THE MINERAL VEIN

THE MINERAL SOCIETY OF MANITOBA NEWSLETTER

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The Mineral Society of Manitoba
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CLUB MEETINGS

February 6, 2008: Speaker was to be Dr Alan Bailes. However he cannot make it. In his place **we will hold a membership evening., Coffee and some munches will be available**. It will be an evening of trade, buy, sell, show, and tell. **Members are encouraged to your bragging items and objects for sale.**

March 5, 2008: Speaker Sharon Hull, topic: turquoise-sourcing techniques. She will also bring along slides of Arazona.

April 2, 2008: Speaker Dr Graham Young, topic: fossil record of jellyfish: do they exist in Manitoba?

May 7, 2008: Speaker Dr Jim Teller with topic "Lake Agassiz".

September 3 Speaker Lori Stewart with topic her research done on Gillies quarry. Lori was a past recipient of a MSM bursary.

CLUB NEWS OUT AND ABOUT:

The University of Manitoba's Wallace Building, 125 Dysart Road, Fort Gary Campus.:
(open to the public during weekdays 8:30 – 4:00)

1. **The Cretaceous Display** See http://umanitoba.ca/geoscience/cretaceousmenagerie
2. **The mineral display**. 15% of the university's specimens are exhibited in the hallway of the Wallace building. .

Manitoba museum

1. **Ice Age Mammals**
2. **Jaws & Teeth Exhibit** in the Activity Room
3. **New Meteorite Exhibit** in the Science Gallery
4.

Canadian Fossil Discovery Centre, Morden, Manitoba

1. **Rock & Fossil Festival**, Feb 22 & 23, 2008
http://www.discoverfossils.com/index

Dues are $15/year ($20 for families) and are payable at the October meeting or by mail during October.

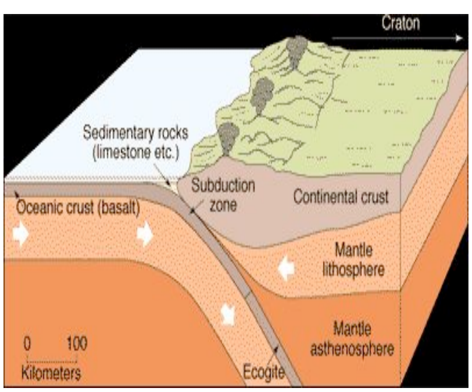
Meetings are held on the first Wednesday of each month from September to May inclusive at the Manitoba Museum in room P47 on the Planetarium level. They begin at 7:30 PM and feature announcements, an invited speaker and a draw.

Members are encouraged to bring along any new, interesting specimens or specimens appropriate to the speaker's topic.

Field trips take place from May to September to interesting sites in Manitoba, neighboring provinces and states

Kimberlite rock samples

Subduction



Diamonds, Where Do They Come From?

Dr Anton Chakhouradian

He gave us a short but in depth view of the formation of diamonds. Here are some excerpts of his presentation.

A diamond is a transparent crystal of tetrahedrally bonded carbon atoms and crystallizes into faced centered cubic diamond lattice structure.

The word *"Diamond"* comes from the greek word *"Adamas"*, which means indestructible. It is the only gem known to man that is made of a single element, *Carbon*. Besides graphite diamond is completely made of *Carbon* atoms (Chemical Composition - 'C') crystallized in a cubic (isometric) arrangement.

Diamonds are not as scarce as most people beleave nor are they always colourless. They can occur in nearly any color, though yellow and brown are by far the most common. Black" diamonds are not truly black, but rather contain numerous dark inclusions that give the gems their dark appearance. Colored diamonds contain impurities or structural defects that cause the coloration, while pure or nearly pure diamonds are transparent and colorless. Most diamond impurities replace a carbon atom in the crystal lattice, known as a carbon flaw. The most common impurity, nitrogen, causes a slight to intense yellow coloration, depending upon the type and concentration of nitrogen present. The Gemological Institute of America (GIA) classifies low saturation yellow and brown diamonds as diamonds in the *normal color range*, and applies a grading scale from 'D' (colorless) to 'Z' (light yellow). A blue diamond recently fetched nearly $8 million. The blue hue was a result of trace amounts of boron in the stone's crystal structure.[

Roughly 49% of diamonds originate from central and southern Africa, although significant sources of the mineral have been discovered in Russia, Canada, India, Brazil,and Austrialia. The value of diamonds mined are: gem 20%, near gem 35%, industrial 45%. Near gem diamonds are marketed as champagne or congac diamonds. Cut diamond production occurs mainly in India, Isreal, Russia, SE Asia, Belgium, S. Aferica, and USA.

