Drilling for Mining Operations
Importance of Drilling and Sampling:

• Important mineral exploration procedure
• Delineate subsurface conditions
• Expensive
• Number of techniques
• Tests ideas and theories developed during prospect and target generation

• LOCATES AND DEFINES ECONOMIC MINERALISATION
Drilling Techniques

• 3 main techniques used in Goldfields
  – RAB (Rotary Air Blast)
  – RC (Reverse Circulation)
  – Diamond drilling
Types of drilling equipment commonly used in mineral exploration (Marjoribanks, 1997)
Rotary Air Blast (RAB)
Rotary Air Blast (RAB)

- Cheapest
- Least penetrative (~100m)
- Geochemical sampling to base of regolith (i.e., only penetrates weathered cover over fresh rocks)
- Uses compressed air to break ground
- Air pumped down through drill rod
- Cuttings blown up hole between rod and hole wall
- Single barrel technique
Advantages of RAB drilling:

- Cheap
- Fast
- Large sample volume

Disadvantages of RAB drilling:

- No fresh rock samples
- Limited depth
- No structural data
- Contamination
RC drilling and sampling
Reverse Circulation (RC)

- Moderately priced
- Good penetration (to ~350m)
- Samples fresh rock
- Dual barrel technique
- High pressure fluid forced down outer pipe and returns chips to surface up inner pipe
Schematic presentation of RC drill rig
Advantages of RC drilling:

- Relatively cheap
- Quick
- Large sample
- Uncontaminated

Disadvantages of RC drilling:

- Limited access
- No structural data
- Sample contamination below water table
Diamond Drilling

- Expensive
- Greatest penetration
- Whole rock samples
Advantages of diamond drilling:
• Maximum geological information
• Uncontaminated
• High quality sampling

Disadvantages of diamond drilling:
• Expensive
• Slow
• Small sample size
• Extensive site preparation and water supply required
Core sample (from diamond drilling)

- Broken Core Sections
- Bedding Traces
- Longitudinal Cut Line
- Down Hole
- Sectorial Bucket
Core boxes at core house, Bulgah gold mine, KSA (photo taken in 6 Dec. 2006)
Appropriate Drilling Methods

- **RAB**
  - Early exploration
  - First pass and infill drilling
- **RC**
  - Intermediate exploration
  - Delineate ore body
  - Grade control
- **Diamond**
  - Late stage
  - Structural controls
**Drilling**

<table>
<thead>
<tr>
<th>Drill Type</th>
<th>Data</th>
<th>Advantages</th>
<th>Disadvantages</th>
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<tbody>
<tr>
<td>Auger</td>
<td>Geochemical sampling, top few metres of unconsolidated material</td>
<td>Portable, usually Landcruiser mounted, uncontaminated sample, Quick, cheap</td>
<td>Poor penetration</td>
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<tr>
<td>Rotary Air Blast (RAB)</td>
<td>Geochemical sampling to base of regolith</td>
<td>Large sample volume. Quick and cheap. Rock chips</td>
<td>Won't penetrate hard rock. Sample contamination. Limited depth. No structural data</td>
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<td>Air Core</td>
<td>Geochemical sampling into bedrock</td>
<td>Minimal contamination. Quick and cheap. Some core recovery</td>
<td>Small sample size</td>
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<tr>
<td>Reverse Circulation</td>
<td>Geochemical sampling in hard and soft rocks at greater than 200m depth</td>
<td>Large sample. Uncontaminated. Rock chip returns. Relatively quick and cheap</td>
<td>Large heavy rig. No structural data. Possible sample contamination below water table</td>
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<tr>
<td>Diamond</td>
<td>High quality sampling to greater than 1000km, Geological understanding</td>
<td>Maximum geological information. Uncontaminated high quality sample. Accurate hole positioning</td>
<td>Site preparation and water supply required. Small sample size. Slow. Expensive</td>
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Marjoribanks, 1997