



# The Evolution of Diamond Exploration



**INDICATOR**  
minerals inc.

# Diamonds – Understanding the Process

Diamond Formation and Emplacement

The Diamond Exploration Cycle

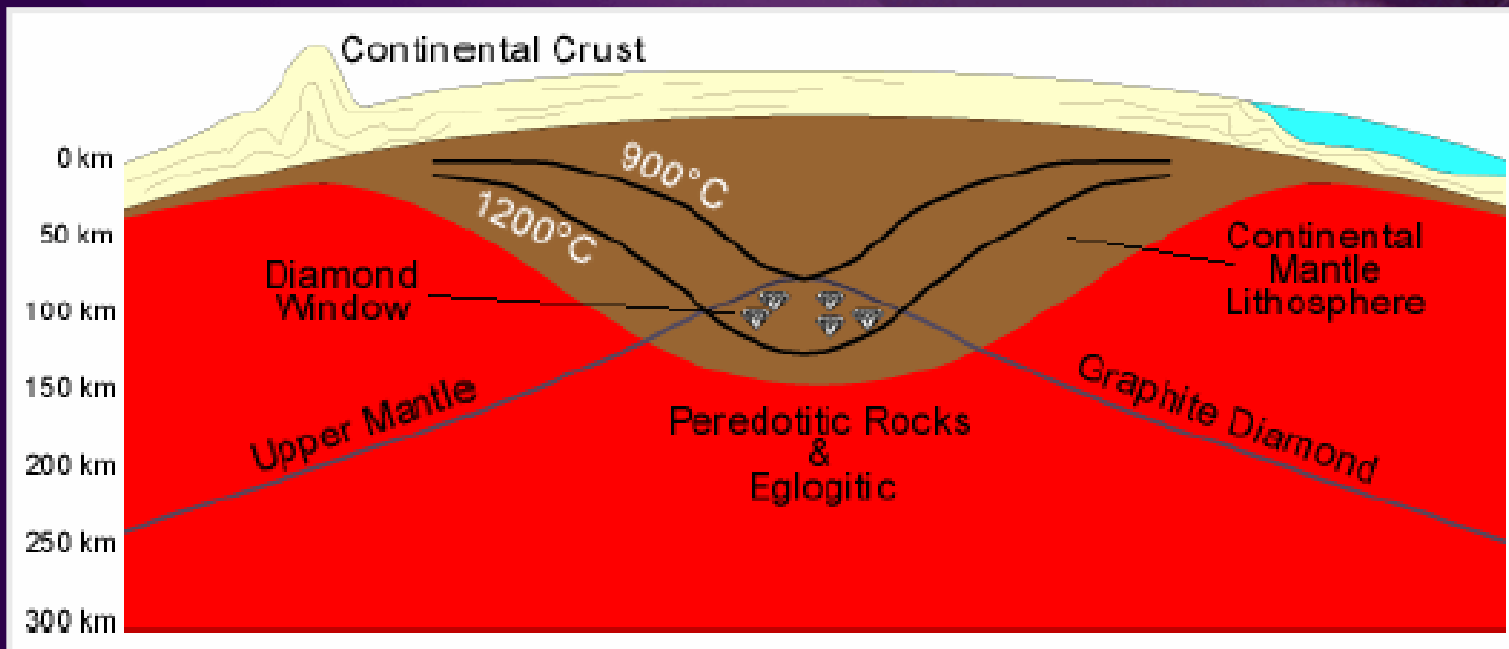
Diamond Economics

The Canadian Diamond Industry



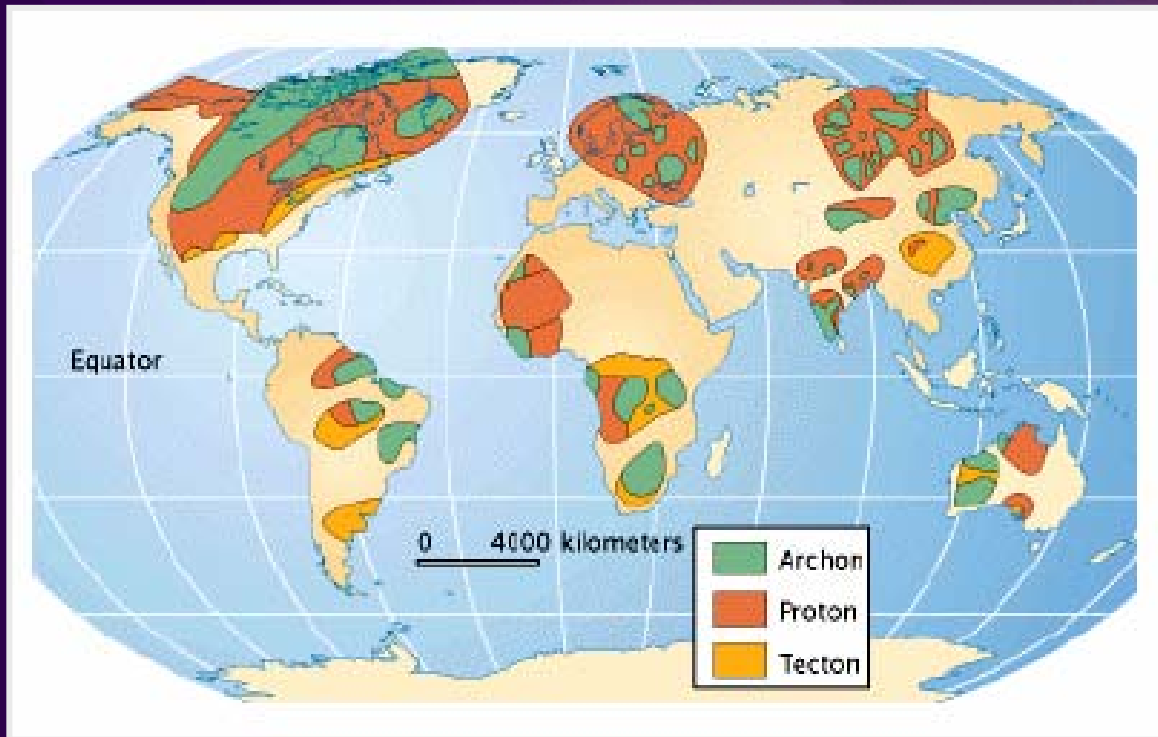
# Diamond Formation and Emplacement

Carbon forms diamond crystals under just the right heat and pressure conditions deep in an area of the earth's mantle called the "diamond window" or the "diamond stability field", a slight variation in temperature or pressure results in graphite not diamond



