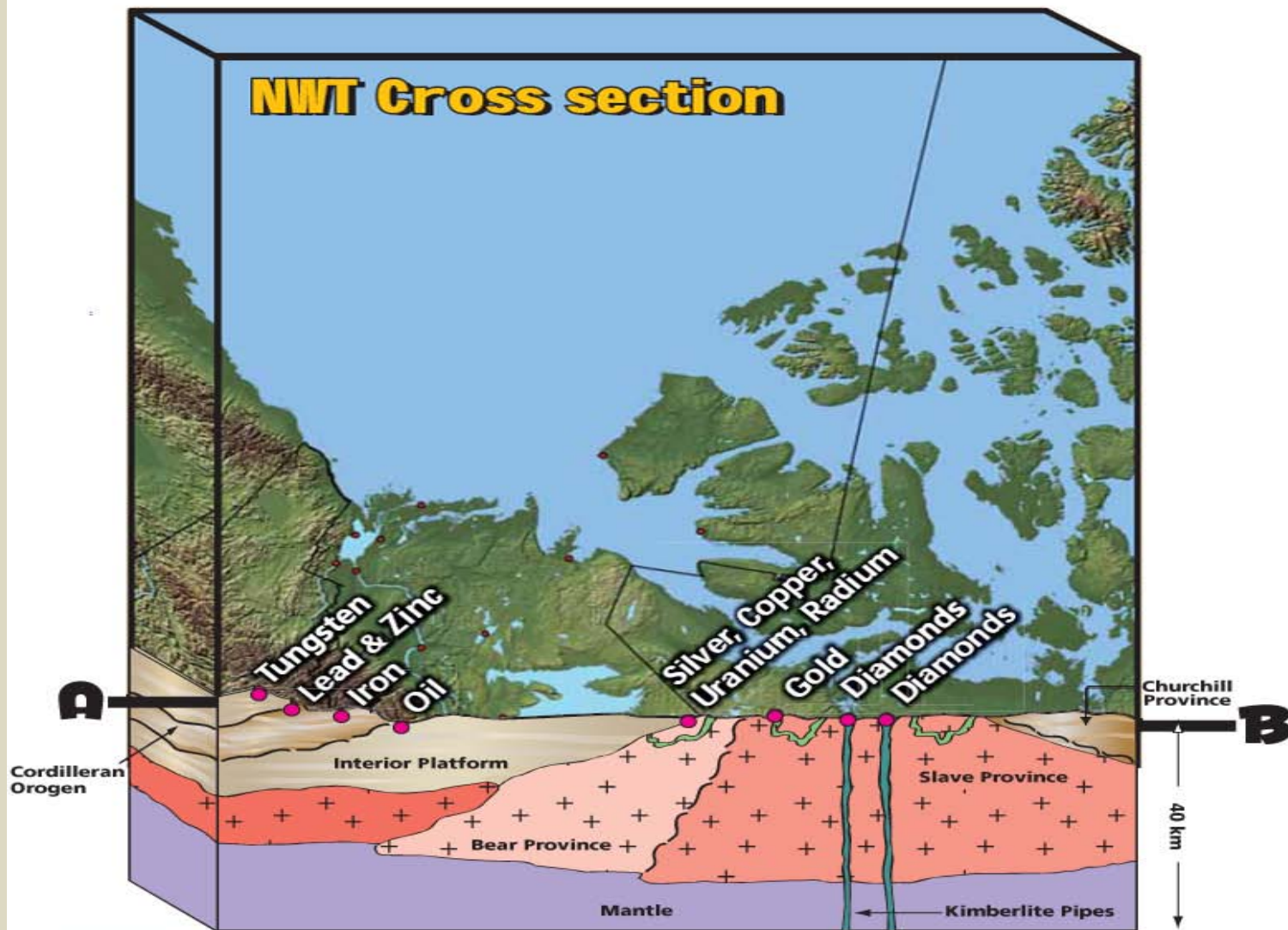


Uranium








Diamond

NWT ORE



## Legend

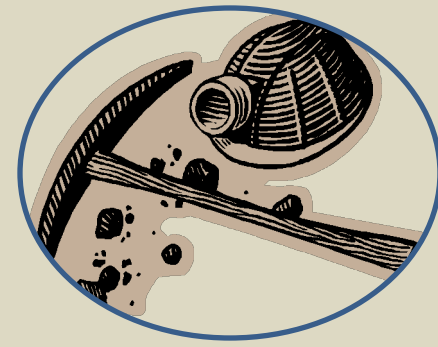
	<b>Oil/Ore</b> (gold, diamonds, zinc & gas)		<b>Volcanic Rocks</b>
	<b>Sedimentary Rocks</b>		<b>Mantle</b>
	<b>Granitic Rocks</b>		

Schreiner, D., Humphries, W., Baldwin, D., Bruce, K., Daniel, S., and Hauser, B., 2007.

Northwest Territories Geoscape: Rocks and Resources; NWT Educational Publication 2007-2. 1 poster.



# EXPLORATION

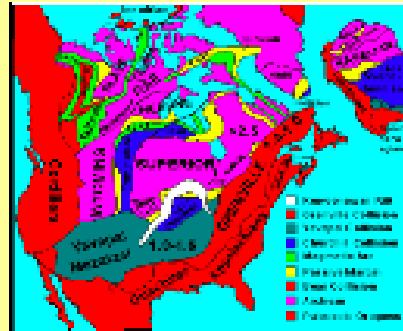


# Levels of Exploration

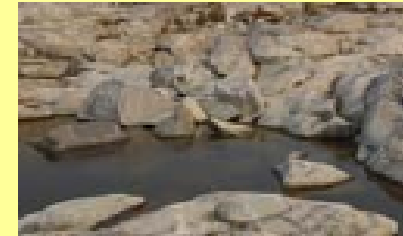


- 1. Desktop Study**
- 2. Fly Camps**
- 3. Preliminary Study**
- 4. Advanced Exploration**
- 5. Feasibility Study**

