



An aerial view of the Argyle diamond prospect, showing the kimberlite pipe AK-1 and associated alluvial deposits. Photo from 1982.



# Argyle, De Beers and the international diamond market

By H M Thompson

A few years ago a leading US business magazine described the diamond cartel, De Beers Consolidated, as "a monopoly no justice department has been able to touch, a money machine without peer in the capitalist world."

In this paper H M Thompson examines the origins of De Beers and how the company has handled two recent challenges to its monopoly position, one from Zaire, the other from the Argyle Diamond mine in Australia.

## SUMMARY

For much of the 20th century the production, marketing and distribution of diamonds has been handled by the various subsidiaries of De Beers Consolidated under the guiding hand of Harry Oppenheimer. 80 per cent of the total world output of diamonds passes through the Central Selling Organization of De Beers before reaching the marketplace. Because of this control, the diamond monopoly is the most successful and powerful of any cartel operation in the world.

Recently the De Beers monopoly position was threatened when it was announced in 1980 that, potentially, the largest diamond mine in the world had been discovered in northwest Australia. Indeed, the Argyle Diamond Mine began production in January, 1983; and by 1985 will be producing 25 million carats per year. This represents 50 per cent of the annual world output at present.

However, with little fanfare, and powerful skills of persuasion, De Beers has seen to it that most of the Argyle output will pass through the Central Selling Organization. This simply shows once again how irrelevant competition has become for the expansion of monopoly capitalism on a global scale.

## Diamonds and their utility

The diamond is one of two naturally occurring crystalline forms of ordinary carbon, the other being graphite. It is among the rarest of minerals to be used by humans and is unique, characterized by extreme hardness and, when fashioned, attractive colours and brilliance.

Over 2 000 years ago the Greeks recognized the flashing fire and brilliant light of the stone, as well as its extreme hardness, so they called it 'adamas', suggesting the 'unconquerable'. 'Adimantum' is probably the root word of the old French 'diamant' and the English 'dyamaund' used at the beginning of the 15th century. Modern spelling seems to have originated in

the mid-16th century.<sup>1</sup> From 'adamas' was derived the word; and today, from De Beers' Central Selling Organization is derived most of the world's diamonds.

The gem is a natural prism, capable of bouncing light rays, bending them or dispersing them into a variety of colours. This ability gives to diamonds one of their two major end uses — a beauty which classifies them as gems and jewels for decoration of the human species. Also, diamonds are among the hardest known materials on earth being listed at 10 on Moh's hardness scale. (A mineralogist by the name of Moh developed one of the earliest relative scales for the test of hardness as a physical property. The test is one of 'scratch hardness' where any mineral in a numbered scale 1 to 10 will scratch those of lower numbers. Some relative examples would include: 1 = talc; 2 = gypsum; 3 = calcite; 4 = fluorspar; 5 = apatite; 6 = feldspar; 7 = quartz; 8 = topaz; 9 = sapphire; and 10 = diamond). Because of this physical property, diamonds have become an essential material of production.

Diamonds are composed of a single element, carbon, crystallized in cubic form. They range from colourless through blue-white, yellow, red, pink, brown, green, blue and grey in gem form; and from yellow-brown to dark brown and black in industrial form. Ten grades of quality (clarity) are also employed for crystals. Only one through five are regarded as gems, although this may be extended to seven if consumer demand is strong. The remainder, six or seven to ten, is defined as 'near-gem' and merge into the industrial category at ten. The colour of gems is also judged according to 'brilliance' — the reflection of light back to the eye; 'fire' — dispersion of light into colours of the spectrum; and 'scintillation' — the twinkling of light changes off the surface of the stone.

Diamonds are also enumerated according to 'carats'. The carat is an ancient term which refers to the uniform weight of a carob seed (set at 142 to an ounce

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*The ASEA company in Sweden was the first producer of synthetic diamonds, a process later sold to Anglo American. Photo from the ASEA laboratory in 1953.*

avoirdupois or one-fifth of a metric gram). The finished diamond is judged by what is referred to as the 4 C's: *carat, cut, clarity and colour.*

### Industrial diamonds

Industrial diamonds are also classified according to the type and size of material. There are three types of industrial diamond — *boart, carbonado* (black diamond), and *ballas*:

- Boart includes stones whose small size, irregular shape, flaws or inclusions, and occurrences in finely crystalline aggregates makes them unsuitable as gems.
- Carbonado is a closely knit aggregate of small crystals, originally found in Brazil.
- Ballas is a hard globular mass of crystals with a radial structure and dark in colour. The word 'industrial' is often used to refer to a stone, larger than boart, which is unsuited for gem quality because of undesirable shape or colour or some other imperfection.<sup>2</sup>

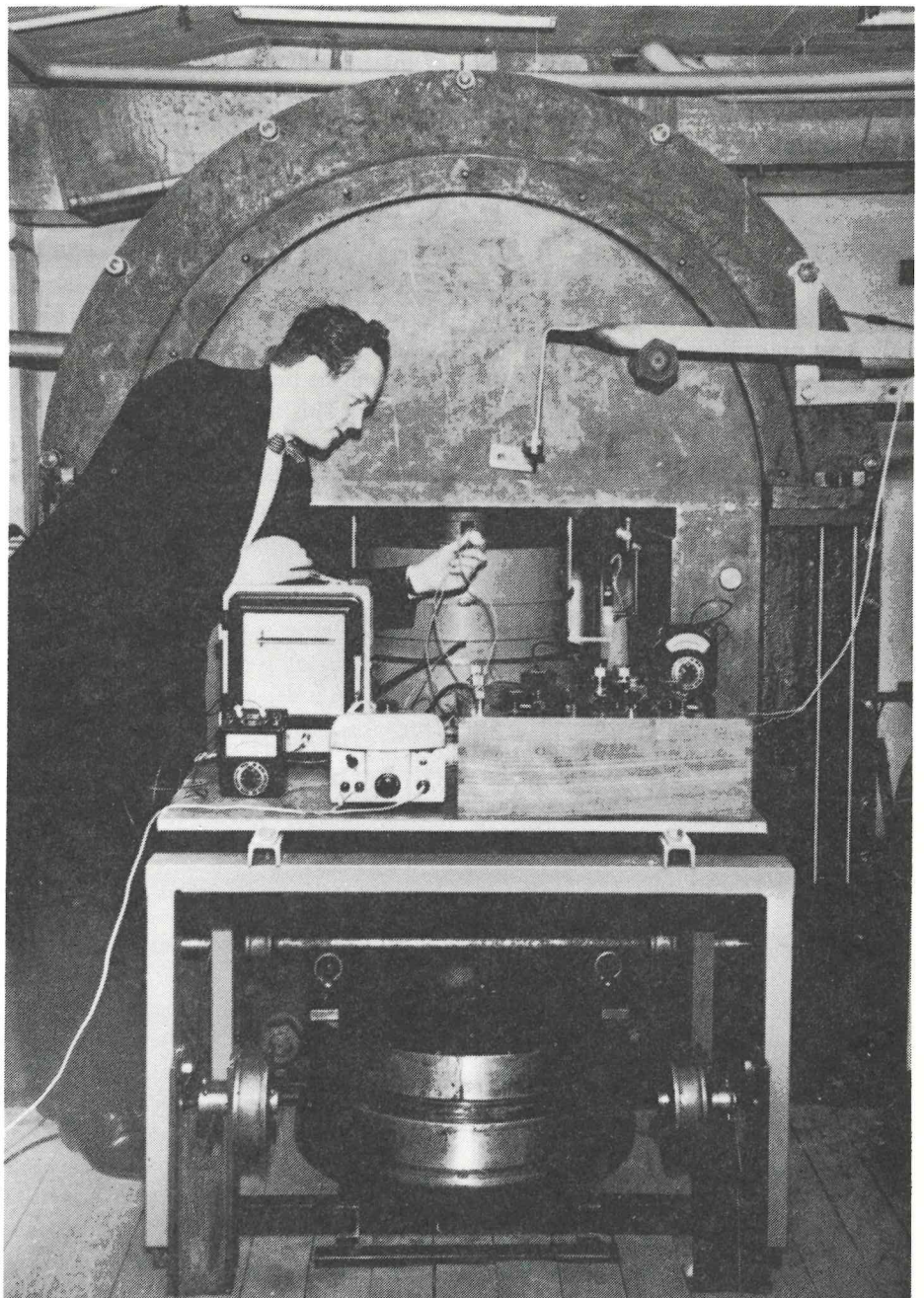
Industrial quality diamonds are also produced synthetically. Although there is some controversy over who actually produced the first synthetic diamond, it is now generally accepted that it was accomplished by the Allmänna Svenska Elektriska AB (ASEA) laboratory in Stockholm, Sweden in 1953. A high pressure apparatus with a carbon solvent catalyst was used to overcome the kinetic barriers and act as a transport agent for carbon.

In 1955, General Electric (GE) announced that it had successfully manufactured synthetic diamonds from carbon in a three stage process: carbon with catalytic graphitization → graphite with dissolution → metal and carbon solution through nucleation → diamond. In 1959, De Beers Consolidated of South Africa announced that they too had managed to produce synthetics on a commercially viable basis. However, General Electric already held the patents and De Beers had to come to

an agreement with GE enabling it to manufacture and sell synthetics in Western Europe.

The advantage of producing synthetics as opposed to mining natural diamonds is that the stones can be produced according to specific requirements of size, shape and quality.