# Diamond Formation and Emplacement

Diamonds were formed more than 3 billion years ago, geologists explore in places where the crust is ancient, deep and stable - these areas are called “cratons” or “archons”



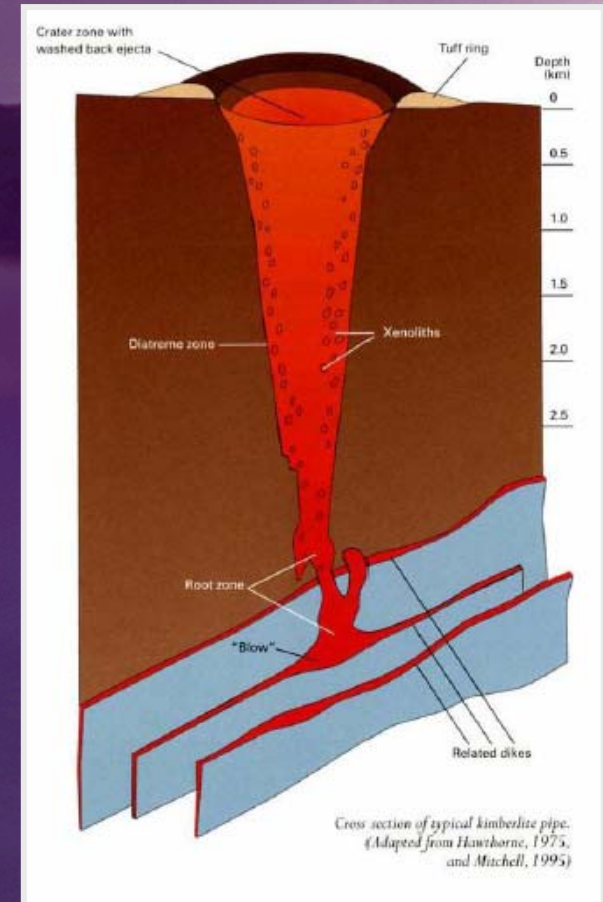
# Diamond Formation and Emplacement

Diamonds are transported to the earth's surface in volcanic rock known as kimberlite

Kimberlite is the elevator - originating lower in the earth's mantle than where diamonds are formed it gathers diamonds on its way to the surface at about 300kms per hour

