REVENUE

4 C’s of polished diamonds:
Carat (size)
Colour
Clarity
Cut (shape/model)

Complexity in establishing $/ct and hence $/ton compared to commodities with unit prices

Further complexity in extrapolating revenue from small initial Deposit Assessment parcels of rough Stones unlikely to contain large high value diamonds
SIZE

Lognormal size distribution of diamonds is used to calculate grade from microdiamond samples

Microdiamond grade as a regionalised variable – some basic requirements for successful local microdiamond resource estimation of kimberlites

Johann Stiefenhof1,2 - Malcolm L. Thurston1 - David E. Bush3

Size dependence of diamond value:
813 ct Constellation sold for $63.11 million in May 2016 (77 649 $/ct)
1 109 ct Lesedi La Rona sold for $53 million in September 2017 (47 777 $/ct)

Caveats:
Diamond properties (and hence value) in a single deposit vary with diamond size
Optimisation of diamond recovery is very important, not only during mining but during deposit assessment
COLOUR

2018: Christie’s sold a 20.49 ct Fancy Vivid Yellow for $5.6 million

2017: Sotheby’s sold the 59.6 ct Pink Star for $71.1 million ($1.19 million/ct)

2014: Original 29.6 ct rough sold for $25.6 million ($864,865/ct)

2015: Blue Moon of Josephine (12.03 ct) sold for $48.4 million
COLOUR: GEOLOGICAL CONTROLS (GROWTH AND MANTLE RESIDENCE)

Brown, pink, red and purple: plastic deformation (e.g. Argyle mine)

Yellow, orange/amber: nitrogen

Blue: boron & a lack of nitrogen

Green: irradiation
Inclusions decrease the value of diamonds, but provide geologists with valuable information about diamond formation processes.

Inclusion compositions form the basis of Mineral Chemistry Derived Diamond Potential (MCDDP) assessment of kimberlites.
INCLUSIONS: DIAMOND GENESIS AGES FROM ISOTOPIC COMPOSITIONS

Early Sm-Nd analyses of garnet and cpx inclusion composites (e.g. Richardson et al. 1984: 3.2 Ga model age for harzburgitic inclusions from Kimberley & Finsch)

Proof of xenocrystic origin of diamonds

Late 1990’s Re-Os dating of individual sulphides: e.g. Pearson et al. 1998 (Koffiefontein)

Use of 13 ohm resistors in N-TIMS instruments at Vrije University to date individual silicate inclusions: Harzburgitic ages of 2.95 and 1.15 Ga from Koornneef et al. (2017) vs previous “Bushveld” age of 2 Ga from inclusion composites from Venetia (Richardson et al. 2009)

ARTICLE

DOI: 10.1016/j.rsr.2018.04.0554

Archaean and Proterozoic diamond growth from contrasting styles of large-scale magmatism

Janne M. Koornneef1, Michael U. Gress1, Ingrid L. Chinn2, Helke A. Jelsma3, Jeff W. Harris4 & Gareth R. Davies3

Image by SH Richardson
INCLUSIONS: DIAMOND GENESIS LINKED TO GEOLOGICAL SETTING

Images from Koornneef et al. (2017)
SUBLITHOSPHERIC DIAMONDS IN THE NEWS

GIA at the forefront of research into large Type IIa and Type IIb diamonds

**Large gem diamonds from metallic liquid in Earth’s deep mantle**

Evan M. Smith,1* Steven B. Shirey,2 Fabrizio Nestola,3 Emma S. Bullock,4 Jianhua Wang,2 Stephen H. Richardson,4 Wuyi Wang1

Smith et al. (2016) Science 354: 1403-1405

**THE VERY DEEP ORIGIN OF THE WORLD’S BIGGEST DIAMONDS**

Evan M. Smith, Steven B. Shirey, and Wuyi Wang

Smith et al. (2017) Gems and Gemology 2017: 388-403
INCLUSIONS: OTHER RECENT WORK

Raman spectroscopy now routinely used to identify inclusions non-destructively

Fluid films around inclusions have been identified using Raman spectroscopy: implications for pressure estimates from elastic barometry, particularly important for eclogitic diamonds
CUT (SHAPE/MODEL)

Diamond shape is affected by physical and chemical growth conditions.

Competition between factors driving crystal nucleation and growth control the resultant outcome in terms of size, inclusion content etc.

Subsequent resorption and/or etching in the mantle and in the kimberlite or lamproite during transport to the surface may also modify the shape.

During resorption considerable volume (grade) loss may occur.
CUT (SHAPE/MODEL)

Characterisation of microdiamonds (SEM and FTIR): sweating the small stuff!

Diamond shape classification and characterisation of etch and resorption features

Natural and recovery-related breakage can be distinguished
RESORPTION (AND ETCHING) OF DIAMOND

Collaboration with Professor Yana Fedortchouk at Dalhousie University

Distinction between mantle and kimberlitic resorption
Information on fluid/melt presence and composition,
Implications for kimberlite emplacement conditions
CATHODOLUMINESCENCE AND SIMS

1492: Columbus lands in the Americas
1489: Tree is planted by Native American
1776: Declaration of US independence
1917 & 1945: Tree Survives two World Wars
1969: Man lands on Moon
1861: Start of Civil War
1971: Birth Year of the IDIOT who cut down this tree!!!

FUNNY PICTURES ON BIZFOTO.COM
SIMS isotope analyses allowing for modelling of fluids responsible for diamond formation

Carbon isotope fractionation during diamond growth in depleted peridotite: Counterintuitive insights from modelling water-maximum CHO fluids as multi-component systems

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