Australia Site Visits: A Brief Introduction To Orogenic Gold Deposits

CRAIG FEEBREY
Vice President Exploration

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# Orogenic Deposits

| 1 | Geological characteristics |
| 2 | Size and grade |
| 3 | Clusters and camps |
| 4 | Significant strike and depth extent |
| 5 | Deposits grow with time |
| 6 | Likelihood of development |
| 7 | St Ives and Agnew camps |
| 8 | Concluding remarks |
Orogenic Deposits

Characteristics

- A distinctive class of mineral deposit

From Goldfarb et. al., 2001
Orogenic Deposits

Ranking by Deposit Type

- Account for 18% of the world's gold endowment (deposits > 500 koz)
- Continue to be a significant source of gold production

<table>
<thead>
<tr>
<th>Rank</th>
<th>Type</th>
<th>Gold (Moz)</th>
<th>%</th>
<th>Cum %</th>
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<tbody>
<tr>
<td>1</td>
<td>Paleoplacer Gold</td>
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<td>37</td>
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<td>2</td>
<td>Orogenic</td>
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<td>18</td>
<td>55</td>
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<td>3</td>
<td>Porphyry</td>
<td>1220</td>
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<td>70</td>
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<td>Placer Gold</td>
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<td>78</td>
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<td>5</td>
<td>Epithermal LS</td>
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<td>84</td>
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<td>87</td>
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<td>8</td>
<td>VMS</td>
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<td>9</td>
<td>IOCG</td>
<td>124</td>
<td>1</td>
<td>94</td>
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<td>10</td>
<td>Gold Skarn</td>
<td>79</td>
<td>1</td>
<td>95</td>
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</tbody>
</table>
Orogenic Deposits

Ranking by Country

- Australia accounts for 22% of gold endowment in orogenic deposits globally (deposits > 500koz)

<table>
<thead>
<tr>
<th>Rank</th>
<th>Country</th>
<th>Gold (Moz)</th>
<th>%</th>
<th>Cum %</th>
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</thead>
<tbody>
<tr>
<td>1</td>
<td>Australia</td>
<td>339</td>
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<td>2</td>
<td>Canada</td>
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<td>3</td>
<td>Uzbekistan</td>
<td>167</td>
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<td>49</td>
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<tr>
<td>4</td>
<td>USA</td>
<td>124</td>
<td>8</td>
<td>57</td>
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<tr>
<td>5</td>
<td>Russia</td>
<td>83</td>
<td>5</td>
<td>62</td>
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<tr>
<td>6</td>
<td>Zimbabwe</td>
<td>73</td>
<td>5</td>
<td>67</td>
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<td>7</td>
<td>Ghana</td>
<td>72</td>
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<td>72</td>
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<td>8</td>
<td>Mali</td>
<td>59</td>
<td>4</td>
<td>76</td>
</tr>
<tr>
<td>9</td>
<td>China</td>
<td>56</td>
<td>4</td>
<td>80</td>
</tr>
<tr>
<td>10</td>
<td>Tanzania</td>
<td>50</td>
<td>3</td>
<td>83</td>
</tr>
</tbody>
</table>
Orogenic Deposits

What makes this style of mineralisation attractive as a business?

● They are well understood geologically

● They can be large and of good grade

● They occur in clusters at different scales providing mining flexibility and optionality

● They can have significant vertical and horizontal dimensions and “grow volumetrically” with time as extensional exploration and development advances

● Access and ore reserve development does not have to be in place years in advance

● They are likely to be developed due to comparatively lower upfront capital investment, shorter construction lead times and clear commercial value drivers
Orogenic Deposits

They can be large and of good grade

From Hagemann & Cassidy, 2000
**Orogenic Deposits**

**Province Scale Clusters**

- 10 clusters > 5Moz Au
- 49 deposits > 1Moz Au
- Area selection is paramount!