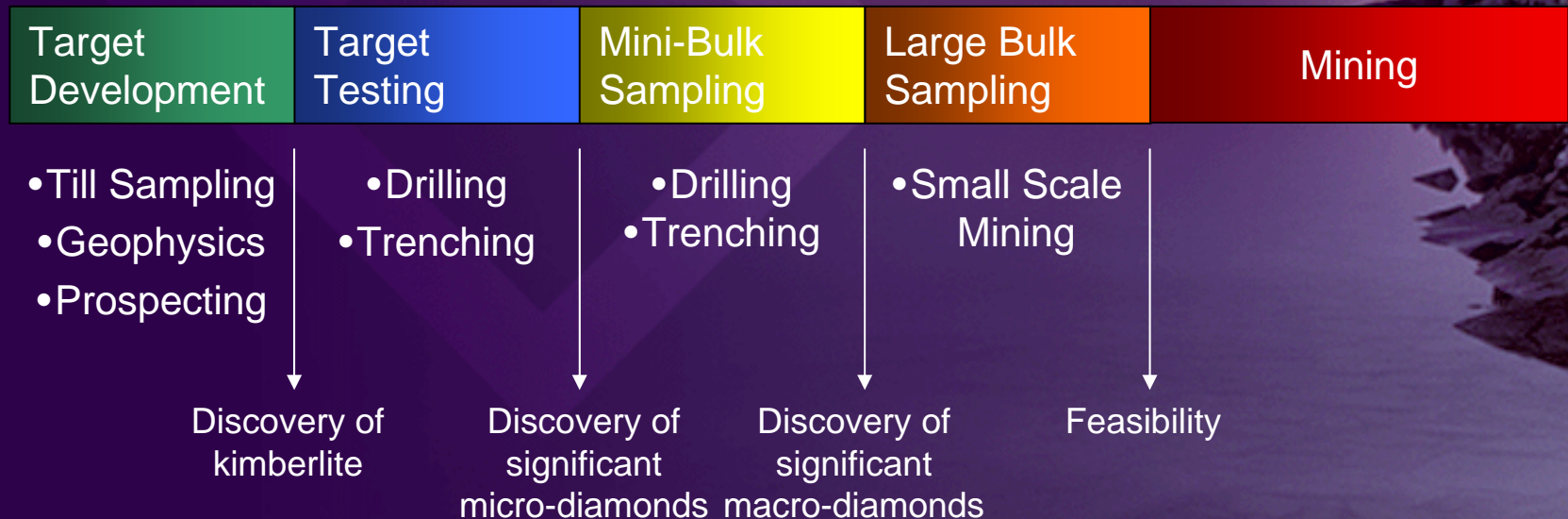
Kimberlite tends to occur in clusters – at Lac de Gras there are more than 200 kimberlites

Not all kimberlites contain diamonds and not all diamond bearing kimberlites are economic – approximately 1 in 25 are diamond bearing and 1 in 250 are economic



# Diamond Exploration Cycle

The Diamond exploration cycle is a long and expensive process  
Explorers and investors require patience and persistence



# Diamond Exploration Cycle – Target Development

## Diamond Exploration Tools

Sampling for kimberlite indicator minerals

Prospecting for kimberlite boulders

Targeting kimberlites with geophysics



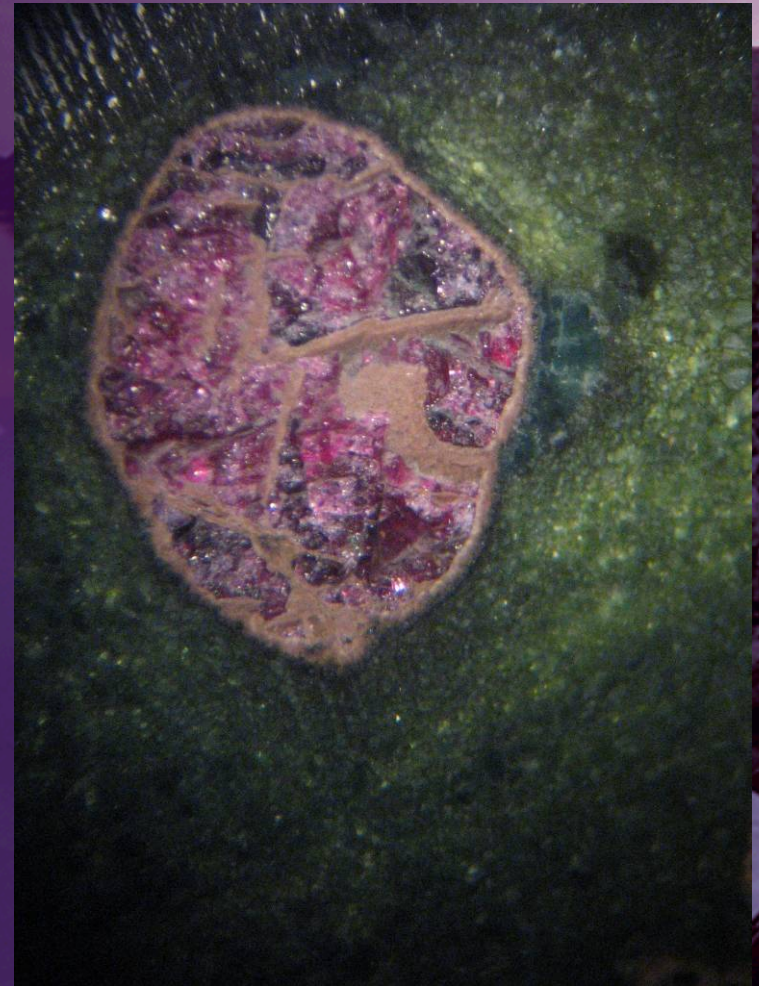
# Diamond Exploration Cycle – Target Development