The application of synthetic diamonds falls into five distinct areas: lapping, grinding, sawing, drilling and turning. In all of these applications the diamond particles are bonded into a solid matrix, such as resin, except for lapping where the particles are suspended in a supporting fluid such as oil. About 75 per cent of all in-





dustrial diamonds are transformed into grit or powder. Grit is used mainly in grinding wheels and saw blades; powder is used for the manufacturing of fine finishing tools and lapping compounds. A summary of the major uses is shown below.<sup>3</sup>

The only major problem with the industrial diamond is that it is not the perfect abrasive. It is subject to chemical attack by ferrous metals or oxidation at high machining temperature. Another synthetic, cubic boron nitride, has the advantage of an exceptional hot hardness with a high degree of toughness. Not surprisingly, both De Beers and General Electric are major producers of this product along with synthetic industrial diamonds.

### Market expansion

From the earliest recorded history up to the 18th century, India provided the only supply of diamonds in the world. As long ago as the 4th century B C diamonds were subject to taxation and a major source of royal revenue in India as well as being commodities in trade. In 1498, after Vasco da Gama opened up a trade route between Lisbon and the Indies, a subsidiary link was established between Lisbon traders and financiers in Antwerp. In this way Antwerp became the centre for the diamond trade between the east

and Europe from the 15th to 18th centuries. After the Thirty Year War (1618–48) Amsterdam, offering religious and civil liberty to merchants, also came to establish trade and a large diamond industry.<sup>4</sup>

In the 18th century, the British took over the supply of Indian production and the Dutch began investing large amounts of capital to secure the diamond deposits discovered in Brazil in 1725. Mainly due to the output of diamonds from the Brazilian province of Minas Gerais, by 1735 the world diamond market dramatically increased and prices fell by 25 per cent. It wasn't until 1830 that prices returned to the levels they had reached in 1700. Throughout the 18th century approximately 50 000 carats per year were produced in Brazil alone. In 1844, new rich deposits were discovered in Bahia province, yielding an average of 250 000 carats per year. However, by this time the increase in supply didn't have the same effect as that of a century earlier because of the rapid rise in demand. Given the expansion of modern capitalism and the ideology of democracy a prosperous middle class emerged in England and France (manufacturers, small industrialists, administrators, engineers, merchants and civil servants), which aspired to the owner-

ship of diamond jewellery as part of its luxurious ostentation.<sup>5</sup>

Just before the Franco-Prussian War of 1870, which disrupted diamond markets to the extent of closing the industry down in Amsterdam temporarily, diamond deposits were discovered in South Africa in 1866. By 1875, more than 1 million carats had been produced.

What is now known as De Beers Consolidated Mines grew out of the original discoveries on a farm in South Africa owned by the brothers J N and D A De Beer. By 1880 there was a diamond rush in the Kimberley region of South Africa and 12 companies had been formed. In that year Cecil Rhodes formed the De Beers Company and by 1887 he had complete control of the De Beers pipe. After a series of ownership struggles and amalgamations, and with the assistance of the Rothschild financial empire, Rhodes established his mining empire by the age of 37 in the year 1890.

In 1902, the year of Rhodes' death, Ernest Oppenheimer arrived in the Kimberley to begin a career resulting in the formation of the Anglo-American Corporation of South Africa (AAC) in 1917. He was ultimately appointed to the board of De Beers, after he had bought all of the German diamond mines in South West

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### Applica-Uses tion

**Metal-working:** Grinding (tungsten carbide; cylindrical grinding of tungsten carbide rolls; electrolytic grinding). Honing of engine cylinders and fuel injection pumps. Lapping and polishing tungsten carbide dies, moulds, metallurgical specimens. Wire drawing. Hardness testing. Turning of non-ferrous metals, pistons, commutators. Boring of non-ferrous and ferrous metals. Jewellery (fly cutting wedding rings, powder compacts).

**Glass:** Grinding, sawing, drilling, cutting, art engraving, and crystal cutting.

**Natural stone:** Circular saws, frame saws, polishing and grinding heads, geological specimens.

**Civil engineering:** Core drills, circular saws, bump cutters.

**Plastics:** Sawing and mould polishing.

**Ceramics and refractories:** Grinding of fired pieces, sawing, drilling, and turning of spacecraft heat shields.

**Electronics:** Slicing, dicing and scribing of semiconductors. Grinding ruby laser rods. Sawing and grinding piezoelectric quartz (heat sinks, thermistors).

**Mining:** Exploratory and production oil and gas drilling. Also coal and minerals core recovery.

**Laboratory:** Microtome knives. High pressure optical cell windows. Polishing specimens.

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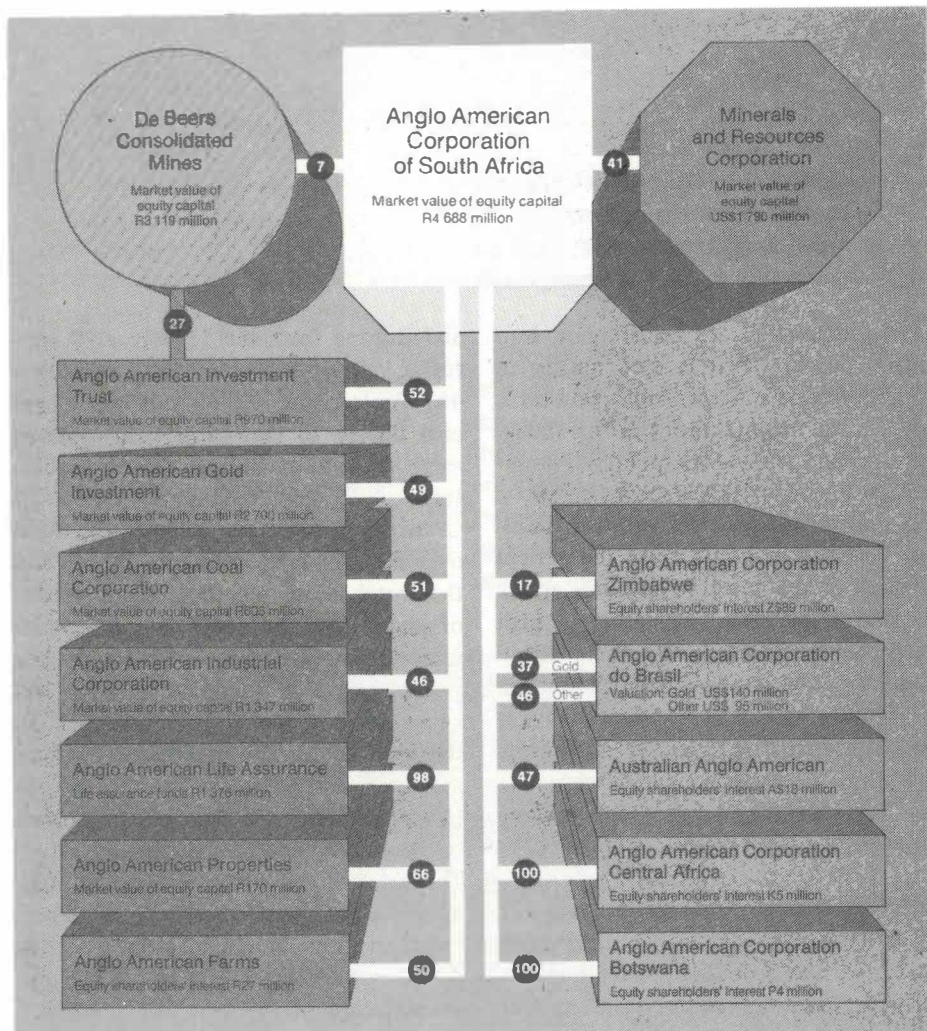
Africa, and was elected chairman of the board in 1929. Oppenheimer then proceeded to tie the knots in his empire by buying a 30.4 per cent interest in De Beers for AAC; and in turn De Beers took a 33.1 per cent holding in AAC.<sup>6</sup>

Today, Harry Oppenheimer, the son of Ernest, presides as chairman of De Beers. Because of his age he has recently resigned as chairman of AAC, but stays on at De Beers to ride it through the "worst crisis since the depression", as he describes it. His major assistants in running the De Beers empire include his son Nicholas; his cousin Philip Oppenheimer who runs the Central Selling Organization, the marketing arm of De Beers; Julian Ogilvie Thompson, who handles the management decisions in Africa; and Monty Charles, the managing director of the Diamond Trading Company in London.

### The Oppenheimer empire

Mr Harry Oppenheimer has built the Anglo-American Corporation and De Beers Consolidated Mines into a 15 billion dollar empire. The shares of AAC alone, the world's largest producer of gold, platinum and vanadium, account for one-half the value of the Johannesburg stock exchange. In South Africa, AAC's major holdings consist of three of the top four mining houses, six of the top ten financial houses, the largest investment trust, second largest property company, second largest merchant bank, the largest transportation company and fastest growing automobile company. AAC and De Beers alone produce 40 per cent of the world's industrial diamonds, 30 per cent of gem diamonds, 30 per cent of gold, 40 per cent of vanadium, 15 per cent of coal, 4 per cent of uranium, and are substantial producers of copper, platinum and manganese. The average annual rate of profit on all investments is over 20 per cent.<sup>7</sup>

As AAC has grown, power has been de-centralized, but financial control and strategic decisions remain at the centre. Over time AAC is becoming more of an



investment holding company. Its three major corporate associates include *De Beers*, *Charter Consolidated* and the *Minerals and Resources Corporation (MINORCO)*. Through MINORCO, AAC holds a 30 per cent share in Engelhard Minerals and Chemicals, a giant American refiner and marketer of minerals and fuels with annual revenues of 200 M USD. Charles Engelhard has been a board member of AAC since 1957, and is a close personal friend of Oppenheimer. One of AAC's biggest takeovers in 1981 was a 30 per cent share in Salomon Brothers (through MINORCO), which is a major Wall Street investment bank, for 554 M USD. Pre-tax profits for Salomon in 1981 equalled 180 M USD.

