

Diamond Drills and Saskatchewan Thrills

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What is a Diamond?

No other precious stone consists of a single element, the element which is the basis for all life on Earth: pure carbon. Although chemically identical to graphite and charcoal, the carbon of a diamond has been crystallized. The dense, strong crystal molecular structure gives it its unique appearance and unique hardness. The difference between the hardness of a diamond and that of the next hardest substance, corundum (ruby and sapphire) is greater than the difference between corundum and topaz.¹ The expression “diamond cut diamond” is truly apt: the diamond will scratch all other substances, yet is marked by none but itself.

Diamonds were formed almost two billion years ago in the Earth’s mantle. About 200 km below the planet’s surface, pressures of 5.5 million kilopascals (800,000 psi) and temperatures of up to 1500 degrees Celsius squeezed carbon molecules close together in tightly packed rigid geometric structures over an unimaginable stretch of time.

During the Cretaceous Period of 100 million years ago, in what was to become Saskatchewan, the coal and oil formations and the Blairmore Formation were laid down. The dinosaurs were dying out and mammals, modern birds and grasses were developing. Sea levels were high. During a series of volcanic eruptions, magmatic materials called kimberlite and lamprosite were forced out onto the planet’s crust, often picking up diamonds along the way and carrying them to the surface within the magma.

Typically, these characteristic kimberlites spewed out onto the surface of continental interiors where they were subject to a great deal of erosion. Any diamonds and other heavy minerals present in the matrix were separated from the source rock and then transported by water and deposited as placer diamonds in river gravels. In contrast, in what would one day be Saskatchewan, kimberlites containing diamonds erupted onto a flat swampy coastal plain and were deposited, possibly under water, in unusual saucer-shaped craters. These craters comprise the Fort à la Corne kimberlite geological province, one of the largest, perhaps the largest, in the world.² The craters have diameters of up to 1600 m and may be deeper 250 m. Over millions of years of weathering and glaciation, these kimberlite pipes became hidden under 100 m of sand and rock which now support the Fort à la Corne provincial forest about 80 km east of Prince Albert.

How Are Diamonds Found?

Traditionally, prospectors found diamonds by searching for kimberlite deposits through tracking minerals often found with kimberlite pipes, then homing in on the pipes themselves and finally sampling the kimberlites for diamonds. Less than 1% of kimberlite deposits are found to contain sufficient amounts of diamonds to make mining them economically feasible.³

Because the Fort à la Corne kimberlites are covered in thick overburden, the usual methods presented difficulties. Instead, since kimberlites are magnetic to some degree, magnetic and

¹ PBS, *Nova*, “A Primer of Gemstones,” <http://www.pbs.org/wgbh/nova/diamond/gemprimer.html>

² Saskatchewan Interactive, “Mining: Base and Precious Metals,” *Diamond*, University of Saskatchewan, http://interactive.usask.ca/skinteractive/modules/mining/search/mineral_typ.../diamond.htm

³ DiamondFacts.Org, “Formation,” World Diamond Council, <http://www.diamondfacts.org/about/formation.html>

gravity geophysical surveys have been used, both on the ground and from the air, to discover the location, size and orientation of the deposits.⁴ Hundreds of potential sites have been found, often in clusters of six to 40, and each cluster about 40 km in diameter.

Several projects are drilling cores to get a better understanding of the geology of the deposits. Much testing must be done to determine if there are enough diamonds of sufficient quantity and quality to warrant the construction of mines. Drill holes vary between 16 and 24 inches. The rough material brought up, washed and bagged for further processing. First the rock matrix is crushed. The gems are separated from the gross kimberlite rock using gravity and concentrated. The individual diamonds are then picked out by allowing them to be caught in grease or by x-ray fluorescence.

What Use Are Diamonds?

When most people think of diamonds, they think of jewellery. The De Beers' "A Diamond is Forever" advertising phrase has been voted the most effective slogan of the past half century.⁵ The refractive brilliance, spectrum-splitting fire and clarity of diamonds have made them highly desirable as ornaments ever since they were first discovered in river gravel about 2700 years ago in India.⁶ Methods of cleaving, cutting and polishing have developed over the centuries. In 1905 the largest diamond known, the Cullinan diamond, weighing 3,106 carats, was found in South Africa. Among the finds, so far in Saskatchewan, is a 10.13 carat light fancy yellow diamond.⁷ Size and weight are not the sole measures of a diamond's quality, however. The diamond's hardness also makes it important in industry for grinding, polishing and on the cutting edges of drills and cutting tools.⁸

Gem quality diamonds are usually valued based on what are called the 4 C's, Carat, Clarity, Colour, and Cut. The carat weight of cut diamonds helps determine their value as the larger the diamond is the more rare it is considered, which increases the stone's desirability. Colour refers to the intensity of the stone's colour, the closer the stone is to a pure white, pink, yellow or blue the higher its value will be. Clarity, the clearer the stone is and freer from inclusions the more valuable it is. Not only the quality of the cut, but the type of cut as well, determine the stone's value as some cuts require more in terms of time and skill and or waste more of the raw stone to create.

The Hunt for Diamonds in Saskatchewan

India was the only known source of diamonds until the 18th century. Since that time, major diamond deposits have been found in Brazil, South Africa, Australia, and, most recently, Canada. Saskatchewan's first known deposits were identified at Sturgeon Lake in 1988 in a gravel pit that contained a greenish rock which later proved to be large blocks of kimberlite.⁹ The exploration had been prompted by information gathered during the 1969 Geological Survey of Canada aerial

⁴ Shore Gold Inc., "Star Diamond Project," <http://www.shoregold.com/sdp.html>

⁵ Murry Lyons, "Diamonds offer dream to buyers," [The Star Phoenix](#), December 5, 2002.