## Kimberlite Indicator Minerals

Kimberlite indicator minerals (KIM's) occur in kimberlites in much greater concentrations than diamond

KIM's are picked up by kimberlites both inside and outside the diamond stability field

KIM's picked up by kimberlites inside the diamond stability field have different percentages of certain elements in their chemical composition



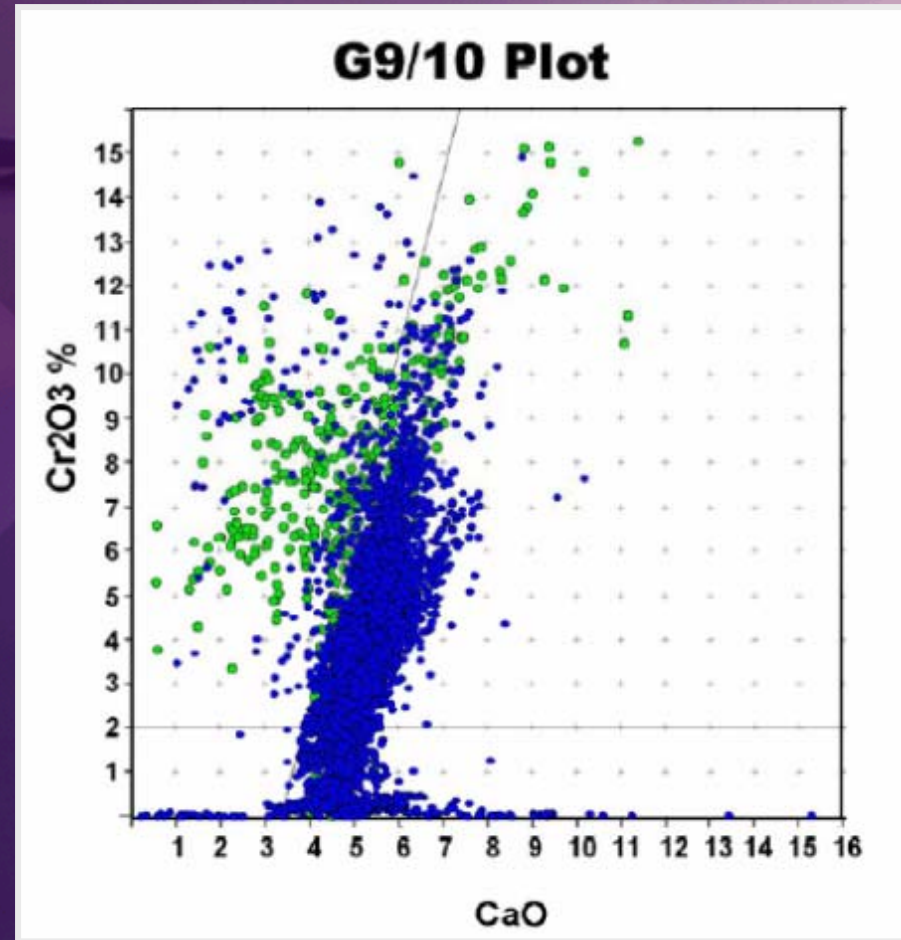
# Diamond Exploration Cycle – Target Development

## Kimberlite Indicator Minerals

Pyrope Garnets play one of the most important roles in the exploration process

The chemical composition of a Pyrope is characteristic of the mantle conditions under which it was formed

G10 Pyrope Garnets have a chemical composition that indicates they formed under the same conditions as diamonds



# Diamond Exploration Cycle – Target Development

## Sampling for Kimberlite Indicator Minerals

The presence of kimberlite indicator minerals in soil indicates that there may be kimberlites in the area

The chemistry of indicator minerals tells the diamond explorer something about the conditions in the earth's mantle

An understanding of how the soil was transported is essential to deciphering where the kimberlites are located