In 1981, there was a sweeping re-organization of AAC mining groups and international interests, much of which was linked to getting a foothold on the North American continent. MINORCO was set up as an offshore, Bermuda-based investment house of the Group. AAC and De Beers pooled various holdings and deposited them in MINORCO.

The Consolidated Gold Fields link will give MINORCO a major and strategic stake in South African mining as well as 60 per cent of CGF's interests in Australia. Charter Consolidated will continue to provide the European connection through financing and development of mining and industrial operations in the United Kingdom and Europe. In 1981 Oppenheimer transferred 800 M USD to Bermuda to help the financial takeoff of the new structure. Expansion will concentrate on natural resources, but American firms such as Phelps Dodge, Newmont Mining and AMAX could also be approached by MINORCO with huge mergers in the offing.

In any case the AAC-De Beers-MINORCO empire is rapidly expanding in mining, energy and commodity companies throughout the world. Hundreds of millions of dollars have been invested in a wide array of assets and potential income earning resources during the past two years. Oppenheimer is making excellent use of a world recession to extend his control over the world's resource base at bargain prices.



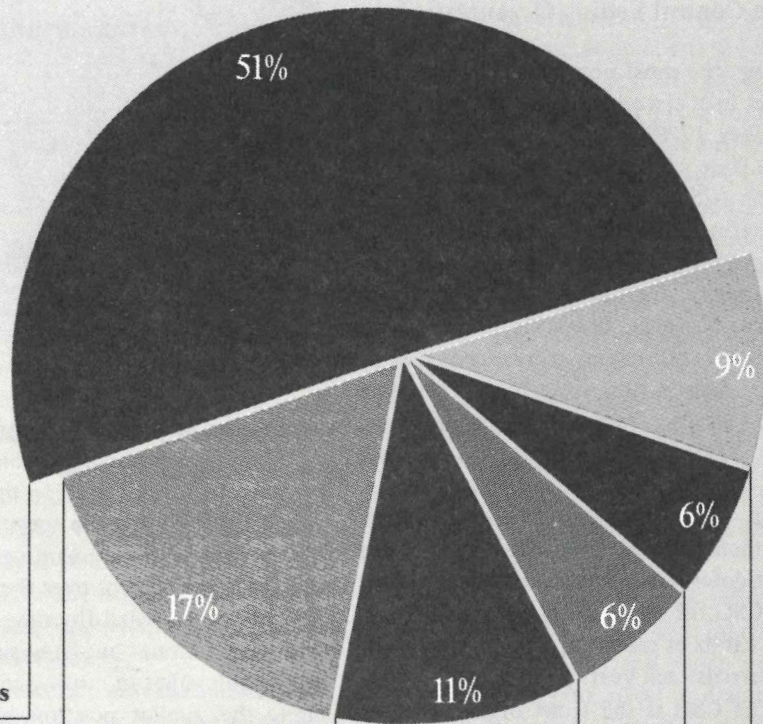
In 1981 there was a sweeping reorganization of the Oppenheimer empire. (Left).

Minorco was set up as an offshore, Bermuda-based investment house of the Anglo group of companies.

(Below). Charts from the annual reviews of Anglo (1983) and Minorco (1983).

### Principal investments: spread of interests

This diagram shows the relative importance of the companies in which Minorco has investments in terms of their market values (carrying values in cases of unlisted investments) at June 30, 1983. The accompanying table depicts the activities of those companies and the interest held in each by Minorco.



Investments and country of incorporation	Interest held	Activities
Phibro-Salomon Inc (USA)	27% (currently 22%)	⊙ * \$
Consolidated Gold Fields PLC (UK)	29%	■ ■ ⊙ * \$
Engelhard Corporation (USA)	27%	⊙
Charter Consolidated P.L.C. (UK)	36%	■ ⊙ * \$
Inspiration Resources Corporation (USA)	60% (voting 46%)	■ ⊙ *

Others including:

Anglo American Investment Trust Limited (S. Africa)	10%	◇
Anglo American Corporation do Brasil Limitada (Brazil)	{ 19% gold interests 11-25% other interests	■ ■ ⊙ \$
Empresas Sudamericanas Consolidadas, S.A. (Panama)	10%	■ ■ ⊙
Zambia Copper Investments Limited (Bermuda)	50%	■
Australian Anglo American Limited (Australia)	{ 24% gold interests 30% other interests	■ \$
Imetal S.A. (France)	6%	■ ⊙

Legend

■ base metal mining	* energy
■ precious metal mining	\$ financial and commercial
⊙ industrial and agricultural	◇ diamonds

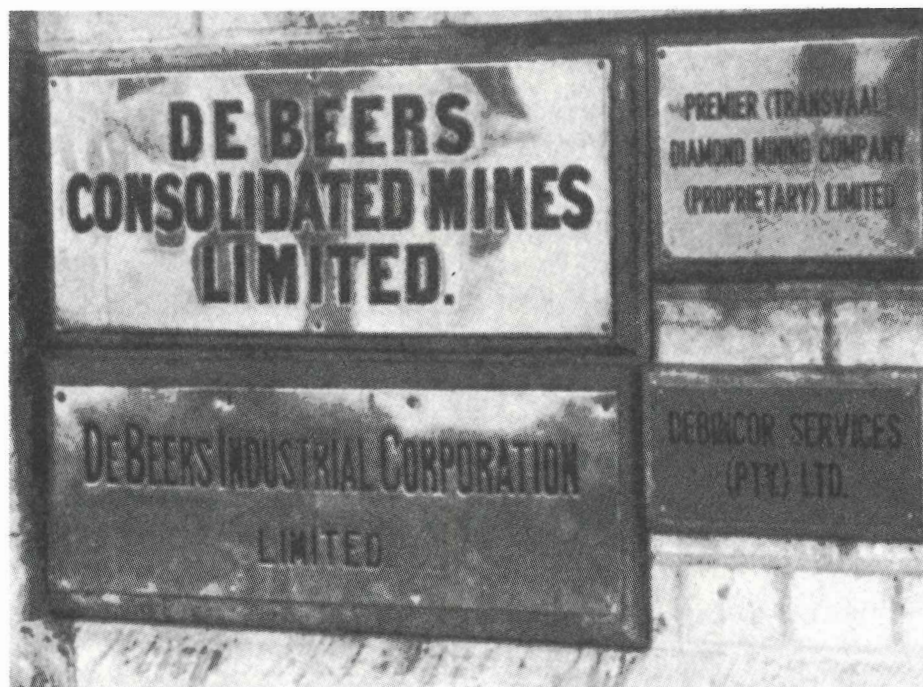


### The Central Selling Organization

Today, the most powerful and successful cartel in the world has its headquarters at Number 17 Charterhouse Street in London. Here sits the Central Selling Organization (CSO) which controls the mining, marketing, distribution and price of 80 per cent of the world's gem and industrial diamonds. This includes mines in South Africa, Namibia, Botswana, West Africa, Tanzania; fashioning workshops in Antwerp, Amsterdam, New York, Tel Aviv and Calcutta; retail jewellers in Paris, New York, Tokyo, Rome and Sydney, and the new diamond mine in Australia, all of whom are dependent on De Beers for their survival. Even the Soviet Union must defer to the commercial expertise of the CSO for the distribution of its 2 million carats of gems and 8 million carats of industrials each year.

The CSO is the front organization of the De Beers and Anglo-American Corporation under the guiding hand of Harry Oppenheimer. As the marketing arm of De Beers, the CSO is divided into three divisions: *the Diamond Purchasing and Trading Company* which handles the output from the 17 De Beers' mines in South Africa, Namibia, Botswana and Lesotho; *De Beers Industrial Diamonds* which markets diamonds below gem quality; and *the Diamond Trading Company*, controlled by the Anglo-American Investment Trust, which sells high-quality gems. It is the Diamond Trading Company which holds 10 'sights' per year where major purchasers come to buy their years' supply.

About ten times a year De Beers holds 'sights' for 300 selected diamond dealers. The 'sights' are held in the CSO building in London where 20 million to 30 million carats are sorted into thousands of categories and placed in plain brown shoeboxes for viewing. Before each sight dealers place their orders for certain types and quantities which may or may not be adhered to by CSO agents. When presented with the box the dealer must buy the



whole box of stones at the quoted price or take nothing at all. Troublesome dealers are not invited back to the following year's sight. During the speculative boom of the late 1970's, hoarding threatened the De Beers control over the market. At first, De Beers tried flooding the market with uncut stones but they simply added to the stockpiles in cutting centres, worsening the market position of the CSO. The governments of a few nations, particularly Botswana and the Soviet Union, began to complain about the fact that De Beers was paying lower prices for their output than they could get on the open market. The problem was rapidly turning into a crisis, remembering the fact that the Soviet Union is the world's second largest producer of gem diamonds behind South Africa, and depends on their sale for 'hard' currency.