## Local Geology



## Local Mines

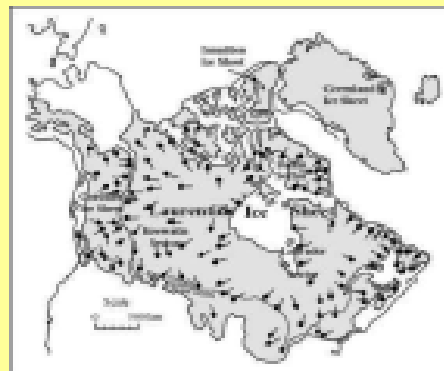


# DESKTOP STUDY

## Read & Learn



## Ice Flow Direction

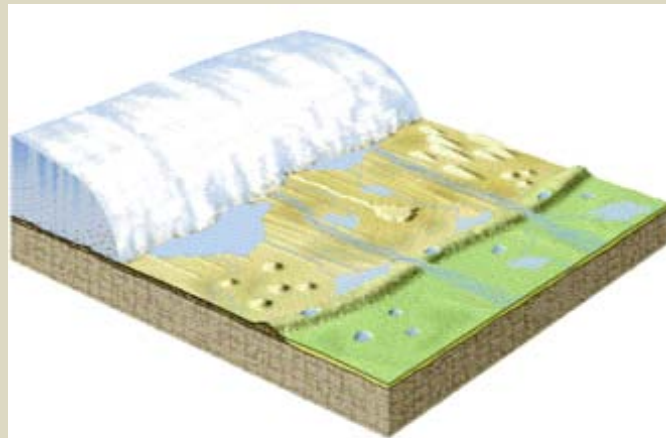


## History of Glaciers

# Clues

## Glacial History

Striation marks and glacial landforms are mapped



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# Levels of Exploration

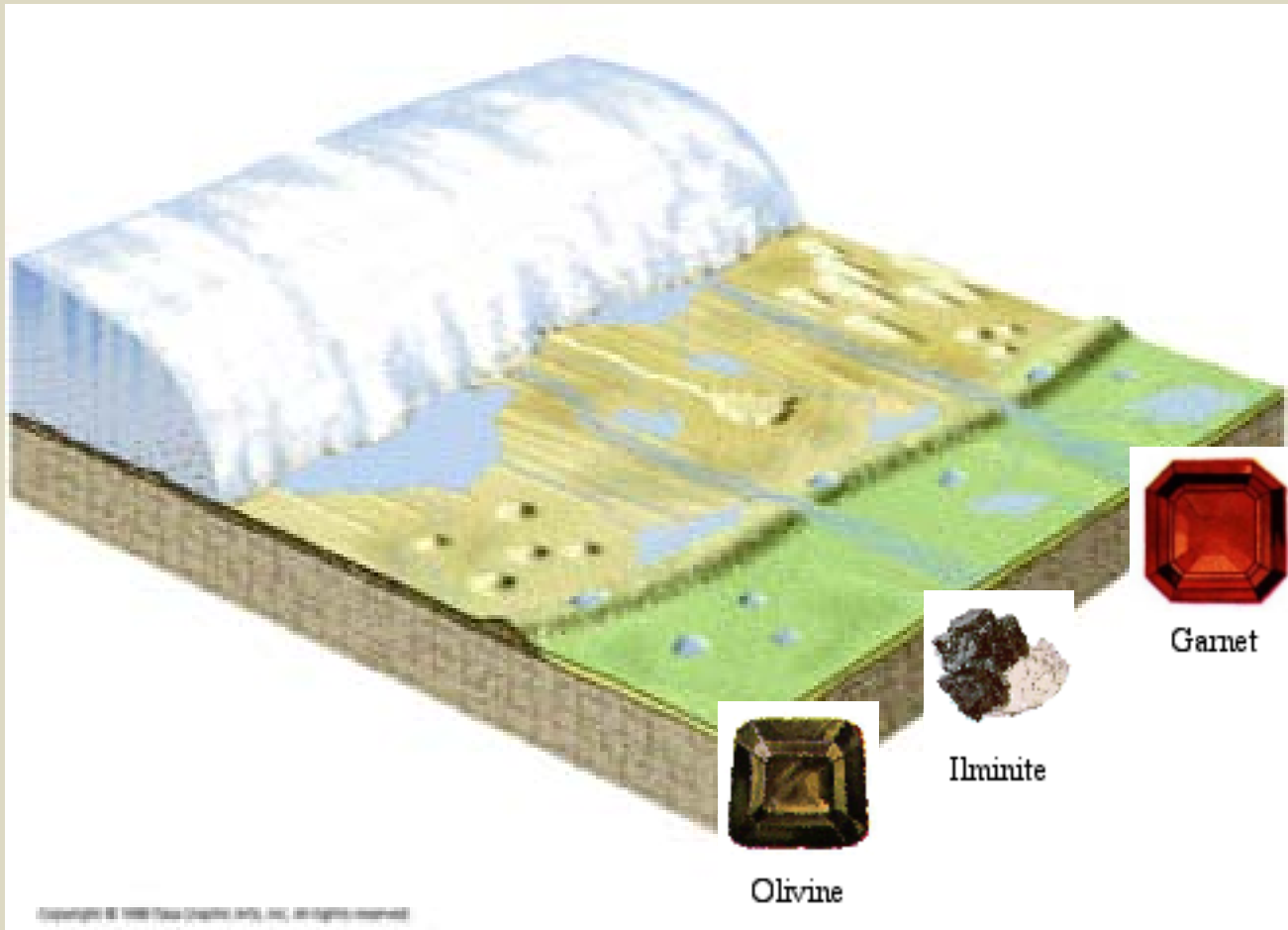


**1. Desktop Study**

**2. Fly Camps**

# Glacial History

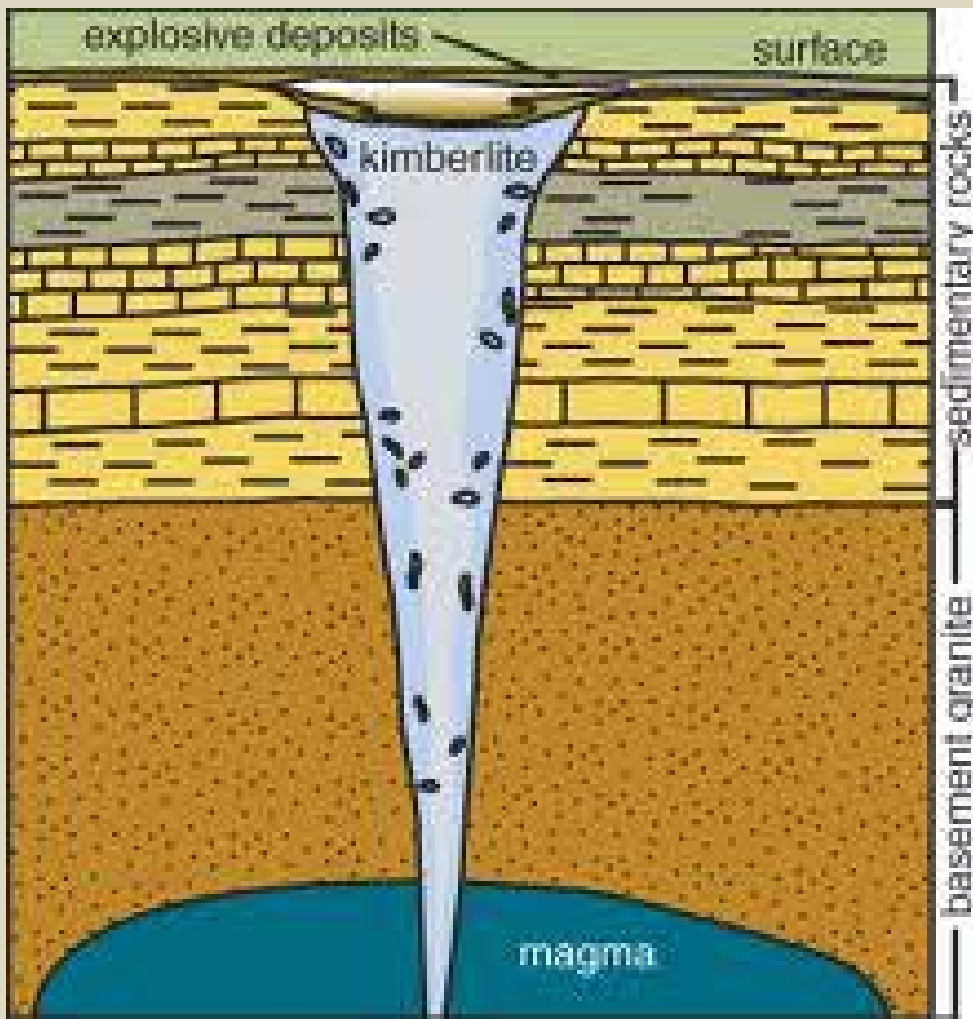
Ice movement: Drift Prospecting



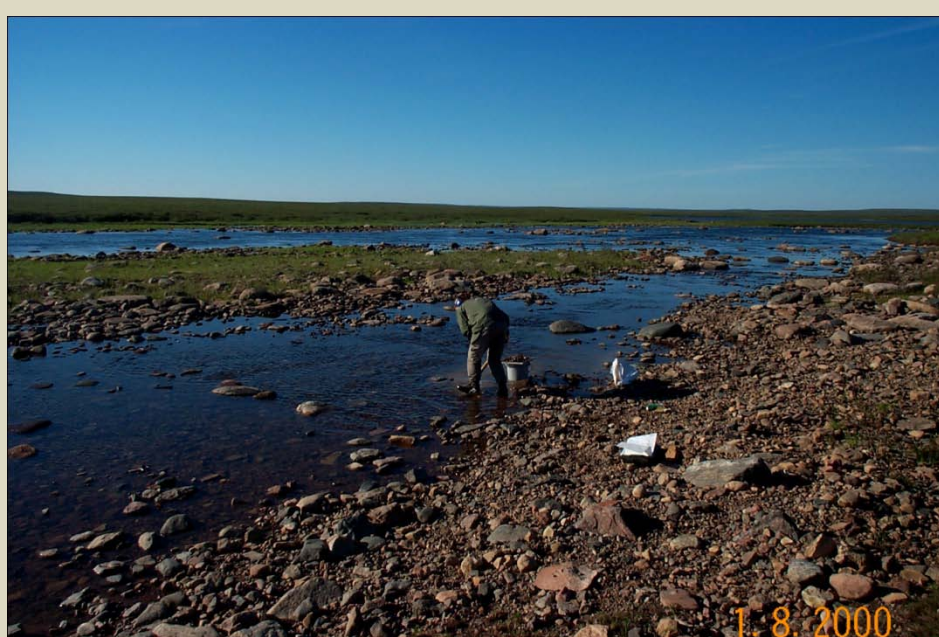
Find the indicators, trace them back to the source

# Kimberlite Pipe

## Indicator Minerals







# SAMPLING







## CAMPS





# Levels of Exploration



- 1. Desktop Study**
- 2. Fly Camps**
- 3. Preliminary Study**



**Frost boils: deep rocks pushed to surface because of freeze-thaw cycles**



**Till is deposited directly from glaciers. This material has not traveled far.**





Photo credit: Maiko Sell



**Camps are more permanent, have more people,  
and operate year round**