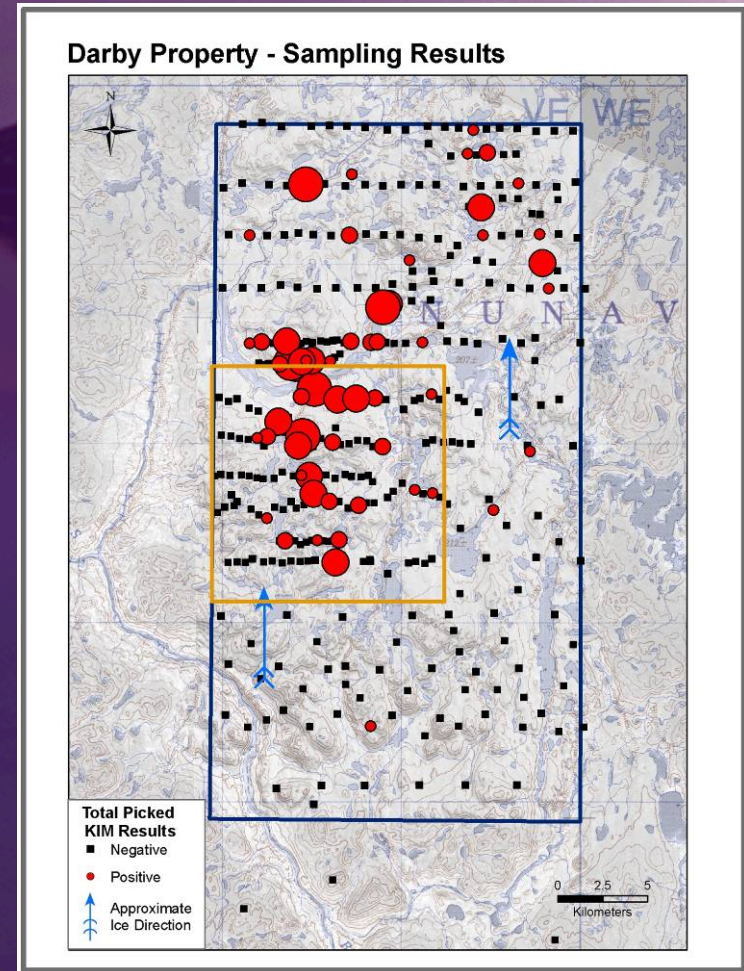
# Diamond Exploration Cycle – Target Development

## Sampling for Kimberlite Indicator Minerals

The number of indicators per kilogram of sample increases as you get closer to the kimberlite

In glacial environments KIM's are often distributed in linear patterns by glaciers forming indicator mineral trains

In desert environments KIM's have been distributed by wind, ancient streams and insects



# Diamond Exploration Cycle – Target Development

## Targeting Kimberlites with Geophysics

Kimberlites often have physical properties (magnetism, conductivity and density) that differ from the surrounding rocks

Large areas are surveyed from the air by helicopter or fixed-wing aircraft

Individual targets are detailed using ground geophysical surveys



# Diamond Exploration Cycle – Target Development

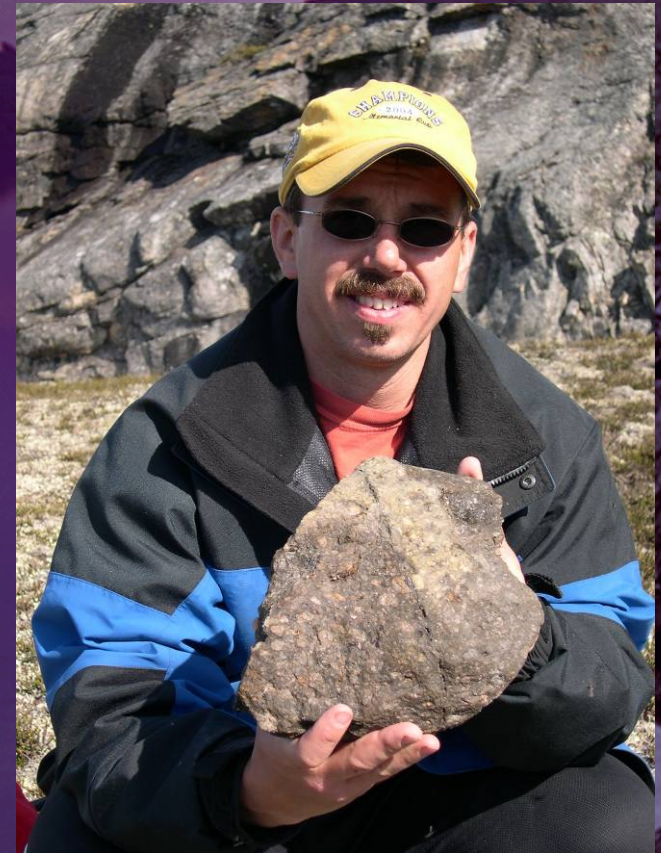
## Prospecting

The presence of kimberlite boulders on a property gives the explorer confidence that kimberlite bodies are nearby

Sometimes kimberlite boulders can be directly associated with geophysical targets

Boulders can be processed for indicator mineral chemistry and diamond content – this helps in deciding which targets to drill test

