To Wash

“to remove matter by or as by the action of water” (dictionary.com)
Wash in Mining Sense

- Remove material from surface of ore.
- Assumes readily liberated particles of ore with loosely agglomerated gangue.
- Distinction from separation; Screens, trommels, classifiers, cyclones, spirals.
- No size reduction.
Why Wash Ore

1. Reduced gangue to process
2. Better quality
3. Higher throughput
4. Easier to dewater product
Key Questions

1. How much energy?
2. What throughput?
3. What PSD?
4. How much time?
Feed Matrix

- **Log Washer**
- **Aggregate Conditioner**
- **Coarse Material Screw Washer**
- **Rotary Scrubber**

**Plasticity of Clay**

- **High**
  - Attrition Cell
- **Med**
  - Aggregate Conditioner
- **Low**
  - Log Washer
  - Coarse Material Screw Washer
  - Rotary Scrubber

**mm Size**

0 6 12 25 40 60 75 100 150 225 300
Testing

Drum Scrubber

video

Logwasher

Attrition cell
Attrition Cells

- Motor
- Gearbox
- Shell
- Baffles
- Paddles
- Inlet
- Shaft
- Hubs
- Drain
- Outlet
• To minimise short circuiting arrange in series
Samuel Calvin McLanahan patented the Log Washer on January 27, 1891.
Spray Water

20 – 80 m³/hr at 500 kPa
Aggregate Conditioner aka “Blade Mill”
COARSE MATERIAL SCREW WASHERS
Coarse Screw Washer Process

- Feed and water are introduced in the feed end of the unit
- Paddles and screw flights provide a moderate scrubbing and agitation
- This scrubbing along with rising current water breaks down and washes off light coatings and light clays
- Organics removal (i.e. wood, leaves, etc.)
- The “cleaned” product is then conveyed to the discharge end of the box
- A rinse screen typically follows the Coarse Material Screw Washer
Rotary Drum Scrubber
Scrubbers and Scrubber Screens combined
Drive Options

- **Friction Drive**
  - Competitive cost
  - Limited to ~100kW

- **Chain Drive**
  - Competitive cost
  - Limited to ~400kW

- **Hydraulic 3-point suspension**
  - Infinitely variable speed
  - Good to ~1500kW
  - Close spacing (end mounted)
  - Low dynamic loads

- **Gear and pinion**
  - Precise gear pinion alignment
  - VFD can be costly
  - Good access to discharge end for maintenance
Support mechanism

- Trunnion mounted end bearing with hydrostatic pads (girth dear drive)
  - Extensive oil cooling and filtering
- Trunnion mounted end bearing with centre mounted planetary drive
  - Limited to ~900 kW
- Roller support
  - 3 or 4 point options
  - Simple/robust
Three Point Support System

Stub shaft & double row spherical roller bearing at drive end.
Liners, Lifters & Weirs

- Retard or advance
- Lift and rotate
- Adjustable
Size and Capacity

• Power 0.3 – 1.5 kWhr/t
• L/D ratio 1.8 – 3.0
• Up to 5m dia / 15m L
• Custom designed
Scrubber Screen

- Combines two functions
- Simplifies layout – less structure
Example 1 – Gold Ore

- Ore mixed with clay-rich overburden
- Trommel for separation
- Downstream mill/flot (coarse) / leaching (fines)
Example 2 – Iron Ore

- Too much energy/time causing attrition and loss of yield
- Audit results in DEM modelling for adv lifters, scoops and speed changes
- Successful installation
Example 3 - Log Washer for U

- Smaller throughput 500 t/hr
- More intensive energy requirement
- Modular design
- Logistic advantage
Overview

- Attrition cells – smaller high intensity scrubbing (5 – 10 kWh/t)
- Log Washers/aggregate conditioners – mid sized, mid level intensity (2 – 5 kWh/t)
- Rotary drum scrubber – large, lower intensity (0.3 – 2 kWh/t)
World Wide Scrubber Installations

Hydraulic scrubber AFRICA
• Questions?