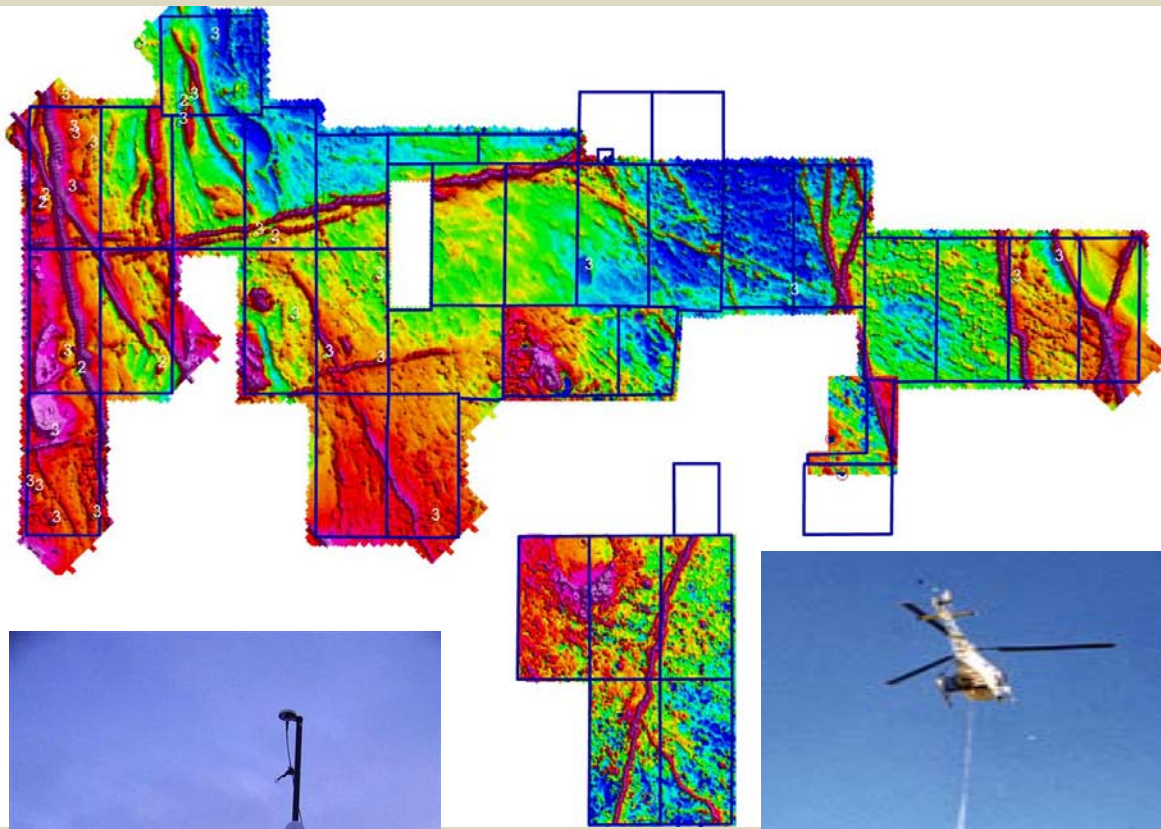


Photo credit: Maiko Sell



# GEOPHYSICS SURVEYS

# Drill Program





# Levels of Exploration

**1. Desktop Study**

**2. Fly Camps**

**3. Preliminary  
Study**

**4. Advanced  
Exploration**



# Advanced Program



- Larger Camps
- Defined Drill Targets
- Large Drill Samples  
(1 tonne bags)
- The GRADE of the ore  
is determined

Diamond GRADE = carats / tonne of rock

1 carat = 200 mg

# EXAMPLES

0.2 carats per tonne

Large deposit



Fort-a-la-corne, SK

[www.saskmining.ca](http://www.saskmining.ca)

0.3 carats per tonne

High quality



Victor, ON

[attawapiskat.com](http://attawapiskat.com)

North \$\$ = > 1 carat/tonne

# Levels of Exploration



- 1. Desktop Study**
- 2. Fly Camps**
- 3. Preliminary Study**
- 4. Advanced Exploration**
- 5. Feasibility Study**

# Mineral Exploration

- Difficult
- Expensive
- Takes Time

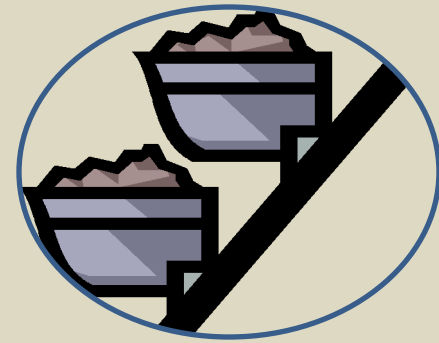




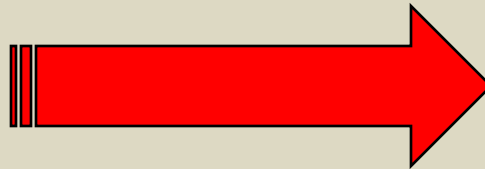
# We do this... To get this...