In 1978 while Oppenheimer was condemning the speculation as "unhealthy and unsound" De Beers was accumulating profits from price increases. In March, 1978 De Beers introduced a 40 per cent surcharge at the sight to check the speculation. Dealers recognized that the surcharge could be lowered as well as raised leaving them with overvalued diamonds with little notice of CSO decision-making. As Julian Ogilvie Thompson, second in command to Oppenheimer, put it:

"The surcharge is a blunt instrument. The market was placing a different premium on different kinds of diamonds, and you needed a

price increase that was not uniform for all goods."<sup>8</sup>

Five months later the surcharge was cancelled. In August, 1978, prices began to creep up again. De Beers raised prices by 30 per cent in August and another 12 per cent in January, 1979.

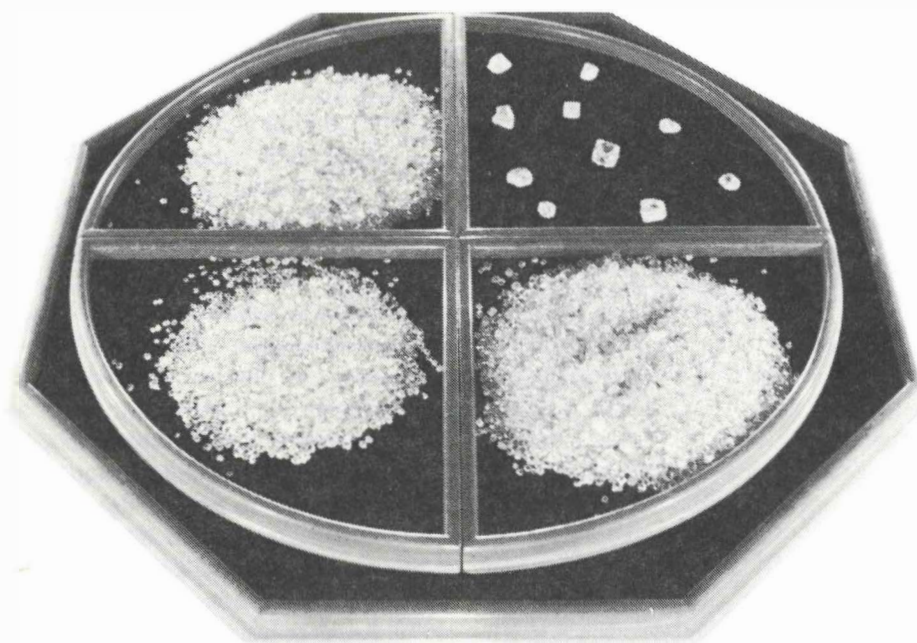
By 1980 diamond prices were 140 per cent above what they had been in 1975 and the number of carats sold remained constant. De Beers' inventory had climbed to a value of 1 G USD. In 1981 the market collapsed as merchants began to panic, unloading their hoards on a market burdened by high interest charges. CSO sales of 1.4 G USD were the lowest in six years.

Although the overall market has broadened over the past twenty years, the stones used in jewellery have been getting smaller. Therefore, in planning for the rest of this decade, De Beers has started a campaign to expand the sales of larger stones. This will increase the profitability on unit sales. Given the assets strength of the company it has the time to change tastes and turn its costly inventory into revenue.

### The international diamond market

The internationally recognized advertising slogan for De Beers is 'A Diamond is Forever'. This implies that its value is everlasting. This is true only so long as large groups of people do not try to re-sell the diamonds they have purchased retail. The fact is that the Consumers Association in





*A display of one day's production of 6 000 carats of diamond at the Consolidated Diamond Company's mine in Oranjemund, Namibia.*

England bought some diamonds in 1970 to test them for purposes of investment. Over a ten year period they attempted to re-sell the stones and ruefully concluded in 1980 that "For the ordinary investor, buying and selling loose diamonds over the counter seems to be a mug's game." The story went something like this:<sup>9</sup>

The U K Consumers Association (CA) visited a number of jewellers shops, diamond investment companies, diamond merchants and auction sales and purchased three loose polished stones, a secondhand diamond ring, a new diamond ring and an antique diamond brooch, all for 1,504 GBP. The diamonds were taken to an independent gemmological laboratory to get a full description of what had in fact been purchased. It was discovered that in only one case had the seller provided them with an adequate and accurate description of what they had bought. The initial investment shock came a few days later when CA attempted to sell the diamonds to a number of shops and were offered for their collection a top price of 775 GBP, 52 per cent of what was initially spent. One year later they tried again and received an offer of 1,152 GBP or 77 per cent of cost price. Ten years later CA tried again and discovered that only by taking a costly trip to Belgium could they receive a bid which gave a yearly return ahead of inflation, 16.1 per cent, not counting the cost of travel. As a result of the experiment, during a time of rapidly increasing diamond prices, CA concluded

that diamonds were a poor investment for the average consumer, even over a ten year period. Indeed selling a diamond is the last thing De Beers wants you to do. The vast stocks of diamonds held by the public could really make a mess of the market should large numbers be put up for sale simultaneously.

When diamond advertisements proclaim that diamond prices have never fallen that is only half of the story. The diamond prices which have never fallen are the monopoly prices charged by De Beers for rough stones and sold to the sight-holders. Having purchased a diamond at retail prices, after total mark-ups from mine to retail shop ranging on 500 per cent, no one will offer more than a wholesale price. The retail diamond jewellery normally purchased will lose half of its value the minute the purchaser walks out of the shop.

Given all of this information diamonds are still touted by business magazines and investment analysts as an alternative to more widely recognized hedges against inflation such as land or gold. Diamonds sold for jewellery constitute 23 per cent of world production, 75 per cent being used industrially and 2 per cent for investment purposes. Despite the fact that only 2 per cent of total demand is for investment, it still represents about 17 per cent of the total value of world diamond trade.

Since 1976 investment certificates have been used to provide the illusion of

objective asset evaluation. These certificates provide information about the stone in terms of the '4 C's', carats, cut, clarity and colour. This is used as a base for price evaluation according to international standards slowly being established. The major problem of course comes back to recognizing the monopoly position of De Beers. Market information is scarce, knowledge is treated as property, grading is subjective, and so-called experts control the trading of wholesale stones. It still remains in the interest of De Beers diamond merchants to push large gems onto the market during a period in which supply exceeds demand. According to the managing director of one diamond trading company in Asia:

"It is true that the diamond is the gem of the rich. But with increasing affluence, more and more people will be able to invest in diamonds. Still, even now, there is a market for gem investors on the lower end of the scale."<sup>10</sup>

It is the gems which provide the excitement in the international marketplace. Every five weeks as much as 300 M USD is spent on the rough gems at the Diamond Trading Company, one of the CSO divisions in London. No one is invited to one of the ten 'sights' each year unless they have at least 150,000 USD to spend, and the wealthiest buyers may spend as much as 5-20 M USD each time. The monopoly price of diamonds moved upwards steadily from 1949 to 1980 before the collapse in 1981. The same diamond selling for 1,000 USD in 1949 would have fetched 10,000 USD at a 'sight' in 1980. It is not possible to argue or bargain with the CSO. Take it or leave it!

All of the decisions affecting the diamond market are made in the boardroom of De Beers Consolidated Mines at Kimberley, South Africa. Monty Charles, managing director of the Diamond Trading Company and Henry Dyer, head of the industrial diamond division are both on the De Beers' board of directors. The



Diamond Trading Company accounts for 90 per cent of all sales and is the guiding force of the entire De Beers operation. As Monty Charles has observed:

"Most diamantaires don't think beyond next month, but I'm planning at least five years ahead all the time. We have to guide the industry, some of whom, if you'll excuse an old metaphor can't see the wood for the trees."<sup>11</sup>

Beyond its marketing position the Diamond Trading Company is the major authority on grading and valuation and possesses the information of world mining and marketing that is not available to any other institution on earth.

At the DTC, the diamonds are first divided into shapes: perfect crystals, irregular crystal called 'cleavages', broken pieces with parallel sides called 'flats', and the triangular twinned crystals known as 'maccles'. These four shapes are then sorted into five grades of quality according to how clean they are or whether they are marred by carbon spots. Each grade is sorted into seven colours compared to CSO colour samples. At this point there are thirty-five categories for each shape and the work has only begun.

Each shape is sorted into fourteen weight categories which takes us to four hundred and ninety options for each shape. Multiplied by four shapes and there exists one thousand nine hundred and sixty separate categories. This is a simple assortment not taking into account coated stones or 'near-gems'.

The sight-holders are made up largely of two types of customers, major dealers who themselves supply a large number of small manufacturers; or large manufacturers who have their own cutting and polishing facilities and service a major market. The number of sight-holders is normally around 300, including 80 from Belgium, 64 from the U S, 61 from India and 45 from Israel, all of which are major fashioning speciality centres in the world.

In each one of these fashioning cen-

tres, two or three banks will act as lenders in the diamond trade. De Beers itself has directors on the boards of leading Antwerp and Tel Aviv banks. Bank loans and clearances are vital to the trade since the CSO requires payment for all sales within seven days and it will normally take four to six months before the rough gems can be fashioned and sold.<sup>12</sup>

As pointed out above the tight monopoly position of De Beers began to falter in the late 1970s as diamond speculation tore away at the seams of CSO control. Sight boxes were changing hands without even being opened at mark-ups of 100 per cent. Dealers and manufacturers were ordering more diamonds than they could possibly use and before long Antwerp, Tel Aviv and Bombay were stockpiling diamonds at prices which continued to rise. After putting on the surcharge in 1978, the CSO then directly approached the major world banks to get them to reduce lending and raise interest rates. Invitations to sight-holders were withdrawn when speculative practices were discovered. And the CSO cut back drastically on the supply of gems to the market. With these steps the CSO was again able to gain control but in the meantime much damage had been done both to investors and dealers. As interest rates continued to rise the speculators began to dump their hoards on the market and by 1981, for the first time in decades, prices began to tumble.