⁶ Wikipedia, s.v. "Diamond," <http://en.wikipedia.org/wiki/Diamond> (accessed December 18, 2006).

⁷ Shore Gold Inc., "Joint Venture," <http://www.shoregold.com/jumi.html>

⁸ Saskatchewan Interactive.

⁹ Saskatchewan Industry and Resources, "Mineral Resources of Saskatchewan," [Diamonds](#), <http://www.ir.gov.sk.ca/Default.aspx?DN=3551,3541,3538,3385,2936Documents>

magnetic survey.¹⁰ The huge Fort à la Corne kimberlite province, one of the largest in the world, was discovered in 1989 and since then more than 70 pipes have been identified.¹¹ Work has been continuing to develop a better understanding of the geology of the area with to determine whether the kimberlites contain diamonds of sufficient quality and quantity to warrant the building of open pit mines. Beyond the Fort à la Corne area, the whole province of Saskatchewan is thought to have potential for diamond exploration.¹²

In 2005, \$55.4 million was invested in diamond exploration in Saskatchewan.¹³ Several companies have or are exploring the Fort à la Corne field. Gem quality diamonds have been found. Nearby to the south, Shore Gold is exploring the Star Kimberlite deposit. One of its test drill holes recorded the thickest continuous intersection with kimberlite ever drilled in a vertical hole in North America.¹⁴

Significant amounts of gem quality diamonds have been found but it is only recently that evidence is being found that the deposits may be of economic grade. As the quality of the diamonds is important, so is the ore grade, or the amount of diamonds found per unit of kimberlite. The Fort à la Corne ore has been found to contain five to 25 carats per 100 tonnes, representing a diamond value which ranges from \$50 to \$150 US per carat.¹⁵ If the potential pans out, the deposits could be mined for a long time, creating a robust new industry for the province.

Beyond the mid-latitude exploration, Geological Survey of Canada mapping projects show that southern Saskatchewan also has many promising sites. High concentrations of diamond indicator minerals in surface deposits in the Moose Jaw to Val Marie area is surprising the experts.¹⁶ The primary kimberlite source rocks have not yet been found.

Why Saskatchewan?

There are several diamond mines operating in Canada, including the new Ekati and Diavik mines in the Northwest Territories. Why are companies continuing to invest in the potential of Saskatchewan? The reasons are many. Eighty percent of Saskatchewan's kimberlite pipes are diamondiferous, 50% contain diamonds over one millimetre in size, a high percentage of diamonds recovered in Saskatchewan are clear, inclusion-free and of high quality in crystal formation.¹⁷ Exploration potential across the province is good.

Compared with the costs of operating in the Northwest Territories, the costs of operating in Saskatchewan would be extremely low. This is because the infrastructure is already in place, including existing paved all-weather roads, nearby communities, service companies experienced

¹⁰ Bruce Johnstone, "Drilling for diamonds," *Leader-Post*, October 28, 2002, <http://www.canada.com/components/printstory.asp?id=9bb42743-9f78-4ac2-8>

¹¹ Saskatchewan Interactive.

¹² Saskatchewan Industry and Resources.

¹³ Saskatchewan Industry and Resources, "Annual Report," <http://www.ir.gov.sk.ca/adx/asp/adxGetMedia.asp?DocID=4157,3088,2936,Documents&MediaID=15406&Filename=05-06+SIR+Annual+Report.pdf>. Page 35.

¹⁴ Shore Gold Inc., "Star Diamond Project."

¹⁵ Johnstone.

¹⁶ Saskatchewan Industry and Resources.

¹⁷ Shane Resources, "Diamonds," <http://shaneresources.com/diamondinfo.html>

in mining technologies and needs, well-established power grids and water systems.¹⁸ Since before it was a province, Saskatchewan has been open to the exploration and harvesting of its mineral resources and the Saskatchewan government has encouraged their extraction and marketing at home and around the world.

What Are Diamonds Important to Saskatchewan?

In 1999, Canada was rated as seventh among world producers of diamonds, with production valued at \$422 million US.¹⁹ Botswana topped the list at \$1,612 million US.²⁰ Since many mines around the world are slowing their production, the value of diamonds is not expected to drop in the future.²¹ Only in Canada is the mining industry is gearing up to deliver more diamonds to the world market.²² In fact as of 2004 Canada has already moved into third place, behind Botswana and Russia, in terms of diamond production by value.²³ Saskatchewan is poised to enter the race. If, or when, Saskatchewan's potential is realized, the provincial economy will be strengthened with a new and valuable export product worth billions of dollars in production and resource royalties.

The cost of construction of an open pit mine and mill facility at Fort à la Corne is estimated at about \$600 million to \$700 million.²⁴ The mine, at a potential production level of 54,500 tonnes per day, might produce the most tonnage for diamonds in the world, employing perhaps 400 people directly in the mine. Revenues have been estimated as high as \$500 million a year.²⁵ A huge benefit to northern communities and the province in general would result, with about 4000 jobs created in the service industries.

If and when diamond mining becomes a reality, the effects on the environment are expected to be minor since the kimberlite ore is relatively benign. Mine tailings weather quickly and eventually disappear into soil. Since diamonds are dense and heavy minerals, gravity processes are sufficient to separate them from the ore, with no need for toxic chemicals sometimes associated with mining and milling of such minerals as uranium and gold.²⁶

At present there are no diamond mines in Saskatchewan.

The potential is excellent- and exciting!

¹⁸ Johnstone.

¹⁹ Jeff Arthur, "Digging Up Diamonds," page 2.

²⁰ Ibid.

²¹ Lyons.

²² Ibid.

²³ De Beers Canada, http://www.debeerscanada.com/files_2/canada-2.html

²⁴ Johnstone.

²⁵ Ibid.

²⁶ Arthur, page 4.