

**EXPLORATION AND DEVELOPMENT
FOR DIAMONDS DURING 1994**

Kansas Geological Survey Open File Report 97-71

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Kansas Geological Survey
Open-file Report

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INTRODUCTION

During the annual review of industrial minerals by the Kansas Geological Survey, it was determined that there was a large amount of exploration and development activity for diamonds during 1994, particularly in North America. As a result, diamonds warranted a separate open file report.

WORLD MARKET

The CSO (Central Selling Organization) of DeBeers reported a record high sales of diamonds in the first quarter, partly due to restocking after the Christmas sales season, as sales rose to \$1.2 billion. Most dealers doubted whether this pace could continue unless prices were lowered. DeBeers reported 6 month sales for rough stones by the CSO increased 42% above 6 month 1993. However, after a strong first half, rough diamond sales fell during the second half of the year and ended the year slightly lower than the 1993 total.

In 1990, Russia and DeBeers signed a 5-year agreement whereby 95% of Russian diamond production would be sold through the C.S.O. of DeBeers. Talks regarding the renewal of the agreement next year have produced some tensions with some Russian officials believing they could get better prices by selling independently. DeBeers has countered with the argument that the 5% sales allowed by the agreement should serve as a price check. DeBeers further claims that Russia has cheated on the agreement by allowing considerable sales outside the C.S.O. It seems likely the agreement will be renewed because it is mutually beneficial. The C.S.O. desires to control world diamond sales and Russia benefits from the marketing provided by the C.S.O. It is estimated that Russia has leaked as much as \$500 million worth of rough diamonds onto the world market. This will produce strain on the agreement with DeBeers that comes up for renewal in 1995.

A very large amount of newsworthy items concerning the exploration and development of diamond areas was reported during the year. The events have been listed for each area in the following sections.

NORTHWEST TERRITORIES, CANADA

Once Dia Met Minerals announced finding diamonds in the Lac de Gras area of Northwest Territories, Canada, the staking rush began, and within a couple of years, over 60 companies, mostly small to mid-size, had staked claims in the area. In view of the number of reported diamond finds, it is hardly surprising that major companies have been attracted to the scene. BHP (Broken Hill Proprietary) Minerals is sinking large amounts of money into the Dia Met discoveries, and BHP Minerals Canada has formally notified its joint venture partner, Dia Met, that BHP intends to use its own money to fund a feasibility study for the first diamond mine in the NWT, in effect giving BHP a 51% controlling interest in the venture. However, the DHK/Kennecott joint venture associated with the Tli Kwi Cho project is also developing rapidly, in part due to Kennecott's funding, as another potential first diamond mine.

\$C3.25 million will be spent on an expanded 1994 exploration program by the joint venture of Mill City Gold Mining Corp, Tanqueray Resources, and Fiber-Klad Industries at their Yamba Lake, NWT, diamond project. Three kimberlite pipes have been drilled and found to be diamond-bearing. The program is largely funded by Mill City and will complete the company's earn-in of 50% interest in the joint venture. Mill City Gold Mining, Tanqueray Resources, and Fibre-Klad Industries joint venture announced they plan to drill 20 vertical holes into the Torrie kimberlite to obtain a large sample and also plan to drill other anomalies (as many as 10).

It was announced that prospects in the Yamba Lake area (Tanqueray Resources/Mill City Gold Mining Corp.) will have DeBeers as a joint partner. DeBeers will invest substantially in the project, also purchasing stock of the joint partners. With the involvement of DeBeers, one can speculate that more than one diamond mine could be operating in the Northwest Territories in a few years.