It is clear that the price reductions were seen as valuable by De Beers because speculators were punished for their endeavours outside the paternalistic support which had always protected them in the past. As Green reports, despite criticism from some sight-holders, it is hard to find anyone in the diamond trade who wishes the monopoly to crumble.

### The trading centres

Of all the fashioning and trading centres in the world which are the home bases of sight-holders, Antwerp is the most impor-

tant of all. The annual value of its official diamond exports is equal to 3.4 G USD which is double that of Tel Aviv and five times that of Bombay. The unofficial value of exports must be close to double this figure. Antwerp's diamond history goes back five centuries, unchallenged except for a short period in the 17th century by Amsterdam. However, in modern times, since the South African discoveries in 1870, Antwerp has become the centre of diamond trading. Four of the sixteen members of the World Federation of Diamond Bourses are located in Antwerp. The other members are in Amsterdam, Ida-Oberstein, Johannesburg, London, Milan, New York, Paris, Tel Aviv and Vienna.<sup>13</sup>

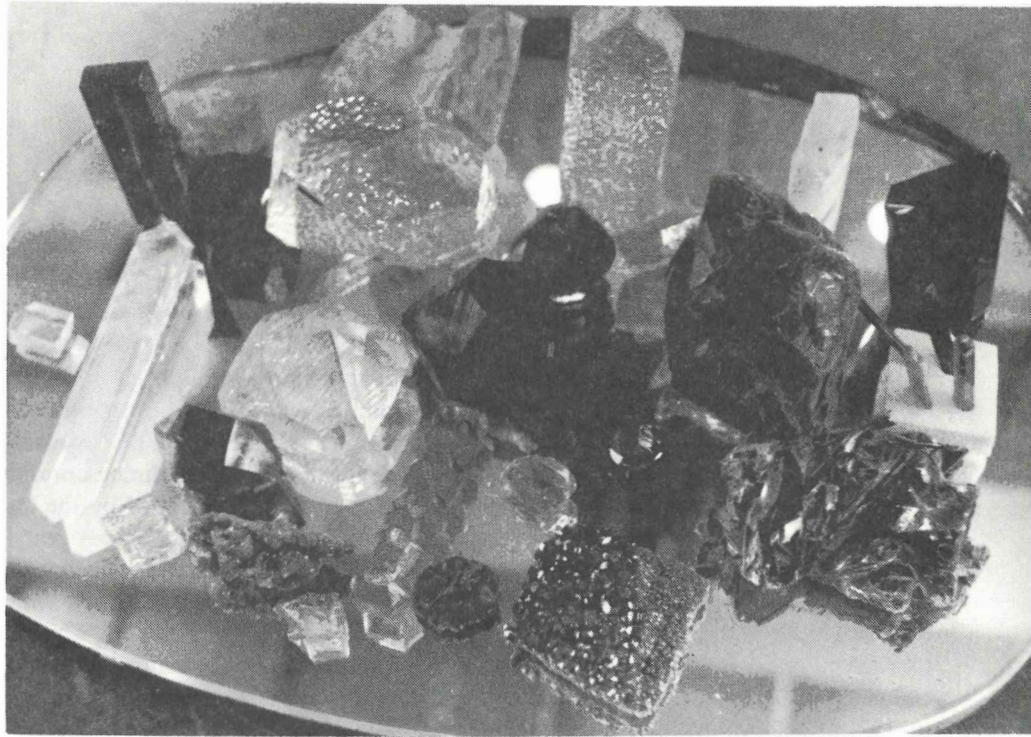
In Tel Aviv, the diamantaires point out that the diamond industry there is older than the State of Israel. The industry has continued to grow so that by 1977, half of all diamond cutting and polishing took place in Israel creating over 1.5 G USD per year in foreign exchange. The major blot on the industry in Israel is that it is blamed by almost everyone in the business for starting the crisis of the last decade. Enormous stocks of gems were accumulated in a low cost speculative fever. When the market collapsed Israel's diamond exports fell and workshops closed all over the country, reducing employment in the industry by one-third. Not only this, but since 1979, De Beers has actively encouraged the expansion of rival cutting centres in India and South Africa to cut and polish 'melee', the medium sized rough between 0.2 and 1.4 carats, which has been Israel's speciality for years.

India is the world leader in fashioning small diamonds. 60 per cent of all diamonds are now cut and polished in India grossing about 900 M USD annually in export earnings. The existence of the industry is based solely on the exploitation of labour-power at very low cost. A diamond cutter in India will earn 50 USD per month, compared to 750 USD for an Israeli or 1,000 USD for a cutter in New



*The Soviet Union is a major producer of diamonds.*

*The photo shows synthetic diamonds, amethysts, garnets, and quartz, all from the Research Institute for the Synthetic Production of Minerals, at the Ministry for Geology.*



York. While Tel Aviv employs about 10 000 to 15 000 cutters annually, India has an estimated 350 000 cutters at work.<sup>14</sup> Most of the cutters in India are ex-peasants working at home on a piece-rate basis. The exploitation of these workers, the power of the diamond sector in India, and the expansion of the fashioning complex is in the hands of about eight families.

One of the interesting elements in the rise of India's fashioning industry is that goods once dismissed as industrials in the past are now classified as gems. There is a shaded area now existing between the industrial and gem, called 'near-gem' which has become a sorter's nightmare. This is the area which India now controls.

The industry in New York is the door to the world's largest and most affluent market for diamonds. About 1.5 G USD worth of gems are imported by the U S dealers each year. Of the 64 American sight-holders, 50 operate out of New York.<sup>15</sup> Dallas, Texas, the headquarters of Zale Corporation and Los Angeles are the two other important fashioning centres in the United States. Los Angeles has both the Gemological Institute and the Gold-finger group of companies which specialize in the wholesaling of polished diamonds.

In the above and other major consumer markets in the world, De Beers spends over 40 M USD per year in advertising and promotion campaigns, about half of which is channelled to the United States and Japan. In 1980, of 14 G USD spent on diamonds in retail markets, 4.5 G USD was spent in the United States where three-quarters of the married women wear diamond rings; 3 G USD was spent in Japan; 1 G USD in West Germany; and 450 M USD in both France and Italy. To give men a nudge in the U S, N W Ayer, one of De Beers' advertising agents, spends over 1.5 M USD on advertisements during the televising of pre-Christmas football games. Half of all diamond jewellery sales (excluding engagement rings) take place in December. And within the past decade

De Beers has planned a psychological campaign to broaden the market to provide diamond jewellery for males.

### Threats to the monopoly

As far as the world's most all-encompassing monopolist is concerned, there are a number of dark clouds on the horizon. Epstein emphasizes the point that there are more than 500 million carats presently being held by the world's consumers.<sup>16</sup> This inventory, scattered as it is, still makes up more than fifty times the number of gems produced each year and must be prevented from ever being put back on the market. The vast difference between the cost of production and retail price, has so far been most effective in preventing diamonds once bought for personal use, from being re-sold. It is still much cheaper for a dealer to purchase a new diamond wholesale than to buy back a secondhand retail gem.

However, a fear has been instilled into the offices of the CSO, given the speculative frenzy which took place among dealers, manufacturers and sight-holders in the late 1970s. These people are more capable of disrupting De Beers' monopoly position than is the general public, and have already shown the damage they can do, when they take competition too seriously as a tenet of capitalism.

Secondly, a new major source of natural diamonds has been discovered in the

Kimberley region of northwest Australia. A mine is presently being developed and will be operating at full capacity in 1985. Overall, this mine, called the Argyle Diamond Mine, will produce the equivalent of 50 per cent of the present output of natural stones. Depending on the ultimate gem — industrial mix, serious pressures will exist adding to the problems of manipulating the market. Even if one accepts the most pessimistic estimate that the Argyle gem output will only be 7–10 per cent of total mine production, that still means an addition to world supply annually of 1.7 to 2.5 million carats of gems; or an increase of 17 to 25 per cent over present world gem production.

Thirdly, laboratories in the United States, Japan, China and the Soviet Union have technicians hard at work developing techniques to produce diamonds synthetically. Close to 100 million carats of industrials are already produced each year by De Beers itself, and by General Electric which is the world's largest synthetic industrial diamond producer. As long ago as twenty years laboratories at General Electric and in the Soviet Union have demonstrated the possibility of 'growing' gems from a carbon solution process which cannot be easily distinguished from the natural stone. While the process is still more costly than mining and produces only small gems, the future holds the possibility of gem diamonds being as rare as cut glass.



## The Argyle diamond mine (ADM)

A concentrated search for diamonds in northwest Australia began in 1967 when alluvial diamonds were found in river streams. In 1972, the Kalumburu Joint Venture had been formed to look for diamonds above the 19°00S parallel in Western Australia. This group's exploration continued without significant success until a shortage of funds in 1975 forced the joint venture to look for a big mining company to help with financial backing. In 1976, the largest transnational mining company in Australia, CRA Ltd, joined the group, and the name was changed to the Ashton Joint Venture.