- [http://www.bcminerals.ca/files/video\\_resources/000180.php](http://www.bcminerals.ca/files/video_resources/000180.php)

# THE MINE CYCLE



Ore Body



Gold ring

**How do we go  
from this..**

**..to this?**

# Mining

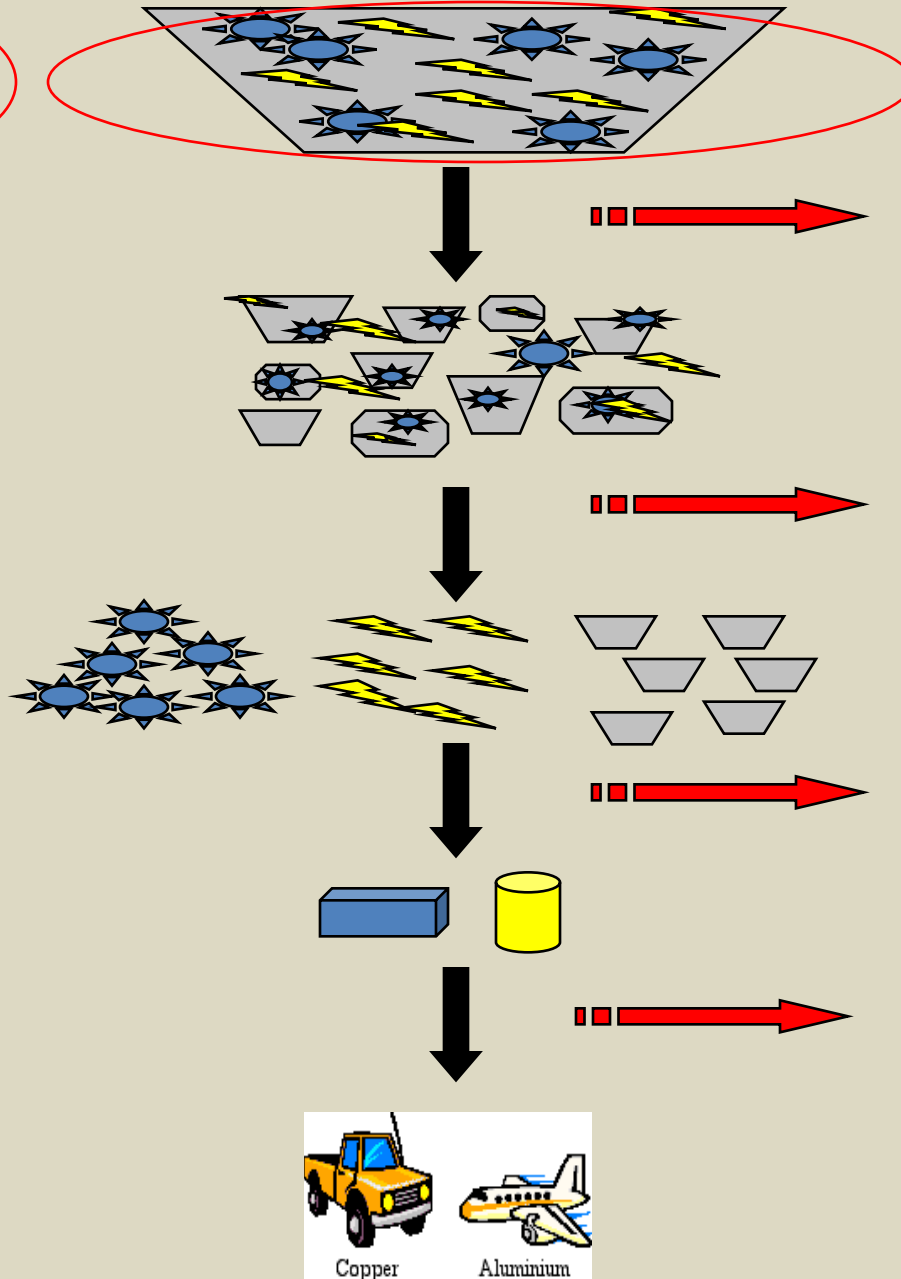
Ore  
Removal

Crush

Separate

Refine

Transform



WASTE

Dust

Noise

Ammonia

Tailings

Waste Rock

Metals

Fuel

Chemicals

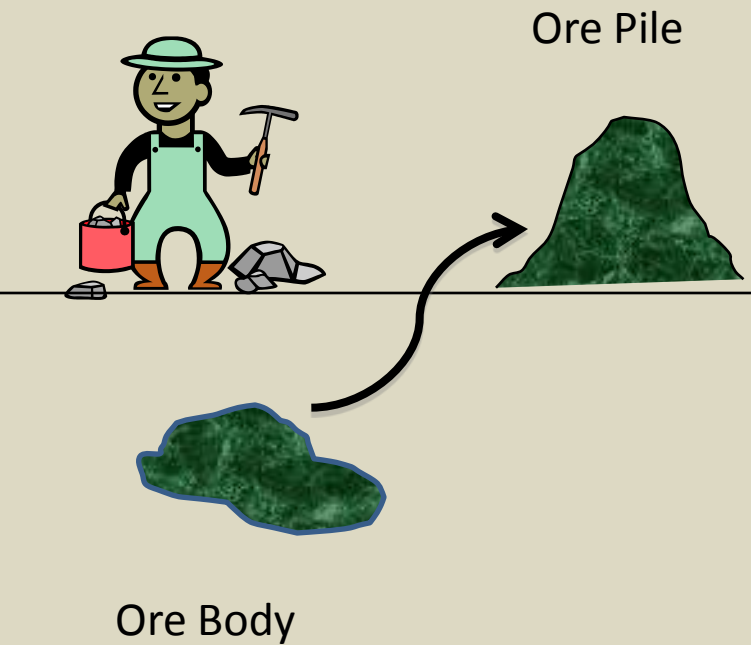
Buildings

Equipment

Garbage

Waste Water

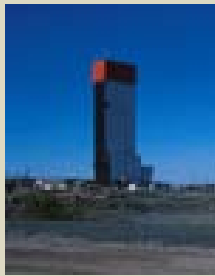
# Step 1 – Ore Removal



**Open Pit**  
Ekati, Diavik



**Underground**  
Con, Giant, Prairie  
Creek, Cantung,  
Snap



# Step 1 – Ore Removal

## Blast



## What waste is created?

- Ammonium
- Dust
- Sediment/small rock fragments
- Waste Rock
- Fuel/exhaust
- Stockpiles
- Runoff water