BHP Minerals/Dia Met Minerals joint venture continue to bulk sample and analyze prospects. Based on recent analyses, the BHP Minerals/Dia Met Minerals proposed plan for the first diamond mine in North America has been expanded to include 5 kimberlite pipes and a 25-year lifetime. If regulatory authorities approve the plan, the company projects a 300,000 ct/yr output by the end of 1997. During the year a 10 ton per hour sampling plant was completed and the following results (next page) were reported from four diamond-bearing pipes (Mining Journal London 322 (8285), p 57);

**Results from the BHP Minerals/Dia Met Minerals Joint Venture
Northwest Territories**

	sample (t=tons)	total carats (ct) and ct/t	average value at Antwerp (\$)
Koala pipe;	1,193 t,	893 ct, 0.75 ct/t	82/t 110/ct
Panda pipe;;	230 t,	270 ct, 1.18 ct/t	150/t 127/ct
Falcon pipe;	426 t,	120 ct, 0.28 ct/t	6/t 43/ct
Misery pipe;	132 t	437 ct, 3.30 ct/t	142/t 17/ct

Slave Diamond Syndicate, a joint venture of four companies, has filed a total of 80 claims east and north of Yellowknife, N.W.T. based on results from satellite imagery and high resolution aeromagnetic reconnaissance that has identified 58 possible kimberlites in the Slave Craton area (Great Slave Lake northward to the Beaufort Sea). The area, based on seismic work, has a sufficiently thick crust (240 km) to provide diamond stability according to conventional theory.

A joint venture of Major General Resources and ASCOT Resources is investigating an area on the north edge of the Slave Craton on Victoria Island, NWT. Pure Gold Resources and Ashton Mining of Canada signed two new J.V. agreements covering more land (Slave Craton Joint Venture) than their 1993 Lupin Joint Venture.

Lumina Investment Corp. has found a kimberlite pipe at the surface (no overburden) on the Brodeur Peninsula of Baffin Island, NWT and a further 61 potential targets have been found using landsat imagery. Samples show a considerable amount of indicator minerals.

Gitennes Exploration/Aber Resources JV are beginning exploration for diamonds at Point Itchen site NWT. Indicator minerals have been found in tills and geophysical work suggests three clusters of 20 targets for further exploration.

Aber Resources reported they had intersected a diamond-bearing kimberlite at the Diavik concession near Lac de Gras, NWT. Later, the company announced encouraging results from their Diavik property (~200 mi NW Yellowknife). Although Aber stressed that the results were only from a single kimberlite pipe, a 155 kg (340 lb) sample yielded 154 stones, 38 of which had >0.5 mm diameter. Aber indicated preliminary results from another pipe also indicated the presence of diamonds. Aber Resources later reported that its first hole drilled into the A-154 anomaly of its Daivik property had encountered kimberlite and visually identified two

diamonds, one ~1.75 ct, clear, white and colorless. As a result, they decided to have the entire core analyzed. Results of the 751 kg (1640 lb) core revealed 402 macro diamonds and 894 microdiamonds but only 112 macrodiamonds with a size larger than 1 mm and of these, only 7 with weights larger than 0.2 ct.

A joint venture of Pure Gold, Tenajon Resources, and Ashton Mining have found microdiamonds in its Cross kimberlite pipe, located 120 mi (200 km) from Lac de Gras region NWT.

With all the good news coming from NWT diamond prospects, it was inevitable that disappointing news also occur. Results from Aaron Oil's (Calgary) Humpy Lake properties in NWT have, to date, been disappointing. Six of the twenty initial targets were drilled but no kimberlite was found. Closely following Aaron Oil's announcement, a joint venture exploring the Tli Kwi Cho reported that bulk sampling of one of the pipes yielded insufficient diamonds or quality to justify further bulk sampling. The best result was from the 3,000 t sample of pyroclastic material in the pipe that yielded only 0.36 ct/t. Also, it appears that less than 30% of the stones larger than 2 mm are of gem quality. Finally, Lytton Minerals (Vancouver) reported that early sampling results from its Ranch Lake kimberlite are disappointing, 5.3 ct/28.5 t. Despite the low weight obtained, 30% were gem quality and Lytton is considering a larger bulk sample.

DIAMONDS IN OTHER CANADIAN PROVINCES

Fueled primarily by diamond exploration, exploration and development spending has increased 46% this year in Saskatchewan and leased acreage is 7 times that leased only two years ago.