In regards to gem quality diamonds, 50 billion carots of cut diamonds is worth $18.7 billion. 50 billion carots of set diamonds is worth $68.5 billion..

They are mined from kimberlite and lamproite pipes. The pipes brought diamond crystals to the surface the from deep in the Earth where the high pressure and temperature enables the formation of the crystals.

How and where are diamonds formed?

Diamond formation requires exposure of carbon-bearing materials to high pressure, ranging approximately between 45 and 60 kilobars but at a comparatively low temperature range between approximately 1652–2372 °F (900–1300 °C). These conditions are known to be met in two places on Earth; in the lithospheric mantle below relatively stable continental plates, and at the site of a meteorite strike.

Carbon found in diamonds comes from both inorganic and organic sources. Some diamonds, known as harzburgitic, are formed from inorganic carbon originally found deep in the Earth's mantle. In contrast, eclogitic diamonds contain organic carbon from organic detritus that has been pushed down from the surface of the Earth's crust through subduction. Diamonds form between 120-200 kms or 75-120 miles below the earth's surface. According to geologists the first delivery of diamonds was somewhere around *2.5 billion* years ago and the most recent was *45 million* years ago. The carbon that makes diamonds comes from the melting of pre-existing rocks and water in the Earth's upper mantle. Plate tectonics. There is an abundance of carbon atoms in the mantle. Temperature changes in the upper mantle forces the carbon atoms to go deeper where it melts and finally becomes new rock, when the temperature reduces. If other conditions like pressure and chemistry is right then the carbon atoms in the melting crustal rock bond to build diamond crystals.

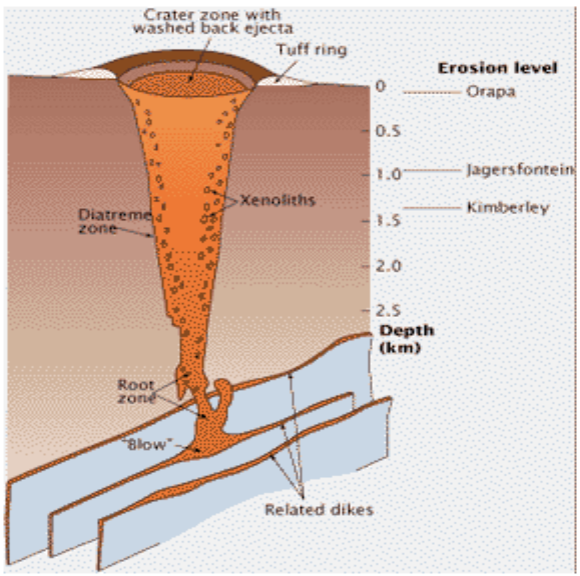
There is no guarantee that these carbon atoms will turn into diamonds. If the temperature rises or the pressure drops then the diamond crystals may melt partially or totally dissolve. Even if they do form, it may take thousands of years for those diamonds to come anywhere near the surface.

Diamond-bearing rock is brought close to the surface through deep-origin volcanic eruptions. The magma for such a volcano must originate at a depth where diamonds can be formed, 150 km (90 miles) deep or more (three times or more the depth of source magma for most volcanoes). These typically small surface volcanic craters extend downward in formations known as volcanic pipes. The pipes contain material that was transported toward the surface by volcanic action, but was not ejected before the volcanic activity ceased. During eruption these pipes are open to the surface, resulting in open circulation; many xenoliths of surface rock and even wood and/or fossils are found in volcanic pipes. Diamond-bearing volcanic pipes are closely related to the oldest, coolest regions of continental crust (cratons). This is because cratons are very thick, and their lithospheric mantle extends to great enough depth that diamonds are stable. Not all pipes contain diamonds, and even fewer contain enough diamonds to make mining economically viable.