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From Robert, F. et. al., 2005
St Ives Camp Scale Cluster

- 30 km strike
- 69 deposits with historic resources
- A 15.9Moz camp and growing!
Orogenic Clusters

St Ives Camp

- 80% of resources occur in 25% of deposits

Larger deposits are the company makers
Larger deposits reset the LoM clock
Smaller deposits sustain the operations

Invincible discovery (as of Dec 2013 R & R)
### Granny Smith 2007

**Wallaby Open Pit Recovered Production 2001- Dec 2006**
1,504,309 oz @ 3.44 g/t

**2007 Wallaby Underground**
288,322 metres drilled

**2007 Wallaby UG Reserve**
442,099 oz @ 5.0 g/t

**Cumulative Recovered UG Production 2004-2007**
176,944 oz

**2007 Total ounces**
619,043 oz
Orogenic Deposits

Granny Smith 2010

2010 Wallaby Underground
430,244 metres drilled
Additional metres 2007-2010
141,922 metres

2010 UG Reserve
604,772 oz @ 5.20 g/t
Cumulative Recovered
UG Production 2004-2010
549,742 oz
Additional ounces 2007-2010
535,471 oz
**Orogenic Deposits**

**Granny Smith 2013**

- 2013 Wallaby Underground
  - 652,607 metres drilled
- Additional metres 20010-2013
  - 222,363 metres
- 2013 UG Reserve
  - 838,431 oz @ 6.34 g/t
- Cumulative Recovered
  - UG Production 2004-2013
    - 1,189,407 oz
  - Additional ounces 2010-2013
    - 873,324 oz

**Wallaby Open Pit**

- View to West
- 1.2km

**2013**

- Zone 250
- Zone 60
- Zone 70
- Zone 80
- Zone 90
- Zone 100
- Zone 110

**Wallaby Underground**

- 652,607 metres drilled
- 222,363 metres
- 838,431 oz @ 6.34 g/t
- 1,189,407 oz
- 873,324 oz
Significant Depth and Strike Extent

Agnew – Lawlers: New Holland – Genesis Resource

[Diagram showing geological features and resource locations]
Agnew – Lawlers: Waroonga Complex
“Grow” with time and are “step changers”

Relative Size (Year 15= 100%)

Caution: In given year figures are based only on deposits with reported resource.
This fixes the problem of delays in reporting a maiden resource, and biases from large deposits

From Shodde, R., 2011 MinEx Consulting
Orogenic Deposits

Are likely to be developed

- There have been 285 gold discoveries >100koz globally since 1994
- Of these 285 discoveries, 29% are orogenics
- Of these 285 discoveries, 21% are in production
- Of those discoveries in production, 41% are orogenics!
## Orographic Deposits

### Long lived operations

<table>
<thead>
<tr>
<th>Ounces (Moz)</th>
<th>Reserves (F2002)</th>
<th>Production &amp; Depletion</th>
<th>Discovery &amp; Additions</th>
<th>Reserves (C2012)</th>
</tr>
</thead>
<tbody>
<tr>
<td>St Ives</td>
<td>2.3</td>
<td>(5.8)</td>
<td>5.6</td>
<td>2.2</td>
</tr>
<tr>
<td>Agnew</td>
<td>1.4</td>
<td>0.6</td>
<td>(1.9)</td>
<td>2.5</td>
</tr>
</tbody>
</table>

### Exploration Performance

**Gold Fields St Ives Discoveries**
- 2002 Greater Revenge
- 2005 Bellerophon
- 2007 Athena
- 2009 Hamlet
- 2012 Invincible

**Sustained Mine Life**

<table>
<thead>
<tr>
<th>Site</th>
<th>2002</th>
<th>2012</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agnew</td>
<td>4 Years</td>
<td>6 Years</td>
</tr>
<tr>
<td>St Ives</td>
<td>6 Years</td>
<td>7 Years</td>
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</tbody>
</table>

A sustainable business built on discovery
**Concluding Remarks**

- Orogenic deposits are an important source of global gold production.
- Although known reserves characteristically do not extend much further than several years on any particular deposit, the nature of orogenic systems can provide companies with long lived, sustainable gold operations.
- Having acquired the WMC assets in 2002, Gold Fields is now leveraging off its initial success and understanding of these systems with the 2013 acquisition of Darlot, Lawlers and Granny Smith operations.
- Orogenic ore bodies are a Gold Fields core competency – we know how to FIND them, DEFINE them and MINE them!

Thank you!