Rhonda Mining Corp. announced drill core samples (Snowden area) have shown a total of 24 diamonds. 80% of the diamonds at Snowden are reported to be gem quality. The cores, from two holes, are from a tuff unit. Rhonda Mining Corp. reports finding 6 gem quality diamond fragments in a drill core from a kimberlite-derived sandstone near the Fort a la Corne kimberlite area. The company feels that area sediments may be richer in diamonds than the source kimberlites. An aeromagnetic survey of the area is expected to begin shortly to find suspected kimberlites in the area in a joint venture with Mill City and Aaron Oil. A hole drilled by the latter company in central Saskatchewan, east of Fort a la Corne, revealed no kimberlite.

The tentative identification of diamonds in a heavy metal concentrate of material collected up-ice from where Noront Resources previously found diamonds has prompted the company to lease more land in its Crystal Valley claims (~25 mi east of Montreal) in the St. Lawrence Rift region. Geophysical work has identified a round buried pipe-like structure in the area.

The KWG Resources/Spider Resources joint venture reported that 100 diamonds (25 macro) were recovered from a 106.6 kg drill core sample in their Kyle Lake property located in the James Bay Lowlands area of northern Ontario. The encouraging results have led the companies and a joint venture partner, Ashton Mining of Canada, to stake nearly 600 additional claims.

Finally, the KWG Resources Inc./Spider Resources joint venture also reported more results, recovering 22 microdiamonds from a 22 kg sample from its Troika kimberlite lease in the Notre-Dame-du Nord area of Quebec.

AFRICA

In addition to all of the press devoted to diamond exploration and development in Canada, a large amount of news originated from Africa during the year. A considerable amount of activity occurred in Zimbabwe. Redaurum Red Lake Mines (Canada) (Auridiam Consolidated of Australia is a 50/50 partner in the joint venture) announced that it's final (and impressive) upgrade at the 50%-owned, River Branch diamond mine in Zimbabwe will allow production to increase from 130,000 ct/yr to 300,000 ct/yr. Proven reserves should allow continuous production for at least 15 years. A heavy medium separation plant was completed in January. Unusually heavy rains filled a dammed area well ahead of schedule and will allow the plant to operate for 18 months during severe drought. Early in the year, the company reported an 8,500 ct lot of diamonds was sold in Belgium. It was later announced that the mine produced over 14,500 ct of diamonds during April, much greater than the projected 10,000 ct. and a sale of River Branch diamonds was planned for June in Antwerp. Among the 30,000 ct are a number of sizeable gems ranging from 18 to 31 ct. The diamond mine continued to report increasing production at mid-year. Second quarter results were 41,651 ct, an 85% increase over the previous quarter. Several gem-quality diamonds of over 15 ct were found as well as a poor quality, 75 ct stone. In addition, the recently installed heavy minerals separation plant was operating at the designed level of 350,000

t/yr. Finally, Redaurum Ltd. announced the final 1994 diamond sale from the River Branch mine in Zimbabwe raised some \$1.2 million. Noteworthy was one diamond that sold for \$2,000/ct.

Reunion Mining reported finding 8 further kimberlite discoveries (a total of 16), some of which have characteristics indicating formation at depths where diamond would be stable. The company later announced further kimberlite pipe discoveries, and by years end, a total of 29 pipes were reported. Over 10 pipes each were reported in the Katete and Milbizi clusters. Argosy is a partner in the joint venture.

In Tanzania, Serengeti Diamonds Ltd. (Toronto) installed a 50t/hr pilot washing plant at its Kahama diamond property. The company plans to recover some 2,000 ct of stones to evaluate their gem-quality, ore grade, and reserves, before considering a larger scale plant. Early results from its leases using samples collected from pits in the gravels (both cemented and loose), showed the average value of gem-quality stones from this area is approximately \$200/ct.

Botswana Diamondfields Inc. (Vancouver) reports the discovery of kimberlite associated minerals in soil samples located near geophysical magnetic anomalies in their Mopipi lease in Botswana.

The lifting of sanctions (US and Canada) against the Republic of South Africa and approval of its new constitution will allow Diamond Field Resources to become the first Canadian company to acquire diamond mines in the Republic, specifically the Loxton Dal and Frank Smith mines in the famous Kimberley area. The company expects reserves are sufficient for 20 years and at expanded ore production rates from 48,000t to 144,000 t/yr at Loxton Dal and from 156,000t to 360,000 t/yr at Frank Smith. Diamond recovery is anticipated to reach 100,000 ct.

