In the world of diamonds, the Big and Beautiful – size does matter!
The industry is changing, but sunset?...take your pick.

Every operating mine in Canada produces stones that fall below the "good average," with all but one mine producing diamonds that fetch less than $100,000. By contrast, both De Beers and Alrosa, which mine more than half the world's diamonds, average $500,000. For smaller miners in Southern Africa, the gap is even more extreme. Gem Diamonds and Lucara Diamond had average selling prices of $111 and $502,000 respectively last year.

While now the world's third-biggest diamond producer, behind Russia and Botswana, its average selling price is the cheapest of the major diamond mining companies.

"If you have and have good mine, you are Agarwal, based in that's a developed jurisdiction. You are related, Indian light in 30, US. caused precious. What is one then five lines into the market. A weaker ratio is also mining diamonds more expensive for Indian manufacturers, who cut out about 93% of the world.

There is also increasing pressure from synthetic diamonds. While still a very small part of the industry, the potential threat poses a worrying sentiment in an already fragile market.

Still, there are reasons why diamond mines must remain in business in Canada — in some cases, the reasons have little to do with economics. For De Beers, which has developed three mines in the country, Canada's independence on Botswana, where most of the world's diamond is mined.

Agarwal, who was involved in the development of the mine that came to be known as the CanadianMark brand, captured on the country's clean image, says there is potential for "smart" diamond mining. "It's a higher net return," he noted. "Those electricity prices make bargaining a dream.

Mantachie, who won a seat in the Ontario legislature in 2019, said that after he had been appointed Minister, he visited all the main mining areas "to reconnect with those communities." He informed them that the mining companies did not talk to them. He passed this on to the companies and also told his own department that it was also failing to communicate with these communities. He affirmed that it was the responsibility of all mining companies to ensure that their relations with communities were harmonious. A second point that was the general attitude in the country towards mining: "Mining is not a loved sector," he observed.

The third point that was increasing empathy in the mining sector is that "mining is not a loved sector," he observed. "It is in the hope of better things to come. They wanted to shoot coal mines now for "a better future".

While accepting that renewable energy would be important in the future, he highlighted that South Africa "likes to destroy what they have" in the hope of better things to come. They wanted to shoot coal mines now for "a better future".
A boom in cannabis investment is spilling capital away from mining and hitting junior firms. It’s time for those in the game and potentially improving the quality of projects in a sector ripe with cowboy speculators.

Canada’s relaxation of cannabis laws culminated in legalization for recreational use in October 2018.

Other jurisdictions are following suit or liberalizing their laws on medical or health uses, creating an industry that has lured a breed of high-risk, high-return investors.

The world’s top three listed cannabis companies—Canopy Growth, Tilray and Aurora Cannabis—have a combined market value of about $30 billion and investors are expected to spend more than $1 billion on cannabis products in Canada alone in 2020, says Deloitte.

In Africa, cannabis companies are setting up projects in Lesotho, while other countries, including Zimbabwe and SA, plan to issue licenses.

“Raising money is extremely difficult,” said Patrick Donnelly, head of Canadian junior gold exploration company Oerzeno Gold, who compared the cannabis boom to the headwinds juniors faced during the dotcom bubble of the late 1990s.

“It’s a cyclical business, and it will come back; but you have to have a good project.”

The rise of cannabis comes at a time when investors were already viewing many miners as a particularly risky bet—have been dubbed “the smoke that broke the camel’s back,” said one explorer at the mining indaba in Cape Town.

For the 2019 year, all major B2Es [instrumental public offerings], once a rite of passage for exploration juniors, have slowed to a trickle with cannabis stocks dominating the headlines of the mining industry in the eyes of prospec-tive investors. There was an emphasis on the need to make sure that new juniors are prepared to face the challenges of the sector.

**Africa’s share of global exploration spend shrinks**

Looking at SAP Global Market Intelligence’s latest report on mineral exploration, the good news is that 2019 saw the global exploration budget increasing for a second consecutive year. The bad news is that Africa’s share of the budget has dropped, resulting in the continent now ranking only fifth in the world as a destination for exploration, behind Latin America, the Rest of the World region (which covers Europe and most of mainland Asia) and Canada and Australia.

The report, entitled *World Exploration Trends 2019*, was released to coincide with this year’s Prospectors & Developers Association of Canada (PDAC) International Convention in Toronto. Based on data collected from over 3,000 companies, it covers non-ferrous exploration.

