

# It's like smelling a forest fire from millions of years ago

Words: Penny Trussell

The kimberlite of the Rio Tinto managed Diavik diamond mine, 300km north east of the city of Yellowknife in Canada's Northwest Territories, yields glittering prizes for diamond markets around the globe. Now, alongside, have come treasures of enormous value to the scientific world: pieces of ancient wood that can tell us what the world was like 55 million years ago.

The mine produces diamonds because, in a period of geological history called the Eocene, forces in the depths of the planet began to propel kimberlite magma upwards. On its way, the molten rock passed a point known as the "diamond stability zone" – the level of temperature and pressure at which diamonds form.

As it moved nearer the surface, gases within the kimberlite expanded, increasing the pressure of the magma until a point – around 1km below the surface – where the surrounding granite could no longer contain it. A violent eruption blasted the granite into the air, creating a pipe shaped void that filled with cooling kimberlite magma – diamonds included – and material from the eruption cloud that fell straight back into the pipe. This type of kimberlite is called "pyroclastic", from the Greek words for "fire" and "broken".

A second type of kimberlite pipe is known as "resedimented kimberlite". These formed a little more gradually: after the eruption, material ejected from the crater mixed with material already on the surface such as mud and plant matter, and made its way back into

the pipe, often through the action of rivers or streams.

At Diavik, both types of pipe exist. The wood fragments have come from four kimberlite pipes, particularly A154S. Diavik's geologists have pulled pieces of wood from trees that were growing at the site when the kimberlite formed, 55 million years ago. As the kimberlite blasted through the Earth's surface and into the forest, pieces of tree trunk became mingled with the other debris that settled in the pipe. The high clay content of the sediments kept the water out, and stopped the wood being destroyed over the millions of intervening years.

So the wood the geologists have found is exceptionally well preserved. It is not in any way fossilised: it has the look and feel of a tree growing today. Dave Eichenberg, Diavik's chief geologist, says the wood has remained remarkably unaltered since the Eocene. "We have actually taken a lighter to some of the wood and it burned. It's like smelling a forest fire that occurred millions of years ago."

Some of the pieces of wood in the pipe were charred by the heat of the initial kimberlite blast, but many are undamaged, and some show a complete section through the trunk from bark, through the tree rings, to the tree's core. For scientists, these entire pieces are the most useful as they preserve a complete record of the tree's life. Diavik has supplied samples from the pipe to several universities in Canada which are carrying out research on the wood. By measuring the widths of

the rings in the wood, scientists can tell what the climate was like in the Eocene.

Geological science usually works on timescales of thousands or millions of years, so for geologists to be able to perceive subtle changes in the environment that took place over the space of a few months is remarkable. "The kimberlites are like a time capsule," said Dave Eichenberg. "Fragments of one tree can tell us about 100 years of summers and winters from 55 million years ago. To get such a continuous data source from such a long time ago is very rare."

Scientists think that trees that used to tower above the Diavik mine site were redwoods from the genus *Metasequoia*. There is a virtually identical modern species of tree called the dawn redwood that they use to help them interpret these ancient samples. For 55 million years, the dawn redwood has remained essentially unchanged. Until 1941, however, it was thought to have been extinct. By chance discovery it was found growing in a remote Chinese village and botanists have since been able to cultivate and reintroduce it to gardens and parks around the world, although in the wild it is classed as critically endangered.

The pieces of wood from Diavik's kimberlites may not have the same price tag as diamonds, but to scientists, they are invaluable. Researchers are continuing to use the wood to unlock information about the Earth's history and its ancient climates. This knowledge may help them to understand the way prehistoric ecosystems reacted to climate change – which could help those studying global warming today.

**Find out more about the Diavik mine at [www.diavik.ca](http://www.diavik.ca)**

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Top, the dawn redwood, the closest living relative to the prehistoric redwood unearthed as fresh wood at Diavik, above.



## A trophy from the Eocene

Earlier this year, a call went out around the Rio Tinto Group to find a work of art that would make a fitting trophy for the 2008 Rio Tinto Prize for Sustainability. Since 2004, Alcan, and now Rio Tinto, has awarded the US\$1 million prize each year to a not for profit, civil society or non government organisation working to advance the goals of economic, environmental and social sustainability.

Pat McCloskey, director Community & Corporate Affairs at Diavik, answered that call. He suggested Rio Tinto commission a young Inuit artist – Joe Jaw Ashoona – whose family’s workshop and gallery is in Yellowknife.

Joe won the commission, and crafted a trophy that represents a link between the Inuit people and Rio Tinto’s operations. Out of a piece of kimberlite from the Anik pipe, with its assemblage of crystals and gems, Joe carved a polar bear standing proudly on its hind legs.

The 2008 winner, announced this year, was Trees, Water & People, a US based conservation organisation that develops and manages community reforestation, watershed protection, renewable energy, environment education and carbon offset programmes.