From February 6, 1976 to November 1, 1982, a time of major discoveries and development, a number of changes took place to the ownership structure so that on November 1, 1982 it was announced that the Ashton Joint Venture was being replaced by the Argyle Diamond Mines Joint Venture (ADM) and Ashton Exploration JV. ADM will cover the development, mining and management of the venturer's diamond interests in the Argyle and Ellendale areas and will be managed by CRA Ltd. The ownership pattern is now:

CRA Ltd	— 56.76 %
Ashton Mining Ltd	— 38.24 %
Northern Mining	— 5.00 %

Of course, these are the companies acting up front in the region itself. If we peer behind the scenes, the pattern of ownership becomes much more complex.

- *CRA Ltd* has wide and varied interest in metals and minerals throughout the world. It is a major subsidiary of Rio Tinto-Zinc (52.6 per cent) which normally receives a significant share of any profits earned.

- *Ashton Mining Ltd* is presently owned by the Malaysian Mining Corporation (50.1 per cent), the largest tin mining company in the world among other things; and Tanks Consolidated Investments (10.2 per cent), a Bahamas-based mining

company. The Malaysian Mining Corporation is also a diamond sightholder, and is considering the possibility of starting a diamond exchange in Malaysia with expertise and guidance from Indian agents.<sup>17</sup>

Most of the Malaysian Mining Corporation is owned and controlled by the Malaysian Government, but 14.5 per cent is held by Charter Consolidated which is the European financial house for Anglo American Corporation and De Beers. While on the subject, it is pertinent to point out that Charter also holds a 10 per cent share of Rio Tinto-Zinc. Overall, this gives Charter a beneficial interest in the Argyle Diamond Mine of 6 per cent.

- *Northern Mining* is a small Australian company incorporated in Victoria. In 1981, the company was taken over by Endeavour Resources which is part of the mining and financial consortium of Alan Bond. Alan Bond is most well-known in Australia for his yearly challenge in the "America's Cup" yacht race off Newport Island in the United States.

Upon purchasing Northern Mining, Alan Bond made it clear that he was fascinated with the idea of a home-grown diamond fashioning industry to replace the diamonds imported into Australia each year, which was a market capable of being covered by his 5 per cent share of the venture. Data on the growing market in Australia, immediately preceding his takeover of NM was as follows:

While the joint venture was establishing its credentials a detailed aeromagnetic

survey was made of 5 500 square kilometres in the northwest which detected some 26 magnetic anomalies. Immediate application was made for the title to a broad area of temporary reserves. 24 proved, with further testing, to be kimberlite pipes which is a geologic formation to the existence of diamonds.

These initial discoveries were in a province called Ellendale, about 300 kilometres to the southwest of the present Argyle mine. The Ellendale area of leaseholds extends over 35 kilometres long and 15 kilometres wide and sampling shows a unusually high proportion of gem stones. However, at present, Ellendale is held on a care and maintenance basis until development of the other area at Argyle is complete.

With the success of the Ellendale survey, the consortium continued its evaluation to the northeast. In September, 1979, an exploration crew located significant alluvial deposits and on October 2, 1979 the AK-1 (Argyle Kimberlite Number 1) pipe was found. The pipe is located in the headwaters of Smoke Creek, in a valley of the Carr-Boyd Ranges about 35 kilometres from where Smoke Creek enters Lake Argyle. It is here that production will occur for at least 20 years.

The principal orebody is the AK-1 pipe which will be brought into production in 1986 when alluvial production has ceased. By the end of September, 1982, sampling had shown a high proportion of boart and industrial stones in the pipe.

	1978		1979		1980	
	Quantity Imported	Value (AUD)	Quantity Imported	Value (AUD)	Quantity Imported	Value (AUD)
Gems	75mc	34.2m	68.4mc	32.0m	81.1mc	50.0m
Industrials	892mc	5.8m	1,139.1mc	7.3m	1,136.2mc	9.9m

Source:

Australian Mineral Industry Quarterly, Vol 33, No 4, 1980, p 147.







The gem content was about 5 per cent, near-gem 25 per cent, and 20 per cent industrial. The remaining 50 per cent was boart. The most common colour was light brown, with some white, grey, pink and deep brown varieties. About 3 per cent of the stones were in the top colours, i e, D and E (exceptional white) and F (rare white). However, given company secrecy, little publicity is forthcoming to what exactly can be expected. In 1983 for instance, more optimistic results took place from continued testing and sampling. It was reported that improved grades were obtained from deeper sampling of the pipe. 12.4 carats per tonne was reported, which is phenomenal compared to cumulative yields of 5.5 carats per tonne from surface sampling and 6.8 carats per tonne from core drilling. A 10 carat gem was recovered and a 16 carat near-gem was also found. As of January, 1983, 815, 377 carats had been produced, largely from sample patterns.<sup>18</sup>

A two-stage mining programme has been established: first the short-life mining (3 to 4 years) of the alluvial deposits; second, long-term mining (20 + years) of the kimberlite pipe AK-1. All other known deposits and pipes are being kept under leasehold on care and maintenance for the present.

Development will take place in stages. The southern end of the pipe is a higher graded area than the northern and capacity could be increased in stages as mining moves into lower grade areas. According to CRA, the richer southern end shows 6.1 carats per tonne on the average. Northern Mining executives say it is 7.7 carats per tonne. Either way, on a carat per tonne basis, Argyle will be the most productive mine in the world.

It appears that a firm decision was reached early on to produce 5 million carats per year of alluvials until 1985 when production from the pipe would raise the output to 25 million carats per year. Construction of the main project on the AK-1 pipe started in mid-1983 and will cost about 350 M AUD. This added on to the

150 M AUD already spent for exploration, development and construction gives the project an initial cost of about 500 M AUD.

It is most likely that with the completion of alluvial mining in 1985 the company will begin development of another area (e g, Ellendale) in conjunction with the mining of the AK-1 pipe itself. By this time mining and marketing data collected will have made the Joint Venture a sophisticated diamond mining operation.

By 1985, the Argyle mine in Australia could increase world output by 50 per cent with 25 million carats per year output. The output will disturb the marketing complex of the CSO making it obvious that De Beers will have to exert significant control over distribution. As Harry Oppenheimer stated, "because Australia's diamonds are not of top quality (80-90 per cent industrials) *it would be in Australia's interests to sell them in a way which doesn't invite a great deal of competition with other people*". (Emphasis added).<sup>19</sup>

#### ADM-CSO marketing agreement

In 1980, the ADM Joint Venture commissioned a study with the objective of recommending a marketing strategy for Argyle diamonds. The study was completed in 1982 and a recommendation was put that immediate negotiations should begin with the Central Selling Organization (CSO) of De Beers. CRA Ltd and Ashton Mining accepted the recommendation but Northern Mining rejected it, deciding instead to pursue its own marketing strategy.

Ashton Mining and CRA had let it be known early that long-term contracts were needed in the early stage of production so as to get access to finance for mine development. It was clear that the CSO was the front runner based on this condition. About 400 M AUD is needed for development, with each one of the partners responsible for funding their share of the venture. The problem with

getting the necessary funds seemed to be the limited knowledge banks have of the diamond trade, which is hardly surprising since De Beers monopolizes market information as well as the diamonds themselves. The marketing contracts were the key to getting money, and only the CSO could soothe the bankers fears.<sup>20</sup>

During the study on marketing arrangements in 1981, the Federal Labor Party in opposition, began to raise questions with regard to the production and marketing of diamonds on an international scale, particularly with reference to getting a 'good deal' for Australia. During parliamentary questioning, Prime Minister Fraser threw the Joint Venturer's deliberations a bit off stride by indicating Federal Government concern over possible South African involvement. He said in the House of Representatives that "any decisions taken on an emerging diamond industry would not be designed to serve the interests of the South African monopoly, De Beers". This statement brought an immediate reaction from Premier Court of Western Australia who told Fraser to mind his own business. He said, "it is a State matter and Mr Fraser should not interfere with the arrangements under negotiation".<sup>21</sup>

To counteract the unfavourable publicity, which resulted from Mr Fraser's comments, De Beers early in 1982 invited a planeload of Australian journalists, all expenses paid, to visit the company's operations on a three week tour of South Africa. In mid-1981, CRA had invited 40 Australian journalists to visit the Argyle deposits. Public relations was in full-flight. Low and behold! In February, 1982, the Deputy Prime Minister, Mr Doug Anthony, announced that "only the CSO was capable of handling the large quantity of diamonds from the Argyle deposits. And of course, it was of little surprise that when the Labour opposition became the Government in 1983 they suddenly agreed with Doug Anthony's position. It was reported that "in a major political reversal,





*In December 1982 Harry Oppenheimer, for the Central Selling Organisation, and Rohan Skea, representative of CRA Ltd, signed the export sales agreement for the Argyle diamond mine.*

the Treasurer, Mr Keating has given approval for the diamonds to be marketed through the CSO". This contrasted sharply with the pledge by Mr Keating in 1981 that he would not allow Australia's diamond deposits to be swallowed up by the South African diamond syndicate. He had warned that the diamond deposits were going to be "raped by the South African group" and that "it would be a tragedy to see the profits of its produce taken offshore with foreign processing". However, in 1983 and as a member of the Government he now "recognized that the arrangements provided a number of benefits", and that "given the central role of the CSO in marketing . . . there was no real commercial alternative".<sup>22</sup>

On February 8, 1982, it was announced by CRA that the basis for marketing arrangements with De Beers had been established. Limited commercial production was to begin as soon as an agreement was reached and approved by the State Government. As a prerequisite Argyle Diamond Mines Pty Ltd was incorporated in Western Australia as the management arm of the diamond mine. It was just as clear at this point that Alan Bond and Northern Mining executives were not at all happy with the rush to commit the Joint Venture to De Beers.