The all-time peak for global exploration occurred in 2012 when budgets collectively exceeded US$31 billion. This spending for 2018 totals US$10.1 billion, less than half the 2012 figure; this nevertheless represents a 10% growth year over year (YOY) compared with US$9.5 billion in 2017. The upward trend is expected to continue with SAP Global projecting that 2019 will show further growth of between 5 and 10% on the 2018 number as the positive fundamentals for most metals encourage increased activity.

According to the report, the industry remains “violent of critical new discoveries, and some metals, such as copper, will see widening deficits without additional investment in exploration for the mines of the future.”

An interesting trend is that the proportion of budgets directed to grassroots or generative exploration fell to an all-time low of 24% in 2018. Part of the reason for this is that junior explorers tend to spend the scarce funding they have on proven assets during downturns. The spend, and head/tailings with 7%. With all the hype about battery metals, it’s no surprise to learn that both lithium and cobalt did well in 2018. Lithium exploration budgets reached a new high of US$347.5 million, a 58% increase over the previous year, while spending on cobalt at US$110.8 million was more than triple the 2017 figure of US$39.5 million.

Uranium and diamonds each accounted for around 2% of total spend in 2018 and platinum group metals—somewhat surprisingly—just 1%.

Specifically on the subject of drilling activity, the report notes that this increased in 2018. In 2017, explorers reported results from 43,312 drill holes at 1,121 projects worldwide. The comparable figures for 2018 were 48,239 holes at 1,561 projects, representing increases of 14% and 33% respectively.

Geothermal drilling jumped nearly 13% globally year over year in 2018, with Mexico, the US and Canada being the largest contributors to the increase.

On the subject of Africa, the report has this to say: “Africa dropped to fifth place from third with 13% of the global budget; however, only US$5 million separated the region from fourth-place Australia. The most significant African exploration destinations included Democratic Republic of Congo, or DRC, Burkina Faso, Ghana and Côte d’Ivoire. A continued focus by explorers on West Africa (Burkina Faso and Côte d’Ivoire in particular) gave good shares of the allocation again in 2019.”

As far as can be seen, South Africa is not mentioned by name anywhere in the report—which perhaps gives some indication of how our status as a leading resource and mining country has eroded over the past decade.

On balance, one would have to say that the SAP Global report is positive, with many factors going the right way. But one can’t help feeling a bit ominous at Africa’s declining share of the global exploration budget. Given the potential of the continent, Africa’s share of exploration spend should be increasing rather than declining and one can only hope that the trend reverses soon.

After all, this is a continent that is still relatively underexplored and which still offers the opportunity for big ‘finds’—as we’ve seen with the Waterberg Project in South Africa, the Kansans copper project in the DRC, and the copper/silver discoveries of MOD Resources and Capricorn in the Kafue Copperbelt of Zambia.

Arthur Tassell
Bain (2018) however remains positive over the long-term.

Middle class in China and India (millions of people)

Projected Demand of Rough Diamond and Mined Diamond Supply

Source: Frost & Sullivan Report on Diamond

Marquise Capital
Diamond price dropping
De Beers sales in US$ m

De Beers records lower sales amid macroeconomic uncertainty

Mining Weekly 21 May 2019
Polished Diamonds inventories - indexed

◊ The industry is supply and not demand driven (Rapaport 2019)
◊ Golan (2019): Diamond industry ‘out of balance’
Rough Diamond price performance by size

5-Years, Quarterly (as of April 2019)

Starting Index Value: 100 at End-Q3 2013, Nominal USD

- Indian demonetization
- Modi fraud uncovered
- LGD production increases
- Zimnisky Global Rough Diamond Price Index

Notable dislocation between smalls and other categories
- +7 to +11 DTC (0.13 to 0.42 carats)
- 3 to 6 Grainers (0.75 to 1.25 carats)
- 3.00 to 4.00 Carats

Paul Zimnisky May 2019
Most diamond mines produce a range of goods including very small low-quality stones to larger ones.

To make their operations worthwhile economically most miners need to sell the entire range.

These mines will stop operating if they cannot sell low and mid-range goods.

But only very few mines that also produce large high-value stunning.
Catalysts for price dislocation

◊ **Synthetics**, disclosed and undisclosed.
◊ New supply from Gahcho Kué, Renard, Liqhobong, Ekati Misery pipe.
◊ Higher recoveries of smalls due to XRT technology.
◊ Indian manufacturer troubles, especially those that deal in smaller goods.
Projected market share of Lab Grown Diamonds (LGD)

According to Chaim Even-Zohar (2017):

◊ Synthetics have become a real threat to the natural diamond producers.
◊ Exploration money will dry up because synthetics are increasingly considered a pure, more affordable economic substitute.

