The Argyle Diamond Deposit

Current Status and Where’s the Next One?

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Outline

- Discovery
- Geology
- Resources
- Open Pit Mining
- Underground Development
- Discovery Factors
- Where is AK2?

Acknowledge assistance of Ian Bell, Mike Erickson, Murray Raynor and Chris Smith (Argyle Diamonds and Rio Tinto)
Location Map

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Discovery & Evaluation

- Regional sampling program for KIM
- 2 samples contained diamonds
- Follow-Up Discovered AK1 pipe in Oct 79
- Adjacent alluvial deposits recognised
- Feasibility Study 1982 – 83
- Ministerial approval November 1983
- Production began late 1985
World Class Resource

- 1982 – Proven Reserves of 61 Mt at 6.8 ct/t @ US$6.50/ct (5% Gem, 40% Near Gem, 55% Industrial).
- Reserves Dec 2006 – 105.9 Mt at 2.1 ct/t.
- Tonnes Mined to end 2006, 1 Billion t
- Ore Mined to Dec 2006, 167 Mt
- Carats Recovered to end 2006 = 681 Mcts
- Initial deposit mineralisation ~ 1 Billion cts (GB estimate)
Argyle Geology

- Age 1178 Ma, Upper Mid Proterozoic.
- Volcanoclastic filled vent, 50 ha.
- Olivine lamproite tuffs and intrusives.
- Phreatomagmatic and Strombolian eruption styles.
- Probable shallow water environment.
- Water escape structures, soft sediment deformation, clastic dykes.
Three Main Facies

Quartzose lapilli ash tuff (“Sandy Tuff”)

Lapilli ash tuff (“Non-Sandy Tuff”)

Olivine lamproite dykes (“Magmatic dykes”)

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Argyle Sandy Tuff

Blocky fine grained (chilled) clasts, typical of phreatomagmatic deposits, set in a matrix of quartz grains and ash.

Irregular “fiamme” shaped clasts, some highly vesicular, set in a matrix of quartz grains and ash.
**Clastic Dyke**, sandstone dyke with rare volcanic fragments, cutting Sandy Tuff.

**Accretionary lapilli layer in bedded Sandy Tuffs**
Mineralisation

North south projection of grade looking east.

White – high grade
Yellow – moderate grade
Blue – lower grade
Argyle Pit and AK1 Pipe
Transition to Underground

- Southern open pit closure 2008
- Full underground production in 2011.
- 13.6 km of UG development (end May 2007)
- Total development required 35 km.
- Mine life to 2018.
- Depth of block cave below pit bottom is 245 m and 480 m below the plain level.
Underground Development

South

North

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Geological Setting

- Archaean lithosphere at depth (Re-Os depletion date 2.3-3.0 Ga, Luguet et al, in press).
- Eclogitic diamonds Sm-Nd age 1580 Ma.
- Archaean Sturt Block down-thrust beneath Halls Creek Mobile Zone to west.
- Host Rocks 1200 Ma sediments.
- Intrusion age 1178 Ma.
Seismic Tomography
Discovery Factors

- Window of exposure (Lower to mid Prot)
- Large dispersion of alluvial diamonds over 350 km².
- High quality field sampling supervised by geologists
- Systematic coverage
- Well trained field and laboratory staff
- Good support, well funded
- Exploration model (Argyle was in low priority area!)
Where is AK2?

- Many people would like to know!
- Old cold lithosphere (seismic tomography)
- Diamond stability field (>150km depth)
- NAC diamondiferous intrusives over 1 Ga
  (Argyle 1200 Ma thru to Ellendale 25 Ma)
- Periodicity of diamond intrusion
- Levels of stratigraphic exposure
Geology, geology & geology

- At depth
- Near surface structure
- Geological age windows
- Surface environment
- Weathering
- Good office and geological field work!
Thank you for your attention

Let’s hope the funding is there to find another major diamond deposit in Australia!