The magma in volcanic pipes is usually one of two characteristic types, which cool into igneous rock known as either kimberlite or lamproite. The magma itself does not contain diamond; instead, it acts as an elevator that carries deep-formed rocks (xenoliths), minerals, and fluids upward. These rocks are characteristically rich in magnesium-bearing olivine, pyroxene, and amphibole minerals. which are often altered to serpentine by heat and fluids during and after eruption. Certain *indicator minerals* typically occur within diamondiferous kimberlites and are used as mineralogic tracers by prospectors, who follow the indicator trail back to the volcanic pipe which may contain diamonds. These minerals are rich in chromium or titanium elements which impart bright colors to the minerals. The most common indicator minerals are chromian garnets (usually bright red Cr - pyrope, and occasionally green ugrandite-series garnets), eclogitic garnets, orange Ti-pyrope, red high-Cr spinels, dark chromite, glassy green olivine, black picpicoilmenite, and magnetite.

Once diamonds have been transported to the surface by magma in a volcanic pipe, they may erode out and be distributed over a large area. A volcanic pipe containing diamonds is known as a *primary source* of diamonds. *Secondary sources* of diamonds include all areas where a significant number of diamonds, eroded out of their kimberlite or lamproite matrix, accumulate because of water or wind action. These include alluvial deposits and deposits along existing and ancient shorelines, where loose diamonds tend to accumulate because of their approximate size and density.

Diamonds ascend to the Earth's surface in rare molten rock, or magma, that originates at great depths. Carrying diamonds and other samples from Earth's mantle, this magma rises and erupts in small but violent volcanoes. Just beneath such volcanoes is a carrot-shaped "pipe" filled with volcanic rock, mantle fragments, and some embedded diamonds. The rock is called kimberlite after the city of Kimberley, South Africa, where the pipes were first discovered in the 1870s.



The volcano that carries diamond to the surface emanates from deep cracks and fissures called dikes. It develops its carrot shape near the surface, when gases separate from the magma, perhaps accompanied by the boiling of ground water, and a violent supersonic eruption follows. The volcanic cone formed above the kimberlite pipe is very small in comparison with volcanoes like Mount St. Helens, but the magma originates at depths at least 3 times as great. These deep roots enable kimberlite to tap the source of diamonds. Magmas are the elevators that bring diamonds to Earth's surface.

Only a very small fraction of the diamond ore consists of actual diamonds. The ore is crushed, during which care has to be taken in order to prevent larger diamonds from being destroyed in this process and subsequently the particles are sorted by density. Today, diamonds are located in the diamond-rich density fraction with the help of X-ray fluorescence, after which the final sorting steps are done by hand. Before the use of X-rays became commonplace, the separation was done with grease belts; diamonds have a stronger tendency to stick to grease than the other minerals in the ore.

Historically diamonds were known to be found only in alluvial deposits in southern India. Diamond production of primary deposits (kimberlites and lamproites) only started in the 1870's after the discovery of the Diamond fields in South Africa. Production has increased over time and now an accumulated total of 4.5 billion carats have been mined since that date. Interestingly 20% of that amount has been mined in the last 5 years alone. . Most of these mines are located in Canada, Zimbabwe, Angola, and one in Russia.

Today, most commercially viable diamond deposits are in Rusia, Botswana, Australia and the Domocratic Republic of Congo.

The presence of kimberlite does not garenteen the presecence of diamonds. The largest blue diamond, the Hope Diamond was found in India yet there are no kimberlite pipes found in India. Nor are there kimberlite pipes found in Brazil, yet many diamonds have been found there.

In some of the more politically unstable central African and west African countries, revolutionary groups have taken control of diamond mines, using proceeds from diamond sales to finance their operations. Diamonds sold through this process are known as *conflict diamonds* or *blood diamonds*.

De Beers used to market 80% of the diamonds but this has since been reduced to 40%. Part of the reasons are new cutting and marketing centres and the reputation of Blood Diamonds".

During the 1990s, De Beers began the then seemingly unusual practice of "Branding" its diamonds, despite the fact of its near-total monopoly of the diamond market. Diamonds from Canada are branded to distinguish them from "blood diamonds".

You can learn more about kimberlite and diamond bearing rocks in Dr Anton Chakhouradian's website: http://umanitoba.ca/geoscience/faculty/arc