- By 2030 LGD will have some 10% share of the market.
- “It all comes down to consumer choice - Uber did not hurt the taxi industry” (Amish Shah 2017).
- Producers of natural gems are unnerved by cheaper, cleaner synthetic jewels (FT 2017).
Hello, we're Lightbox (Element six – part of De Beers Group)

Our diamonds are laboratory-grown. In soft shades of pink and blue and white

Science & Sparkle

- Lab-grown diamonds share the same physical, chemical and optical characteristics as rare, natural diamonds.
- But the process to create them is different from nature, so while they are neither as valuable or precious, they are just as sparkly.
Lab Grown Diamond (LGD) prices

- Compared to wholesale transaction prices of natural diamonds, prices of LGD are on average 65–84% lower (Golan 2019).
- Rapaport (May 2019) shows that retailers can make higher profit margins selling synthetic diamonds.

LGD wholesale transaction prices % change: Q1 2019 vs Q4 2018

Source: Edahn Golan Diamond Research & Data
The value of the big stones

Lesedi La Rona:
• Found 2015
• Uncut: 1,109 cts
• Sold 2017 for US$53m

88.2 ct stone (size of a pigeon egg) sold for US$ 13.8 M
**Karowe Mine (Lucara Diamond)**

- **7 ha kimberlite**
- **Orapa Kimberlite field, Botswana**
- **Discovered 1970: mine opened 2012**
- **2\textsuperscript{nd} (1,758 cts) and 3\textsuperscript{rd} (1,109 cts) largest diamonds ever found in 2019 and 2015 respectively.**

- **Lesedi La Rona**
  - **1109 carat**
  - Second largest gem diamond ever recovered in the world
  - Sold in 2017 for $53 M USD

- **Constellation**
  - **813 carat**
  - Sold for a record $63.1 M USD

- **Apr 2019**
  - **Unbroken 1,758 carat near gem quality diamond; largest diamond from Karowe to date**

- **Lesedi was cut into the largest square emerald cut diamond – 302.37 cts.**
◊ +10.8 cts (Specials), contribute ~5% by volume and 70% by revenue.

◊ Since 2012 some 181 diamonds +100 cts, and 13 diamonds +300 cts have been found.

◊ 187 diamonds sold for more than US$1 M each and 10 single diamond for more than US$10 M since 2012.
Cullinan Mine (Petra Diamonds)

Sold for US$15 M

424.9 and 209.2 cts
2019

The Cullinan Diamond
3,106.8 cts (0.62 Kg)
1905

121.3 ct
2016

Crown Jewels
Anna Keay
The Official Illustrated
Cullinan Mine (Petra Diamonds)

Found: Cullinan in 1986
599 cts

Cut to 273.85 ct

Centenary Diamond
Lulo mine (Lucapa Diamonds)

◊ An alluvial mining operation
◊ Exploring a large kimberlite field within its concession
◊ Cuango drainage basin in Angola
Proximal to the Lulo mine are numerous kimberlites which are being tested for the source of the large Type II stones.

In addition, Lucapa Diamond operates a second large diamond producing mine Mothae in Lesotho. This is next to Letšeng-la-Terae of Gem Diamonds.
Letšeng-la-Terae (Gem Diamonds)

603 cts
2006
Sold for US$ 12.4 M

Lesotho Promise

Cut in to 26 pieces
76.4 cts largest
Valued US$ 60 M
Letšeng-la-Terae (Gem Diamonds)

- Main pipe 17 ha, satellite pipe 5.2 ha in the highlands of Lesotho.
- Highest average dollar per carat kimberlite diamond mine.

$ per carat - 12 month rolling average

<table>
<thead>
<tr>
<th>Month</th>
<th>Price</th>
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<tbody>
<tr>
<td>Dec 2016</td>
<td>1,695</td>
</tr>
<tr>
<td>Jun 2017</td>
<td>1,625</td>
</tr>
<tr>
<td>Dec 2017</td>
<td>1,930</td>
</tr>
<tr>
<td>Jun 2018</td>
<td>2,415</td>
</tr>
<tr>
<td>Dec 2018</td>
<td>2,131</td>
</tr>
</tbody>
</table>

Revenue by size fraction

- > 10 cts: 80%
- 5 - 10 cts: 11%
- < 5 cts: 9%

495 cts
Sold for US$10.4 M

138 cts
Hope Diamond (Type IIb)
◊ Found in the early 1600s, India
◊ Cut: 45.5 ct
◊ Insured for US$250m
◊ At Smithsonian

Moon of Josephine (Type IIb)
◊ Found 2014 Cullinan as a 29.6 cts
◊ Cut to 12.03 cts – sold for US$48.4 M