In other South African news, Canadian Overseas (Toronto) has expanded its marine diamond properties by acquiring two areas in South Africa. One of the gravel areas has been sampled and yielded 193 ct/ton with an average size of 0.8 ct. Sentinel Resources has reported finding a diamond weighing over 60 ct at its Holpan mine in South Africa as well as a 10.25 ct octahedral diamond at its joint venture Good Hope Property. The company also reported a high quality 17.8 ct bipyramidal stone was obtained from the Vaal River.

Considerable activity also occurred in Namibia. Ocean Diamond Mining plans to acquire a second vessel for its offshore operations in Namibia.

Recently the company demonstrated the diamond potential of the area by producing 1,700 ct from two-and-a-half weeks of seabed mining. BHP Minerals and Benguela Concessions Ltd. have agreed to fund exploration in both deep sea and shallow water areas of the Ludecitz Sea diamond area off the shores of Namibia. In so doing, the joint partners will earn a 50% interest in the joint venture now owned by Angra-Pequena Diamond Co. Ltd., a subsidiary of Diamond Fields Resources. After further exploration and sampling, the new partners will consider the viability of a 100,000 ct/yr operation and a possible expansion of their ore processing facility to 200,000 t/yr. The result of two years of negotiations is the formation of Namdeb Diamond Corp., 50% owned by the government of Namibia and 50% by DeBeers. In addition, the agreement between the co-partners includes changes in the tax and royalty regulations. The agreement also covers marine prospects of DeBeers Marine that recovered 300,000 ct. last year. Finally, Redaurum Ltd. plans to acquire alluvium diamond prospects on the Konkiep river in Namibia, located 15 mi. north of the diamond region around the lower section of the Orange River, using ground penetrating radar in preparation for first stage drilling.

In Ghana, plans are underway to double the production of the country's only large diamond mine at Akwatia to 40,000 ct/month. DeBeers has stepped in to take the place of the withdrawal of a partner in a proposed joint venture. DeBeers will operate the mine, install a dense media separation plant, and combine the existing two operations into one. The government (20% owner) must approve the reorganization.

United Reef Ltd. sold its first parcel of diamonds collected from its samples on the Bamingui property in the Central African Republic. Over 400 ct were sold at an average price of \$180/ct.

ASIA AND INDONESIA

1993 sales of diamonds by Almazy Rossil-Sakha, Russia's largest producer, were higher than expected and totaled \$1.65 billion. Approximately \$1.27 billion were exported, and the \$334 million profit realized will be reinvested in operations.

A new diamond mine and ore processing plant is under development at Aykhal in the Yakutskaya region of northeastern Siberia. While not as rich as the Udachnyy mine, it is felt the new mine will become increasingly important as production falls at Udachnyy. The new operation is scheduled to begin production in late 1995.

Ocean Resources (Perth, Australia) has completed an exploration phase (using radar imagery to locate swamp and off-shore, diamond-bearing channels) at the Sunda shelf area of Indonesia's southeast Kalimantan (Borneo) coastline. The company plans to use a bucket dredge to retrieve gravels in the channels. The area has been worked by individuals for an estimated 1,000 years but such activity has not affected the bulk of these deposits.

India established The Mines and Minerals Regulation and Development that effectively liberalizes the country's mining industry, thus making it more attractive to foreign companies. Already, Ashton Minerals of Australia and DeBeers of South Africa have contacted government officials expressing interest in the diamond industry of India. Another gemstone of possible interest is alexandrite.

AUSTRALIA

A new theory of diamond formation has been proposed by geologists at the Geological Survey of New South Wales where numerous alluvial diamonds were found in areas underlain by thin, relatively young crust with no kimberlites or lamproites. They believe the origin involves a dynamic model involving subduction of carbon-bearing marine sediments in a collision zone of two tectonic plates. A thick subduction "slab" might remain relatively cool as it sinks but a sufficiently high pressure may allow diamonds to form, possibly as shallow as 80 km or 260 feet in depth instead of the traditional static environment at 150 km or deeper. Rocks such as nephelinites or alkaline basalts could bring them to the surface rather than traditional kimberlites or lamproites as is likely in South Africa and Western Australia. The new model provides a new range of indicator minerals and makes specific predictions about the trace element compositions of certain minerals which can be used as exploration tools. In another development, Benride Pty has recently discovered both diamonds and sapphires in New South Wales and is searching for a joint venture partner.