Not all kimberlites cast off boulders



# Diamond Exploration Cycle – Target Development

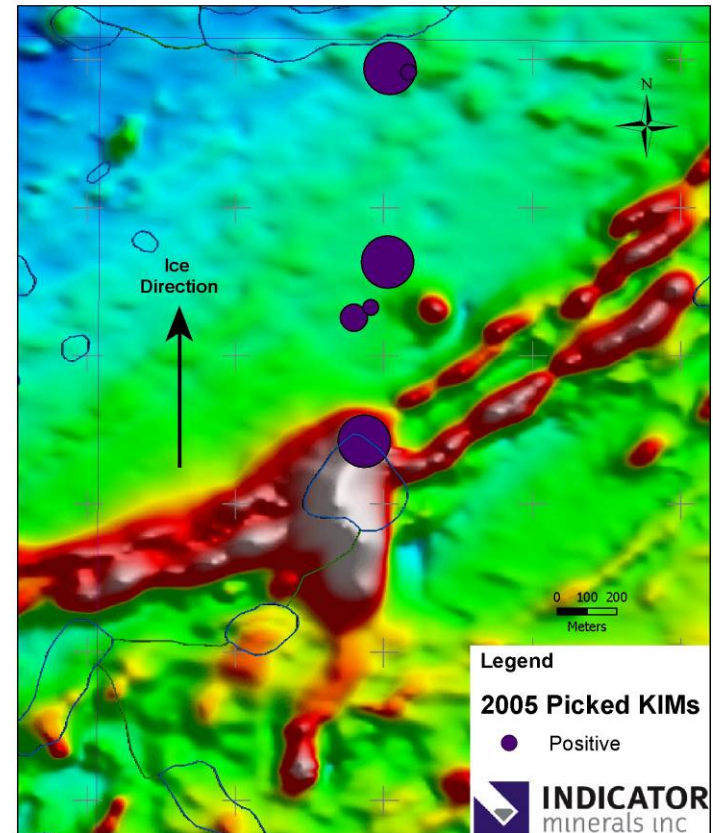
## Targeting the Drill

The best kimberlite targets are those supported by geophysics, kimberlite indicator minerals and prospecting

Mineral chemistry is the tool used to determine which targets have the best chance of being diamond bearing

Drill holes are primarily targeted using results from geophysical surveys

Darby Property  
Iceberg Anomaly KIM Dispersion



# Diamond Exploration Cycle – Target Testing

## Drilling

Once a target is firmly established with geophysics, geochemistry and geology the next step is to confirm that it is an actual kimberlite by drilling

Discovery drilling looks to achieve two goals:

- Prove that the target is kimberlite
- Obtain enough kimberlite for micro-diamond testing – 100kg or more is desirable



# Diamond Exploration Cycle – Target Testing

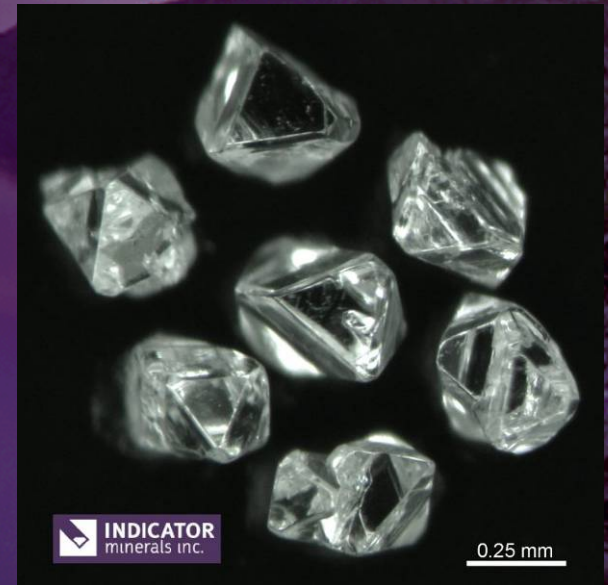
## First Diamond Results

Kimberlite is usually analysed by an independent laboratory for diamond content using a process called “caustic fusion”

One diamond greater than 0.150mm per kilogram and a distribution of diamond sizes is considered a compelling result