# Mining

Ore  
Removal



Crush



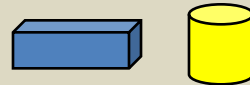
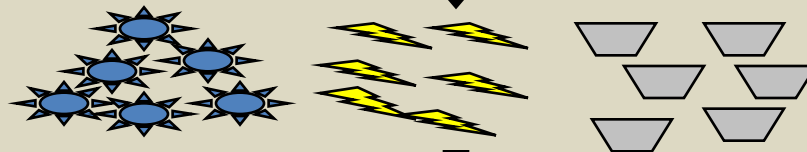
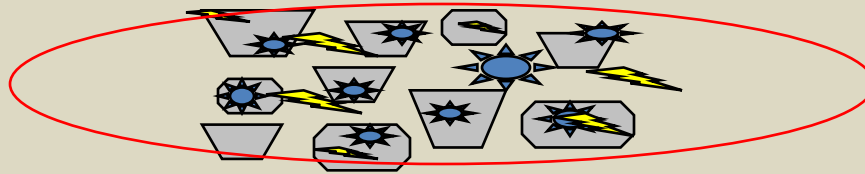
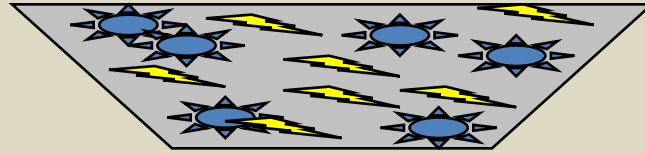
Separate



Refine



Transform



WASTE

Dust

Noise

Ammonia

Tailings

Waste Rock

Metals

Fuel

Chemicals

Buildings

Equipment

Garbage

Waste Water



# Step 2 - Crushing

Break up ORE

What waste is created?

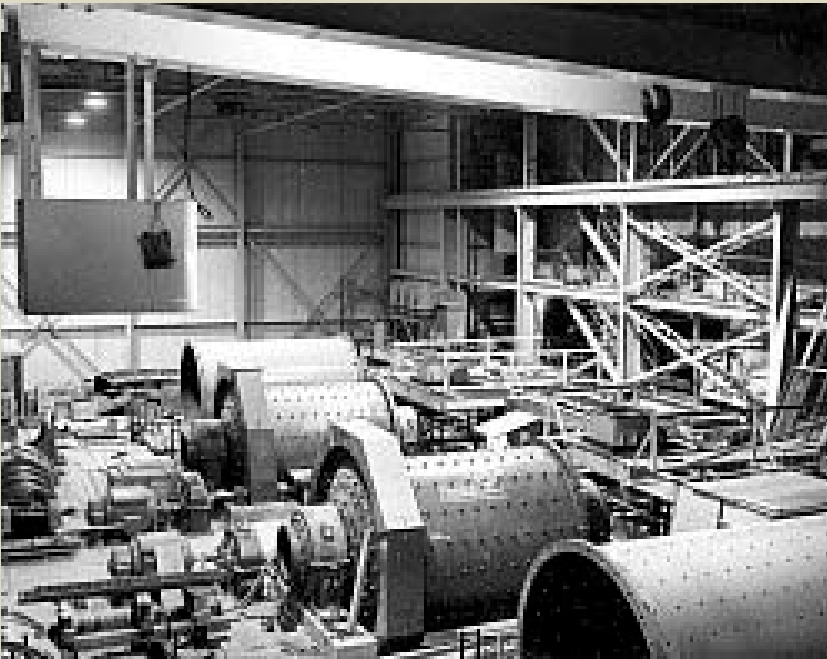


- Dust
- Fuel/exhaust
- Chemicals
- Tailings
- Contaminated water
- Buildings/Equipment

Crush & Grind

# Crushing Devices

## Crushers at Pine Point



Uganda

Mozambique



# Mining

Ore  
Removal



Crush



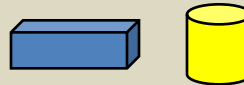
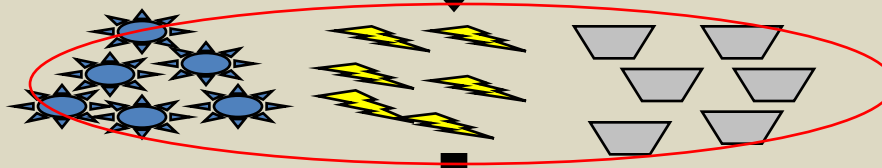
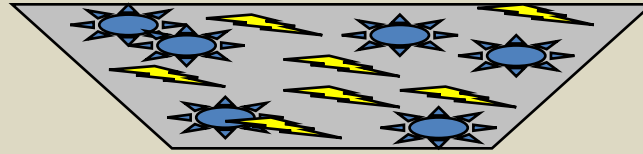
Separate



Refine



Transform



WASTE

Dust

Noise

Ammonia

Tailings

Waste Rock

Metals

Fuel

Chemicals

Buildings

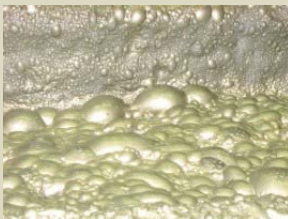
Equipment

Garbage

Waste Water

# Step 3 - Separating

Get valuable minerals out of rock



## SEPERATION

- We use the properties of the materials to separate the grains
  - Sizing
  - Gravity
  - Magnetic
  - Floatation
  - Electrostatic