Alan Bond looked upon this potential agreement with the CSO with considerable

scepticism, putting Northern Mining's participation in doubt. Shortly after the above announcement by CRA, one of the Bond Corporation's chief executives was in Japan studying the market for jewellery and investment diamonds. In May, 1982, an Indian trade delegation met with Bond corporate executives. The delegation, led by Prakash Jhaberi, a Bombay diamond merchant wanted to discuss the possibility of buying a portion of the ADM diamonds. CRA and Ashton Mining people gave the Indians a very cool reception. As they argued, while commissions and margins might be avoided in deals with Indian merchants, a diamond price could not be guaranteed over a long term, as it could with the CSO.<sup>23</sup>

The CRA, Ashton Mining attitude did not prevent the Indians from continuing to try to gain access, particularly as media information emphasized that the size and quality of Argyle diamonds were almost exactly the type specialized in by Indian cutters and polishers. In June, 1982, the Indian Government's Metals and Minerals Trading Corporation (MMTC) made an offer to play a major role in marketing diamond production from Argyle. In what was said to be a vast improvement on the CSO offer, MMTC representatives offered to take 20 million carats per year. However, CRA quickly announced that they found the proposal unsatisfactory

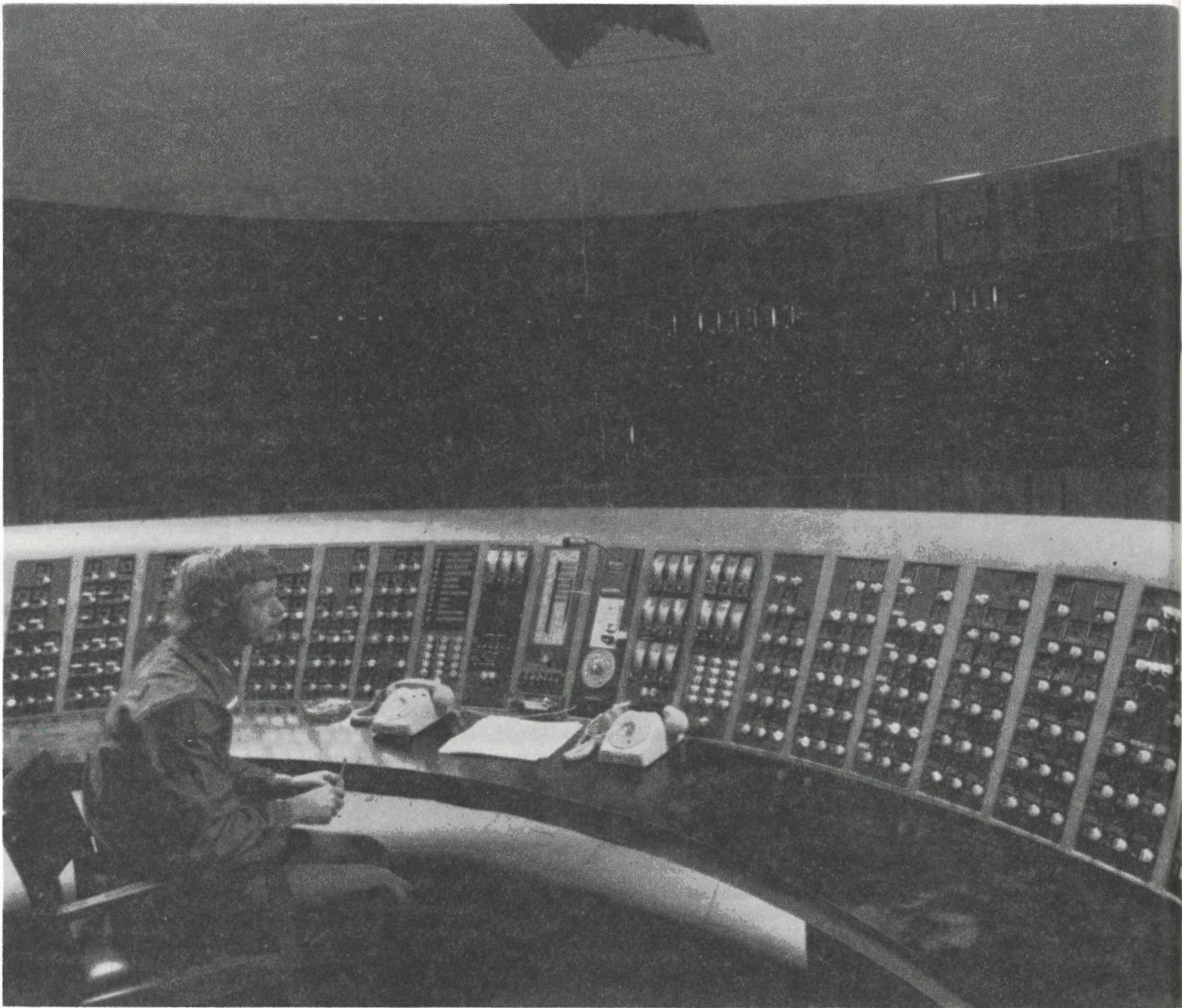
with regard to marketing capability. The major factor in CRA's position, stated by a number of financial media and business representatives was the fear of a competitive war with De Beers which would disrupt and threaten the stability of prices in the market.

### The Zaire experience

To a degree the fear of De Beers is not to be exaggerated given the company's corporate power and its actions in recent times to punish transgressors of its self-made prerogatives. In June 1981, the world's largest producer of industrial diamonds, Zaire, pulled out of its marketing agreement with the CSO by refusing to renegotiate its contract. The major complaint by officials of Sozacom, the industrial diamond agency in Zaire, was that CSO was taking an excessive commission and paying a price far below market value. The Government of Zaire announced that the "middleman would be done away with and they would go straight to the market". At that time Zaire became a major source of supply to India and independent dealers in Antwerp. Just as in the case of Australian negotiations, Indian diamond merchants were prepared to top any price offered by CSO.

For a limited time and for a limited number of carats Zaire was able to negotiate good contracts for its production. For instance Zaire was able to sell 441 900 carats to the Industrial Diamond Company of London and Caddi and Glacol of Antwerp for an average price of 19 USD per carat, which is excellent compared to the average prices paid by the CSO.<sup>24</sup> However, any joy this might have created was to be short-lived. Throughout 1981 and into 1982 the CSO began to flood the Indian market with cheap gems to destroy the main market of Zaire's relatively few near-gems. Secondly, the industrial price for boart was slashed by the CSO by almost 50 per cent from 3.00 USD to 1.60 USD per carat. While this lower price still provided a profit for the CSO it drastically reduced the revenues going into Zaire.





An additional problem resulted, in that without CSO assistance, smuggling stones out of Zaire increased. It so happened that the CSO had placed a number of buyers across the border to purchase smuggled stones and possibly as much as 50 per cent of Zaire's output was ending up in CSO hands anyway without the benefit of Sozacom receiving any returns.

When it was evident that the CSO was going to get access to the Argyle output which will be directly competitive with Zaire, Sozacom officials offered 40 per cent of its production to De Beers. De Beers responded that the contract had to be all or nothing.<sup>25</sup> For a while Sozacom continued negotiations with the CSO but announced sales to independent dealers hoping to increase output to as much as 20 million carats annually to increase revenues.

The situation for Zaire was becoming desperate as their markets were slowly becoming isolated. Even the Indians, as shown above, seemed to be more interested in the Argyle mine. Whether or not CSO gained the marketing contract for Argyle, it was clear that because of the quality of stones, most of ADM production was going to find its way to India. The 360 000 cottage industry workers in India were specialized in cutting and polishing the type of stone coming out of the Western Australian mine. India imports 550 M USD in rough stones which is nearly one-half of world output. Since Argyle output was going to increase world production by 50 per cent it appeared possible that the situation for Zaire could only get worse.<sup>26</sup>

In one last effort, the Secretary General of Sozacom put out 'feelers' to ADM

management to join Australia and Zaire together in a producers cartel. Citoyen Miko said:

"Australia and Zaire will control 80 per cent of the world's diamonds when the ADM begins producing. It is in the interest of both economies to establish a cartel. It is important to realize industrial diamonds are in a free competitive market, not artificially controlled like gem diamonds."<sup>27</sup>

The plea fell on deaf ears.

After two years of selling its diamonds independently and struggling against the monopoly power of De Beers, Zaire rejoined the CSO in early 1983. The decision came as no surprise to industry analysts after seeing prices and revenues for



Zaire output slump, based on the tough, exacting and punishing manipulation of the market. As Harry Oppenheimer was reported to have said during the Argyle negotiations: "Zaire is more of a warning than a lesson for those considering the option of going it alone." The return of Zaire to the fold and the contract with ADM, once again gives the CSO control over the world's natural industrial diamond output as well as the world's gems.<sup>28</sup>

Only Ghana, Guinea, Brazil and Venezuela still sell some of their output outside the CSO market. De Beers has blocked publication by the British Government of figures on shipments of diamonds from the USSR to London. The link, known for years, has never been formally admitted by either side. This additional measure wraps another layer of secrecy around the international movement of both diamonds and gold. It is approximated that shipments from the USSR to London of gems and industrials range in value from 500 M USD annually, upwards.