Blue diamonds (Type IIb)
The Cullinan Dream

122.5 cts Blue diamond recovered in 2014 sold for US$ 27.6 m

Cut into 24.18 cts fancy intense blue sold for US$25.4 M in 2016
Diamond ‘Types’

♦ **Type I Diamond**
  ◇ Contain structurally bonded nitrogen
  ◇ Often yellow in colour
  ◇ Good crystal shapes

♦ **Type IIa/IIb Diamond**
  ◇ No or low Nitrogen content
  ◇ Usually colourless - Type IIa
  ◇ Skewed to larger sizes
  ◇ High proportion of white stones (D colour)
  ◇ < 10% luminesce

♦ **Type IIb**
  ◇ Blue (contain boron)
  ◇ No or low N content
  ◇ High value

Type II producers include:
  ◇ Karowe
  ◇ Letšeng
  ◇ Mothae
  ◇ Jagersfontein
  ◇ Cullinan
  ◇ Jwaneng
  ◇ Luo (Alluvial)
Larger diamonds are more likely to be D colour.

Type II diamonds are more abundant in the larger sizes.

Type II diamonds very slightly included to flawless (substantially fewer inclusions than Type I).

Type II represent a high proportion of large D colour diamonds.
Autogenous Milling as Opposed to Conventional Crushing

**Autogenous milling:**
- Self grinding of the ore
- Not crushing
- Preservation of large diamonds
- Installed at Cullinan and Karowe

Atypical Kimberlite Processing Plant these days would include:
- Autogenous milling
- Hybrid Crusher
- XRT/BV recovery units
- Waste Sorting (if country rock rich)
X-Ray Transmission (XRT)

- XRT – Sensor identifies the atomic number (C)
- XRT can recover low fluorescence and non-fluorescence diamonds
- 200 tph machines on the horizon
- Replaces DMS for +8 mm material, shortly +4 mm material
- Recovers diamonds before secondary or tertiary crushers
- Diamond breakage minimised
- Feed preparation is critical
The source of the Type II diamonds

- Most of Type I diamonds form at the base of the lithosphere (150-200 km depth)
- The majority of the Type II diamonds form at 600 to 800 km depth and are also referred to as ‘deep’ diamonds.

- Peridotitic: base of the thick Lithosphere
- Eclogitic: subduction related
Diamond inclusions

Internal growth structures

◊ Lithospheric inclusions: olivine, Cr-rich pyrope, CPX
◊ Sub-lithospheric inclusions: Ca-perovskite, majorite garnet, ferropericlase and even Fe-Ni-C-S inclusions

Garnet inclusion (Richardson 2017)

Silicate inclusion (Davies 2017)
Formation of CLIPPIR diamonds

CLIPPIR = Cullinan-Like, Inclusion-Poor, relatively Pure, Irregularly shaped, Resorbed.

- Metallic iron segregates aided by deformation of the subduction slab in transition zone.
- Liquid metal evolved to Fe-Ni-C-S.
- Diamond crystallization occurs within metallic liquid ($P \sim 12$ to $25$ Gpa) under reducing conditions.
- CaSi-perovskite inclusions.
- C saturated by increase $P$, adding more C, or increasing S.
- After growth diamonds are physically separated and transported upwards.

Smith et al. 2016
1. Serpentinitization of seafloor introduces Boron into oceanic lithosphere
2. Subduction and metamorphism of serpentine to DHMS
3. Breakdown of DHMS yields hydrous Boron-rich fluids.
4. Crystallisation of Boron-bearing diamonds triggered by Redox reactions
5. Vertical transport by upwelling mantle and kimberlites
CLIPPIR diamonds are found:

◊ Near the edges of cratons: Lulo, Karowe, Jagersfontein, Letšeng, Mothae

◊ Close to major discontinuity within cratons: Cullinan, Jwaneng (?)
Exploring for sources of large stones

- Approx. 7000 known kimberlites
- Some 70 have been or are mined (1%)
- Only a maximum of 10 diamond mines are known to produce CLIPPIR diamonds (0.1% of total kimberlites)
- Mainly primary kimberlites but also secondary deposits

Kimberlites with large stones are found on the margin (Letseng, Mothea, Jagersfontein, Karowe) or major tectonic boundaries within (Cullinan, Jwaneng) the Kaapvaal Craton: and the alluvials of Lulo along the Kasai Craton.

Large diamonds form in subducted blocks pushed deep down into the lower mantle.

Exploration will have to refocus to identify those kimberlites that contain ‘deep large diamonds’.

So coming from.....

A Diamond Is Forever

.....towards a new reality.

“I’ll give you my answer in ... just ... one ... minute.”

REAL IS RARE

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