The Argyle mine, located in the Kimberley region of Western Australia, is one of only two mines in Australia (the other being the much smaller Bow River operation) but in terms of carats produced, is the largest diamond mine in the world. It is set apart from most mines that are primarily associated with kimberlites in that the host is an ultrabasic rock, lamproite. Originally planned to process 3 Mt/yr ore, an upgrade in 1990 coupled

with a second upgrade nearing completion will allow the plant to process about 7 Mt/yr. Projected diamond production this year should be around 39 Mct of which half are industrial quality (5% revenues), 45% near-gem quality (45% of revenues) and 5 % gem quality (50% of revenues).

A combination of companies known as the Australian Diamond Exploration Joint Venture is exploring the Batten Trough area, Northern Territory, where diamondiferous pipes are known. Samples of small pipes showed fewer stones (17/ct) relative to the Argyle Mine (30/ct). This means the stones of the Batten pipes are larger but insufficient analyses have been done as yet to indicate the larger stone size is typical of the entire deposit. The pipes currently known are small, and the venture hopes, by further exploration, to locate a larger pipe.

SOUTH AMERICA

South Atlantic Diamonds Corp. (Canada) reported they had found more microdiamonds in a kimberlite intrusion at their Coromandel project, Minas Gerais, Brazil.

Diamonds up to 1 ct have been found in the Cana Verde pipe and Southern Copper Corp. has acquired claims on two kimberlite intrusions (Corrego D'Anta district of Minas Gerais, Brazil). The company plans to sample both pipes in the near future.

Golden Star Resources plans to do (axial survey work) diamond exploration on two areas of the Roraima Plateau in Guyana.

Lumina Investment Corp. has acquired several diamond properties in the Bolivar State, Venezuela, including areas where diamonds are known, but several of the alluvial tracts are unexplored. Lumina also acquired five areas about 60 miles south of Caracas where volcanic pipes are known to occur.

UNITED STATES

Although the United States is not known as a significant diamond producer, there were two developments during the year that warrant mention.

Ashton Mining of Canada Inc. has announced the discovery of a small kimberlite in the Crystal Falls area of Michigan as part of their Great Lakes exploration project.

Redaurum Red Lake Mines (Canada) is examining the Kelsey Lake kimberlite pipes in northern Colorado. Redaurum Ltd. has also decided to acquire the remaining 75% interest in the Kelsey Lake property from individual investors. The property contains 8 kimberlite pipes and more than 600 stones have been found in the area, the largest being 14 ct. It is estimated that of the stones found, 60% are of gem quality.

EUROPE

Ashton Mining Ltd. announced the discovery of a new diamond area in Finland that includes two kimberlite fields plus isolated kimberlites. 21 kimberlites have been found to date. Diamonds have been found with "a significant proportion" of the stones being clear and colorless. Two pipes were sampled (100 t samples) with quantities of >0.8 mm stones ranging up to an average 0.26 ct/ton. The study is similar to Dia Mets in the North West Territories, Canada, and Ashton has quietly been exploring in Finland since 1986. At least seven kimberlites are known to contain diamonds.

Nordic Exploration Group plc has been exploring areas of Sweden and Finland for the past 3 years and the geology coupled with the recent announcement by Ashton Mining Ltd. concerning a potential diamond area in Finland has convinced the company that the area could become similar to Canada. In fact, the geology of the Baltic Shield is similar to the Archaean Shield area of Canada and Australia. Much of the past exploration in Scandinavia was for base metals and iron. Neither gold or diamonds have attracted much attention. There are circular magnetic anomalies in Sweden that may well be kimberlites and diamonds have been found in kimberlites and glacial fills just to the east in Russia.

REFERENCES

All of the information for this review was obtained from the Mining Journal, London, Volumes 322 and 323, 1994, published by The Mining Journal, London, England. Some of the information is also present in other mining related journals such as Mining Magazine and Engineering and Mining Journal.