Micro-diamond < 0.50mm in two dimensions

Macro-diamond > 0.50mm in two dimensions

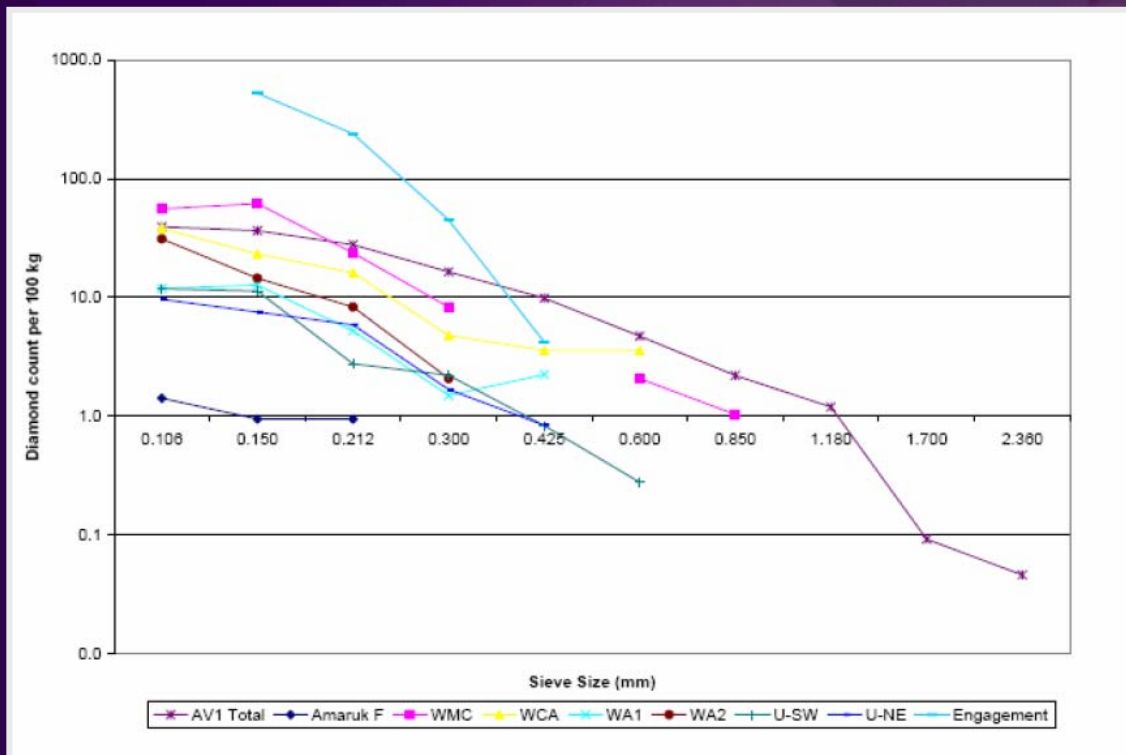


Sample UPR6401DK 25.5kg	0.150mm	0.212mm	0.300mm	0.425mm	0.600mm	Total
Diamonds	19	16	18	6	1	60

# Diamond Exploration Cycle – Target Testing

## First Diamond Results

A graph of diamond frequency vs. diamond size should indicate that there will be macro-diamonds if enough kimberlite is processed



# Diamond Exploration Cycle – Mini Bulk Sampling

Mini bulk samples are loosely defined as 50 to 200 tonnes of kimberlite material – usually collected with large diameter drills

This amount of kimberlite material should yield a parcel of macro-diamonds large enough to obtain the first indication of diamond value (measured in \$/carat) and grade (measured in carats/tonne)

Together value and grade give the explorer the first indications of the value of the kimberlite (measured in \$/tonne)



Photos: Courtesy of BHPBilliton Ekati

# Diamond Exploration Cycle – Large Bulk Sampling

A large bulk sample is collected if the initial diamond grade and value obtained in the mini-bulk sample indicates a potentially economic deposit

The large bulk sample aims to collect at least 10,000 carats of diamonds – this is usually done by tunneling into the kimberlite

The large bulk sample result is used to refine the estimate of grade and value and will be key in making the decision to move to a full feasibility study and mining



# Diamond Exploration Cycle – Mining

After a deposit is determined to be economic it must be permitted and a mine constructed

Permitting and construction can take several years and many hundreds of millions of dollars