In December, 1982, the Western Australian Government approved the agreement between CRA Ltd., Ashton Mining, De Beers and the CSO, bringing marketing arrangements into force. 95 per cent of ADM output will be marketed as follows (excluding Northern Mining's share): All gems will be sold to CSO other than a small amount (about 5 per cent) which will be retained for cutting and polishing in Australia; sale to the CSO of all cheap gems and industrials until June 30, 1984; sale to the CSO of 75 per cent of all cheap gems from that date, with the remainder to be sold independently; production will be controlled through a 25 million carat ceiling on annual production. The main unknown is the commission to be paid to CSO on sales, but it is thought to be 7.5 per cent by knowledgeable sources. This and the average price are important in determining profitability. A team from CSO recently stated an average price based on a sample of about 11 USD per carat. Al-

though the actual price for sales in 1983 is known to be higher than this announced figure, it is unknown.

In return for reduced speculation and increased control over the world marketplace, De Beers announced a price increase of 2.5 per cent in September 1982 even though the market remained weak for gem diamonds. And in April, 1983, another price increase of 3.5 per cent was announced. This control over distribution and pricing shows why it was absolutely essential for Oppenheimer to get control of the marketing arrangements for the Argyle diamond output; and to regain access to Zaire's production. Without this control in the hands of the CSO, the market would have remained destabilized for the rest of the decade. It will be difficult enough for a monopoly to control world production, and almost impossible if real competition were to take place. As usual, when it comes to the crunch, capitalism cannot afford the luxury of a truly competitive marketplace.

#### Notes:

<sup>1</sup> Eric Bruton, *Diamonds*, 2nd edition, London: NAG Press Ltd, 1978, p 1.

<sup>2</sup> K Reckling, R B Hoy and Stanley J Lefond, "Diamonds", in Stanley J Lefond, (ed), *Industrial Minerals and Rocks*, 4th edition, New York: American Institute of Mining, Metallurgical and Petroleum Engineers, Inc, 1975, pp 587-591.

<sup>3</sup> "Industrial Diamonds - natural or synthetic?" *Industrial Minerals*, No 163, April, 1981, p 54.

<sup>4</sup> Jacques Legrand (ed), *Diamonds: Myth, Magic and Reality*, New York: Crown Publishers, Inc, 1980, pp 12-36.

<sup>5</sup> *Ibid*, pp 38-64.

<sup>6</sup> Leo Chapman, *Diamonds in Australia*, London: Bay Books, 1980, pp 57-59.

<sup>7</sup> Michael Tanzer, *The Race for Resources*, New York: Monthly Review Press, 1980, pp 178-187.

<sup>8</sup> Peter W Bernstein, "De Beers and the Diamond Debacle", *Business Review Weekly*, January 15-21, 1983, p 27.

<sup>9</sup> "Diamonds are for . . . Suckers?" *Choice Magazine*, September, 1982, pp 325-328.

<sup>10</sup> Quoted in Millicent Danker, "When diamonds are for Real", *Malaysian Business*, September, 1982, p 33.

<sup>11</sup> Timothy Green, *The World of Diamonds*, New York: William Morrow and Company, 1981, p 142.

<sup>12</sup> *Ibid*, p 150.

<sup>13</sup> *Ibid*, p 164.

<sup>14</sup> *Ibid*, p 186.

<sup>15</sup> *Ibid*, p 198.

<sup>16</sup> Edward Jay Epstein, *The Diamond Invention*, London: Hutchinson, 1982, p 223.

<sup>17</sup> Michael Pascoe, "Malaysian Mining boosts world tin share to 20pc", *Australian Financial Review*, June 25, 1981.

<sup>18</sup> Peter Maher, "Shafts on Argyle pipe yield better diamond grades", *Australian Financial Review*, January 28, 1983, p 54.

<sup>19</sup> Sandra Jobson, "De Beers' Empire in Trouble", *Australian Business*, December 3, 1981, p 53.

<sup>20</sup> Alan Dean, "Banks keep dreams on ice", *Australian Business*, November 11, 1982, pp 114-115.

<sup>21</sup> *The Miner Newspaper*, October 26-November 8, 1981, p 3.

<sup>22</sup> Robert Bowden, "Keating's reversal will allow gems deal", *The Weekend Australian*, April 9-10, 1983, p 1.

<sup>23</sup> Bruce Jacques, "Bond considers deal with India outside the CSO", *The Australian*, May 13, 1982, p 16.

<sup>24</sup> *Australian Financial Review*, September 3, 1982, p 27.

<sup>25</sup> *Mining Journal*, June 5, 1981, p 425.

<sup>26</sup> Peter Maher, "India certain to share in Argyle diamond trade", *Australian Financial Review*, March 25, 1982, p 38.

<sup>27</sup> Cited in Jan Mayman, "Zaire wants link for diamonds", *Western Mail*, February 22, 1982.

<sup>28</sup> Peter Maher, "De Beers regains control of Zaire's diamond marketing", *Australian Financial Review*, March 10, 1983, p 50. ■





# SOURCES

"Diamond comes from carbon, which is the most common substance on earth, a part of all living things and of certain rocks, gases and liquids. Between one and three thousand million years ago, some of it was crystallized into diamonds through a combination of high temperature and pressure 150–200 kilometres below the earth's surface.

Subsequent convulsions drove the diamonds upwards, mixed with rocks and other minerals in magma, liquid or semi-liquid, to form diamondiferous fissures ('pipes'), shaped like huge carrots with their tops roughly at ground level. (. . .)

It was the advent of cemented tungsten carbide tools that caused a surge in contemporary demand for boart (industrial-grade diamond). Because the material of which they were made was harder than contemporary steel alloys, only the hardest known substance could shape them. (. . .)

There was a rapid rise in demand for it from the middle of the 1930s, stimulated by armaments production, first for the Italian-Abyssinian War and then World War II. From about one million carats in the middle of the 1930s, annual consumption of industrial diamond grew to 15 million by 1945; today it is more than 100 million. (. . .)

In 1936 Sir Ernest Oppenheimer, then chairman of De Beers Consolidated Mines, formed *Boart Products South Africa (Pty) Ltd* to exploit this market and use the profits from it to finance research into, in his own words, "the many uses of industrial stones".

That aim was not pursued really vigorously, however, until 1947, when a number of associated diamond producers, headed by De Beers and prompted by Sir Ernest, established the *Diamond Research Laboratory (DRL)* at Crown Mines on the southern outskirts of Johannesburg. (. . .)

From the start, in pursuing its theoretical studies, the DRL was in contact with

certain European universities already engaged in research into pure diamond. In 1950 it began sponsoring university research, while continuing with its own programme. The university work subvented by the DRL proved invaluable, not only for those involved with natural diamond but also for companies that later sought to manufacture the synthetic variety. (. . .)

In 1955 Oxford physicists Sir Francis Simon and Dr Berman, both recipients of funding from De Beers, published calculations giving a more accurate indication than had hitherto been available of the temperature and pressure conditions necessary for controlling production of synthetic diamond to meet a range of specifications. The importance of their calculations is derived from the physics of diamond synthesis.

All substances exist in vapour, liquid or solid form, depending on ambient temperature and pressure. Water for example, can solidify into ice or vaporize into steam: as it does so it undergoes a phase (form) change. Phase changes are brought about by alterations in temperature and pressure, but two phases of a substance can co-exist in unchanging proportions at certain pressure-temperature combinations, each of which is known as an 'equilibrium point'. In addition, many materials can adopt more than one solid phase, depending on their arrangement of symmetrical planes of atoms, called the 'crystal structure'.

Carbon is such a substance. If its crystal structure is hexagonal, it is graphite; if cubic, diamond. The equilibrium point is variable; in the case of graphite-diamond, the higher the temperature the greater the pressure, producing an ascending equilibrium line on a graph.

It was this, the 'Berman-Simon line', that was defined by Dr Berman and Professor Simon.

To turn carbon into diamond, a combination of temperature and pressure above the line is necessary, and the furth-

er this combination from the equilibrium line, the faster the phase change. When, as it is during synthesis, diamond is produced by crystallisation from graphite in the presence of a molten solvent, the growth rate of the crystal increases as the pressure and temperature combination moves further into the diamond zone; but the crystal structure is weaker because, when joining the nucleus, the atoms do not have time to find their optimum positions and produce a strong, blocky shape. Indeed, they may be pushed into interstitial positions by larger atoms of the solvent metal, resulting in an irregular formation with many 'stacking faults' and metal inclusions. By contrast, growth close to the equilibrium line is slow and controlled, resulting in relatively pure, well-formed particles. (. . .)

These methods were used for large-scale synthetic production, begun by a specially-formed company, *Ultra High Pressure Units (Pty)*, in 1961 at Springs, near Johannesburg; by a sister company, *Ultra High Pressure Units (Ireland)*, which began manufacture at Shannon in Ireland the following year, and by its Scandiamant plant at Robertsfors in northern Sweden, originally owned by ASEA.

These three plants, constituting the manufacturing facility of De Beers Industrial Diamond Division (Debid), now produced natural and synthetic diamond ranging from tiny particles for lapping and polishing, finer than face powder and measuring to 0.001 millimetre on a single face, to others almost 1 000 times bigger, for use on saws in the construction industry."

#### Source:

Quoted from: John Collings: "New frontiers in diamond synthesis", *Optima*, Vol 30, No 2, p 102–109.

*Optima* is published by the Anglo American Corporation and De Beers groups of companies.