# Size Separation



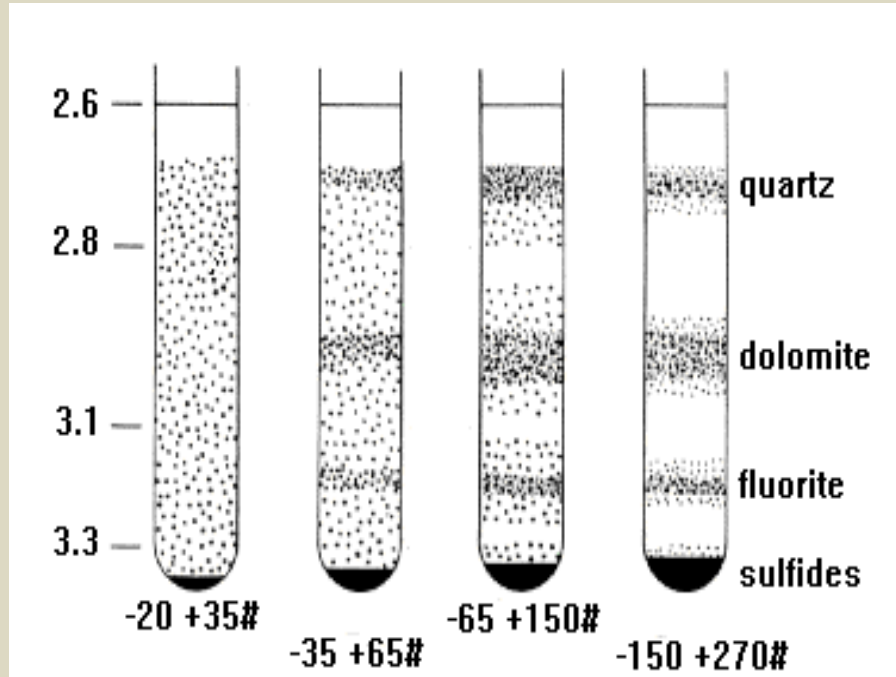
Mining Shaker Table



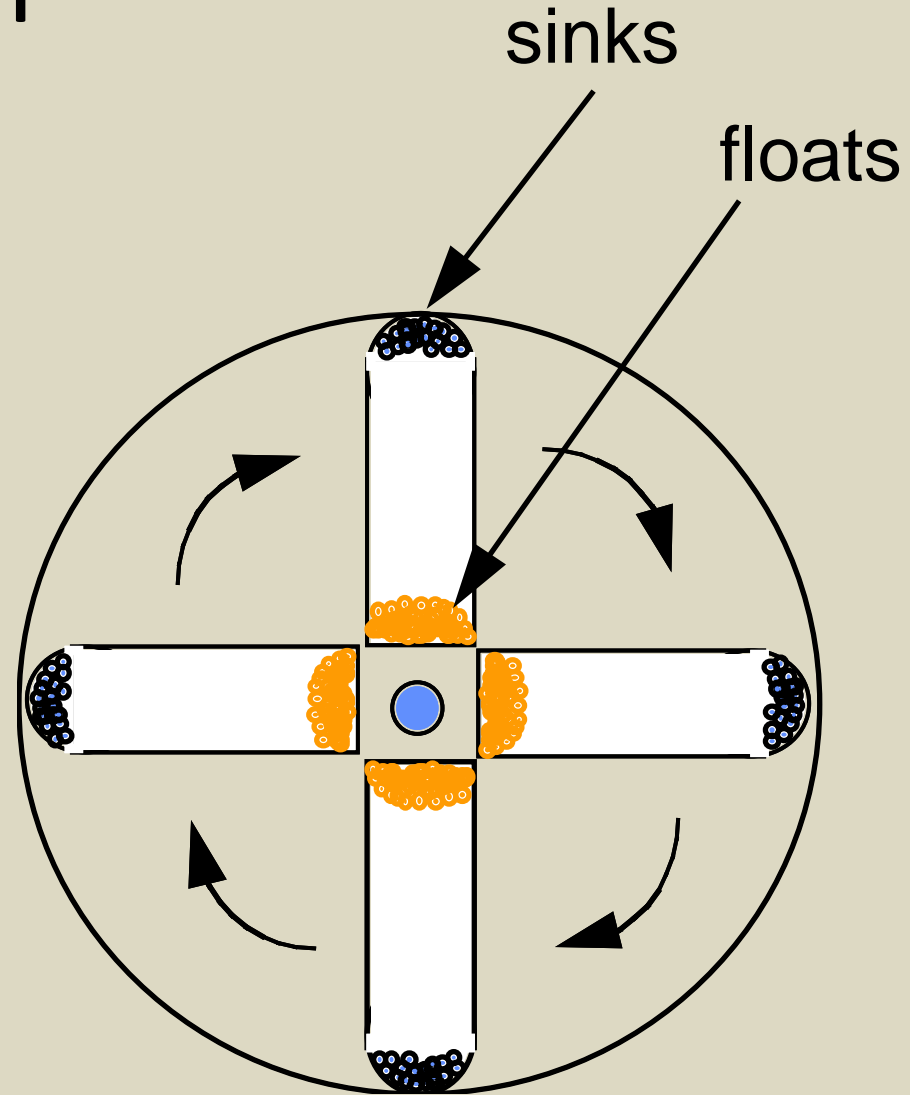
Uganda



# Gravity Separation



1. Heavy Liquid



2. Centrifuge

# Gravity Separation

Heavy Gold

Light



## 3. Panning

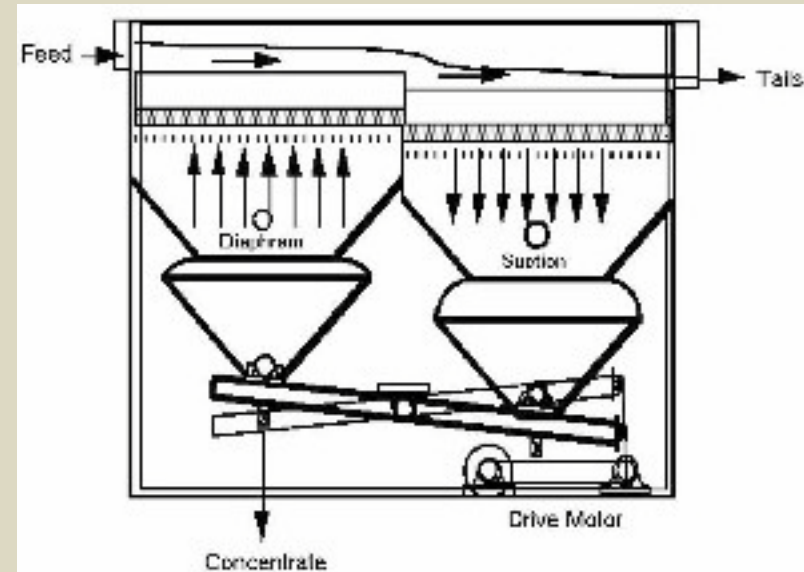
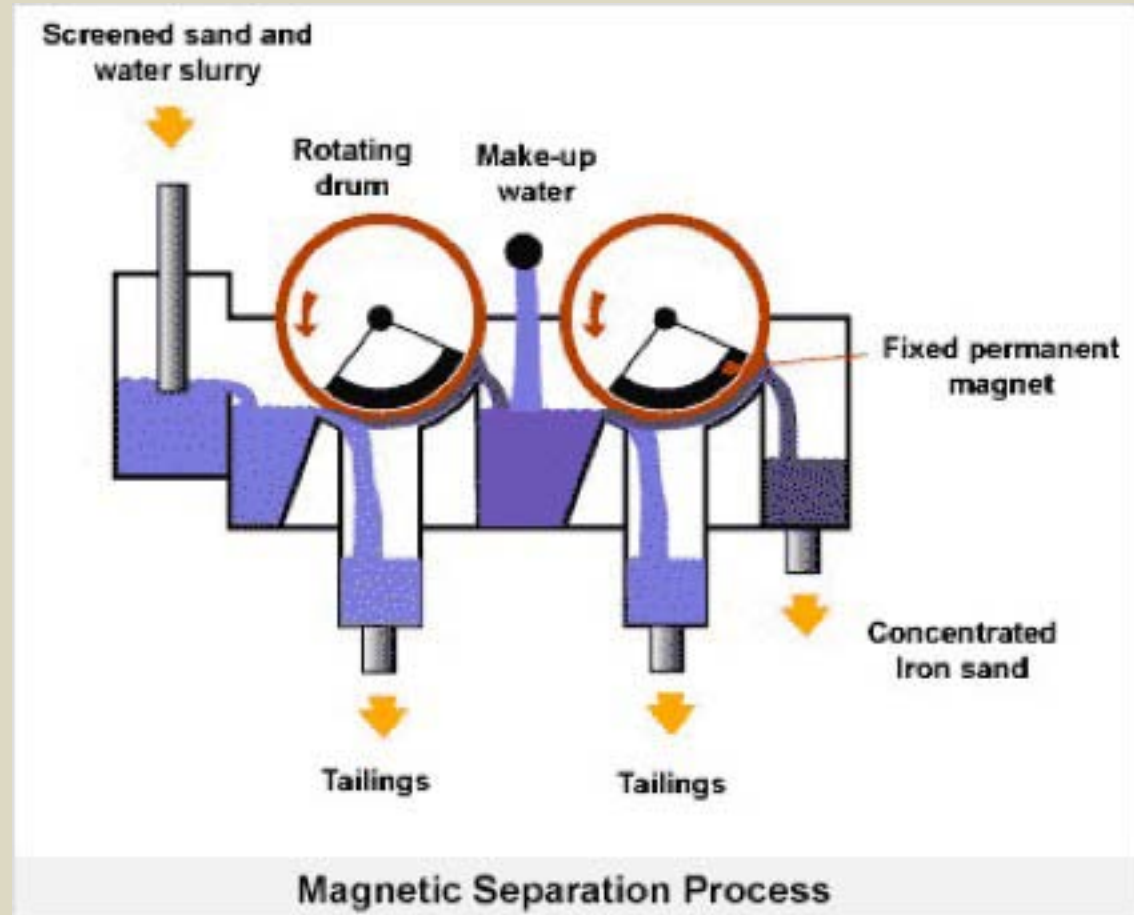