Ekati took 8 years from discovery to market



# Diamond Economics

## Diamond Mines are Very Valuable

### Aber Resources

40% of Diavik – Mkt Cap of \$2.2 billion

### Dia Met Minerals Ltd

29% of Ekati – Sold for \$800 million

### Shore Gold Inc

100% of Star Kimberlite – Mkt Cap of \$947 million

### Tahera Resources

100% of Jericho – Mkt Cap of \$307 million

### Winspear Resources

60% of Snap Lake – Sold for \$300 million



# Diamond Economics

Demand Expected to Exceed Production by 2008

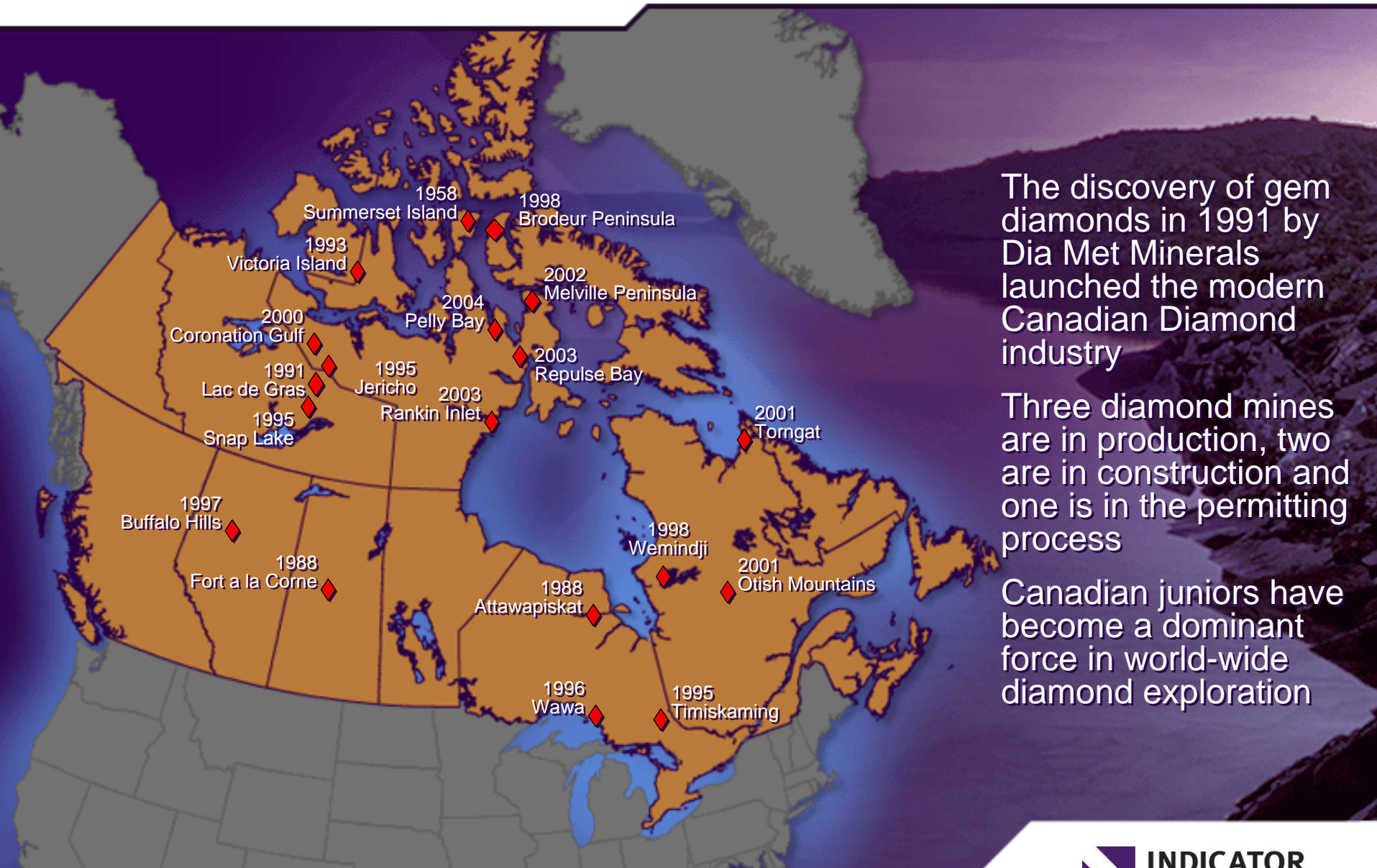
Rough diamond market estimated at \$US 13.2 Billion in 2005

Value of diamond content in jewellery retail sales estimated at \$US 62.5 Billion in 2005

Diamond jewellery market growth in China and India



# The Canadian Diamond Industry



The discovery of gem diamonds in 1991 by Dia Met Minerals launched the modern Canadian Diamond industry

Three diamond mines are in production, two are in construction and one is in the permitting process

Canadian juniors have become a dominant force in world-wide diamond exploration

# The Canadian Diamond Industry - Facts

- In 2005, Canada ranked as the world's fourth largest diamond producer by value behind Botswana, Russia, and South Africa with production estimated at 11.7 million carats. Diamond mining provides approximately 4,000 direct and indirect jobs in Canada
- By 2008, there could be four mines open in the NWT and western Nunavut. Annual production from diamond mines could reach \$1.6 billion, and be expected to generate about 1600 direct jobs
- Advanced diamond exploration points to the prospect of additional mines in the NWT, Nunavut, and Ontario and exploration is also under way in Alberta, Saskatchewan, Manitoba, Quebec, and Newfoundland and Labrador
- A small diamond cutting and polishing industry is centered in Yellowknife and in the Gaspé region of Quebec