Figure 1. Section of a modern placer jig

## 4. Jig

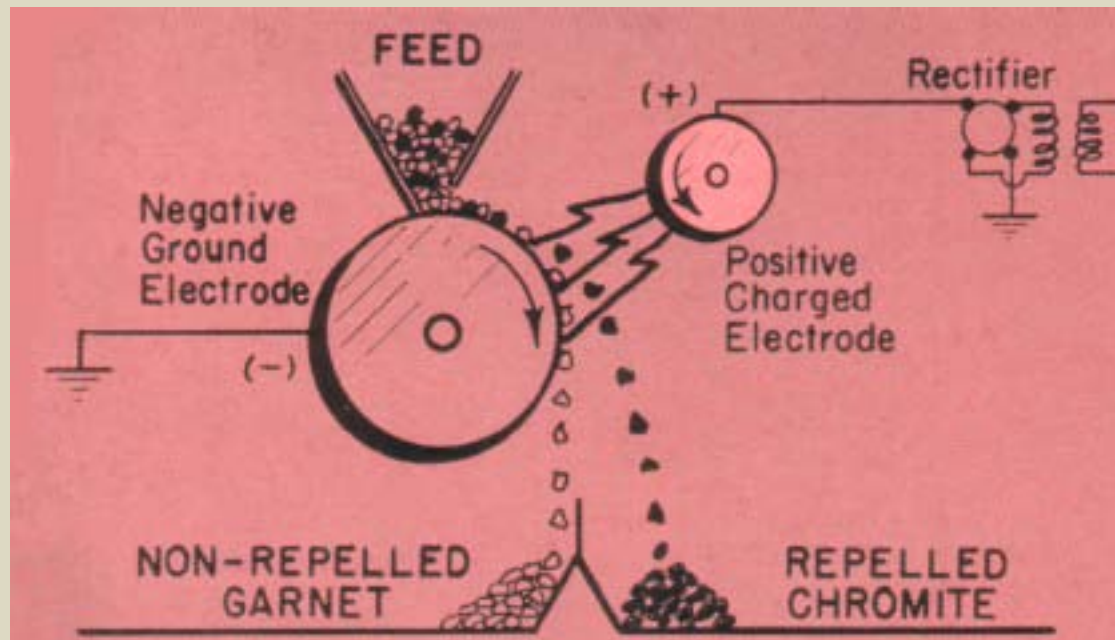


# Magnetic Separation



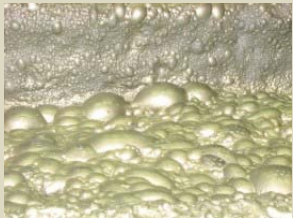
# Electrostatic Separation

- Some grains maintain an electrostatic charge (induced electrically) and are pinned to a charged drum. Grains that are not charged, fall off the drum. Thus, minerals like ilmenite and chromite can be separated.

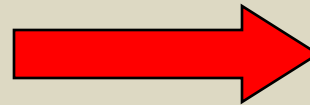


# Mineral Processing:

What waste is created?



- Sizing
- Gravity
- Magnetic
- Electrostatic



- Tailings
- Waste Rock
- Fuel
- Equipment
- Buildings
- Chemicals
- Contaminated Water
- Metals



# Mining

Ore  
Removal



Crush



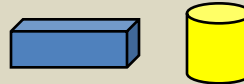
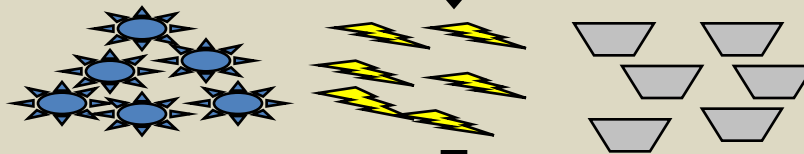
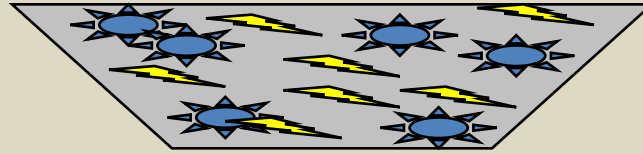
Separate



Refine



Transform



WASTE

Dust

Noise

Ammonia

Tailings

Waste Rock

Metals

Fuel

Chemicals

Buildings

Equipment

Garbage

Waste Water

# Steps 4 – Refining



-Add heat

How do miners purify metals?



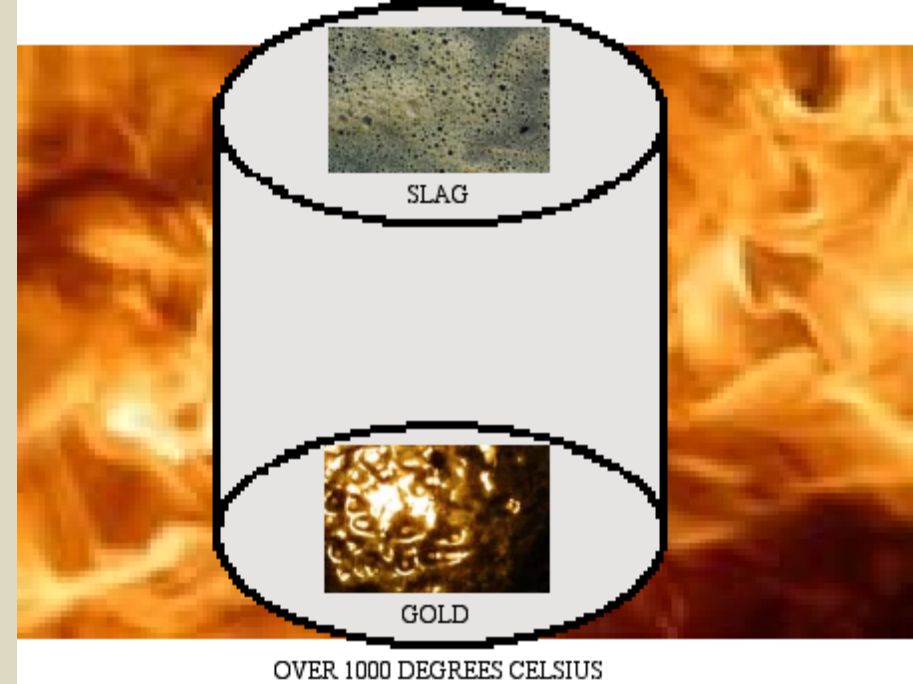
-Add chemicals



-Increase pressure

# Step 4 – Refining

- Remove impurities
- Some refining may happen on site, but usually, mines ship their “concentrate” (concentrated ore) to specialized refining/smelting operators



# Step 4 - Refining

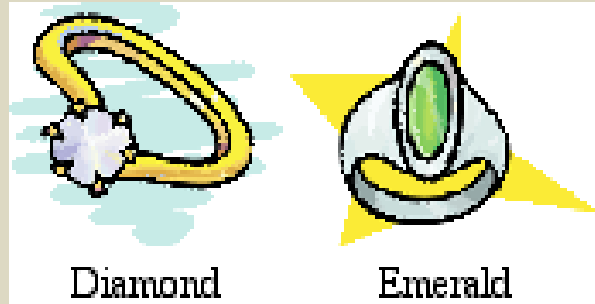
Sometimes refining is not needed..

- Coal - it is ready to sell once separated
- Diamonds at BHP and Diavik – diamonds only need to be separated before being cut (separation is by crushing, gravity, and x-rays)



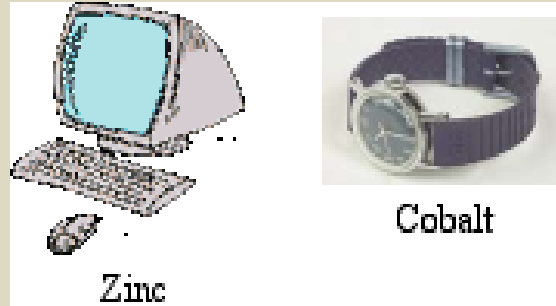
# Mining Products

## Why Mine?



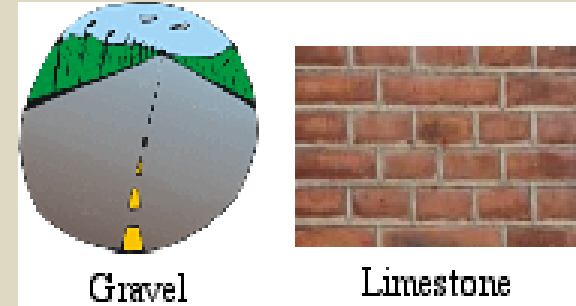
Diamond

Emerald



Zinc

Cobalt



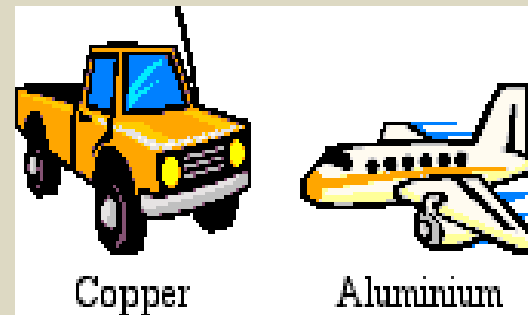
Gravel

Limestone



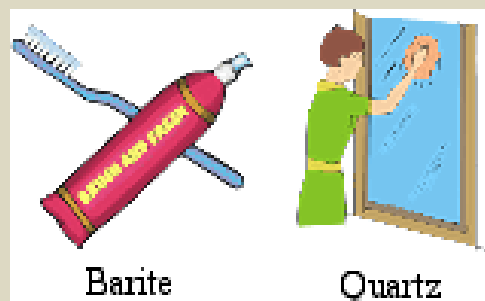
Coal

Steel



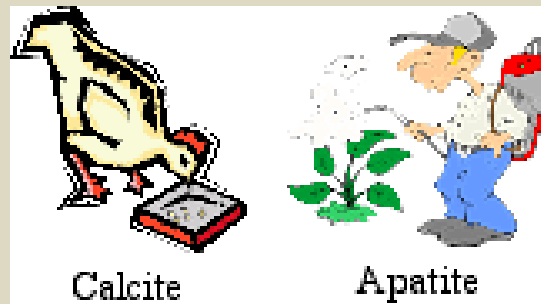
Copper

Aluminium



Barite

Quartz



Calcite

Apatite



Carbonate

Kaolinite

# Mining

Ore  
Removal



Crush



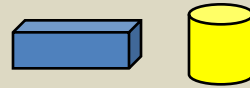
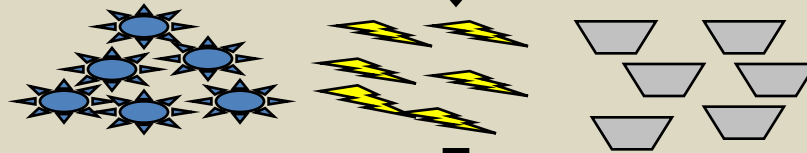
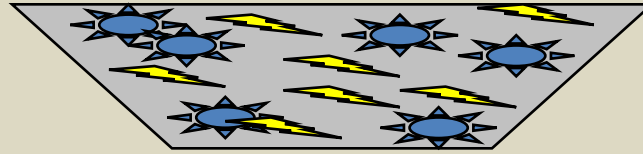
Separate



Refine



Transform



WASTE

Dust

Noise

Ammonia

Tailings

Waste Rock

Metals

Fuel

Chemicals

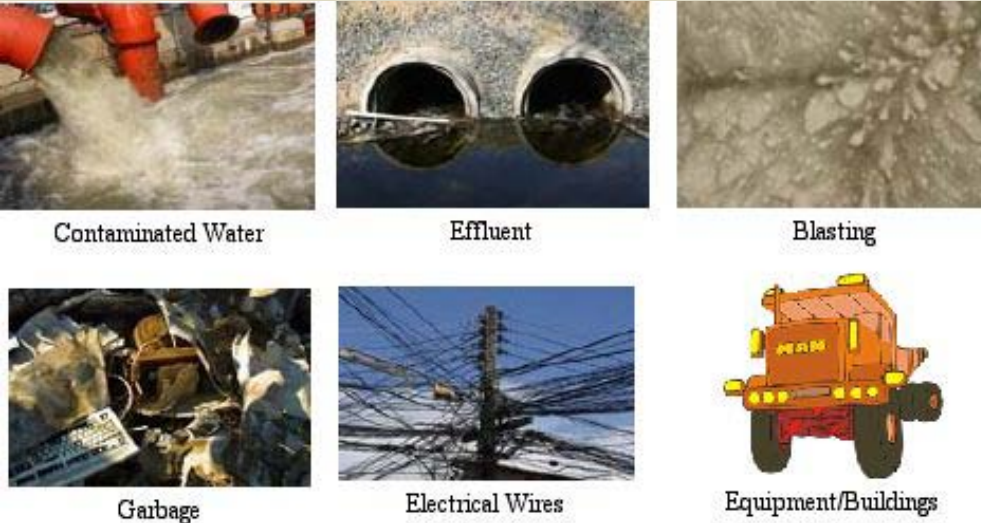
Buildings

Equipment

Garbage

Waste Water

# WASTE



- Dust & Noise
- Ammonia & Fuel
- Tailings & Waste Rock
- Metals & Chemicals
- Buildings & Equipment
- Garbage
- Waste Water
- Naturally Occurring
- Brought On-Site
- Mining Effects

# Mine Components

- Underground
- Open Pit
- Waste Rock & Overburden
- Tailings
- Buildings & Equipment
- Infrastructure
- Landfills/Waste Disposal Sites
- Water Management Systems

