



## Case Study: Minerals processing solutions

### FrothMaster™ froth analyzer system improves concentrate grade and recovery at Newcrest Mining's Cadia.

Newcrest Mining's Cadia Valley Operations, near Orange, NSW, is one of Australia's largest gold producers, encompassing both the Cadia Hill open cut and the adjacent Ridgeway underground

<b>Organisation:</b>	Newcrest Mining Limited
<b>Site:</b>	Cadia, NSW, Australia
<b>Year:</b>	2000
<b>Application:</b>	Copper/gold flotation
<b>Challenge:</b>	Automation of flotation circuit. Automatic, accurate measurement of froth speed
<b>Solution:</b>	FrothMaster™

- Key benefits:**
- Improved recovery
  - Control of concentrate grade
  - Reduced frother consumption
  - Operators available for other tasks

mine sites. The two mines jointly supply more than 22 million tonnes of ore annually to high and low grade concentrators which employ conventional grinding and flotation technology. The resulting copper-gold concentrate averages 27% copper and a gold content of 60-80 g/tonne.

Newcrest Mining Limited is a leader in the exploration, development and operation of gold and copper mines. Newcrest Mining Limited is renowned as a strong, independent and growing Australian-based resources group.

### Froth speed and stability are the key to optimum cell performance

In a typical flotation cell circuit, optimization of concentrate grade and product recovery depends largely on the ability of the plant operator to monitor and control the speed at which the froth crosses the lip of each cell, the stability of the froth and bubble size.

**Outotec**  
More out of ore

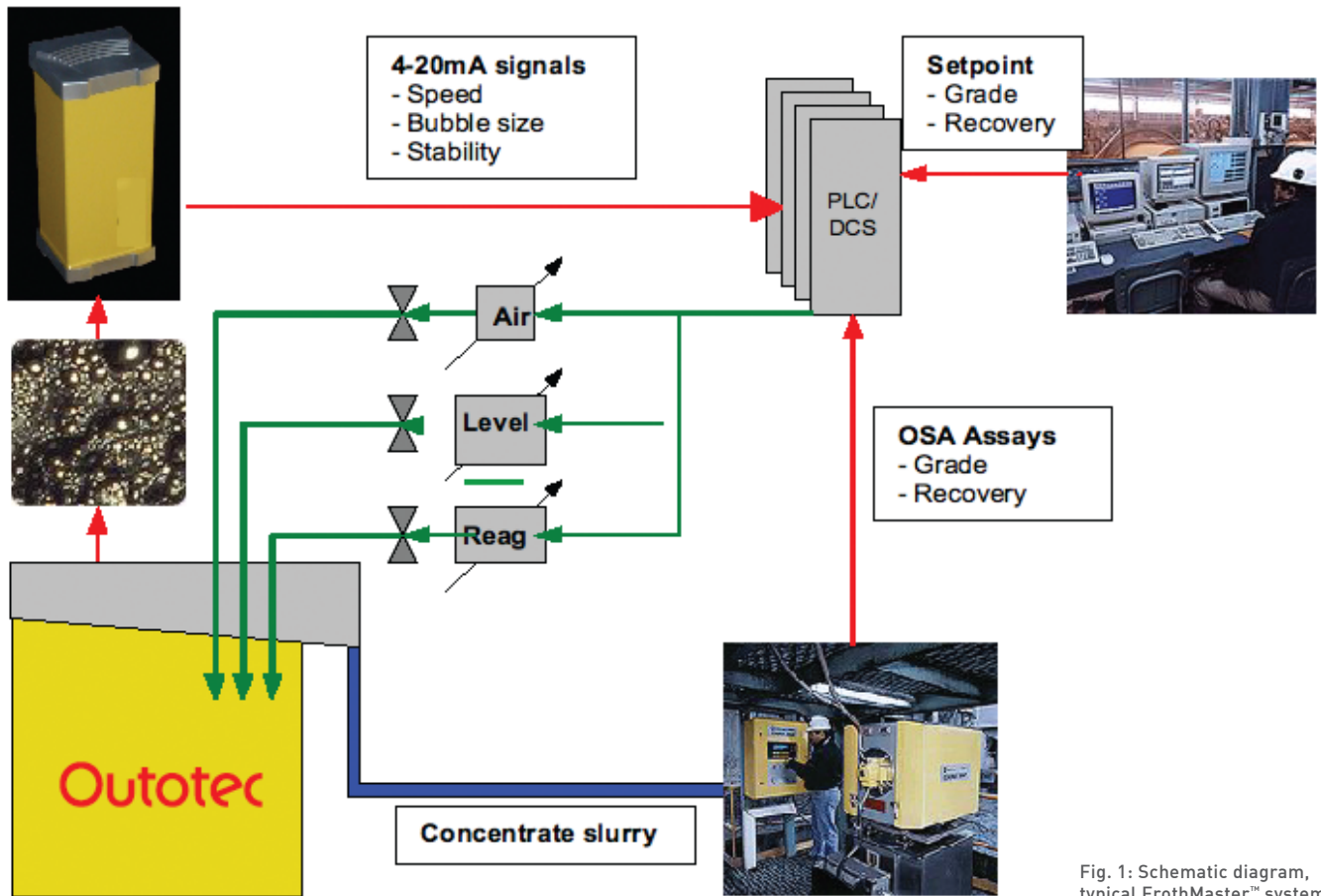


Fig. 1: Schematic diagram, typical FrothMaster™ system.

Experience has shown that variations in these parameters directly influence concentrate grade and recovery. For example, if the speed is too high, this will lower the grade of the concentrate produced. Conversely, if the froth speed is too low, the grade will improve but recovery will be reduced.

Ideally, every cell in the flotation circuit would produce a stable, smooth-flowing froth, characterized by uniformly-sized bubbles steadily crossing the lip of the cell at just the right speed to achieve the most productive balance of concentrate grade and recovery. Unfortunately, naturally occurring changes in ore grades, combined with even minor variations in process flow conditions, call for frequent corrective adjustment of feed and aeration rates, pulp levels, reagent additions and other essential control factors.

Traditionally based more on operator perception and judgement than on actual measurement of froth flow and stability, these adjustments are often performed manually, with response times always subject to operator experience and availability. In these circumstances, unduly long response times and imprecise manual adjustments of process control settings fail to fully correct variations in froth speed and stability, frequently resulting in costly reductions in grade and recovery performance.

## The Cadia experience

In April 2000, process plant management at Cadia commenced trials of a pilot installation of three Outotec FrothMaster™ froth image analyzers.

Designed to acquire continuous real-time digital images of the froth surface, the FrothMaster™ system accurately measures froth speed, bubble size and froth stability in each flotation cell. The measurements obtained by individual units are transmitted via analogue cables to the plant control system, which simultaneously receives real-time process data.

Using this key data from the FrothMaster™ technology at Cadia, a new automatic control system was designed. The system's first controller, using crucial FrothMaster™ data, adjusts cell slurry level, aeration rate and reagent addition parameters to control to a froth speed setpoint. The second controller uses the process data from the On-stream analyser to manipulate the froth speed setpoint so as to achieve a grade setpoint specified by the plant metallurgist. As a result, the speed of the froth, in mm/sec, can normally be maintained to within 5% of the setpoint requirement and the first rougher concentrate grade within 10% of the setpoint. By achieving grade control in this way, recovery in the flotation circuit can be optimized.

In the Cadia concentrator complex, the rougher circuit comprises 14 Outotec 150m<sup>3</sup> flotation cells arranged in two parallel lines, each of seven cells, with the first four cells in each line producing the rougher concentrate and the last three producing a scavenger concentrate.

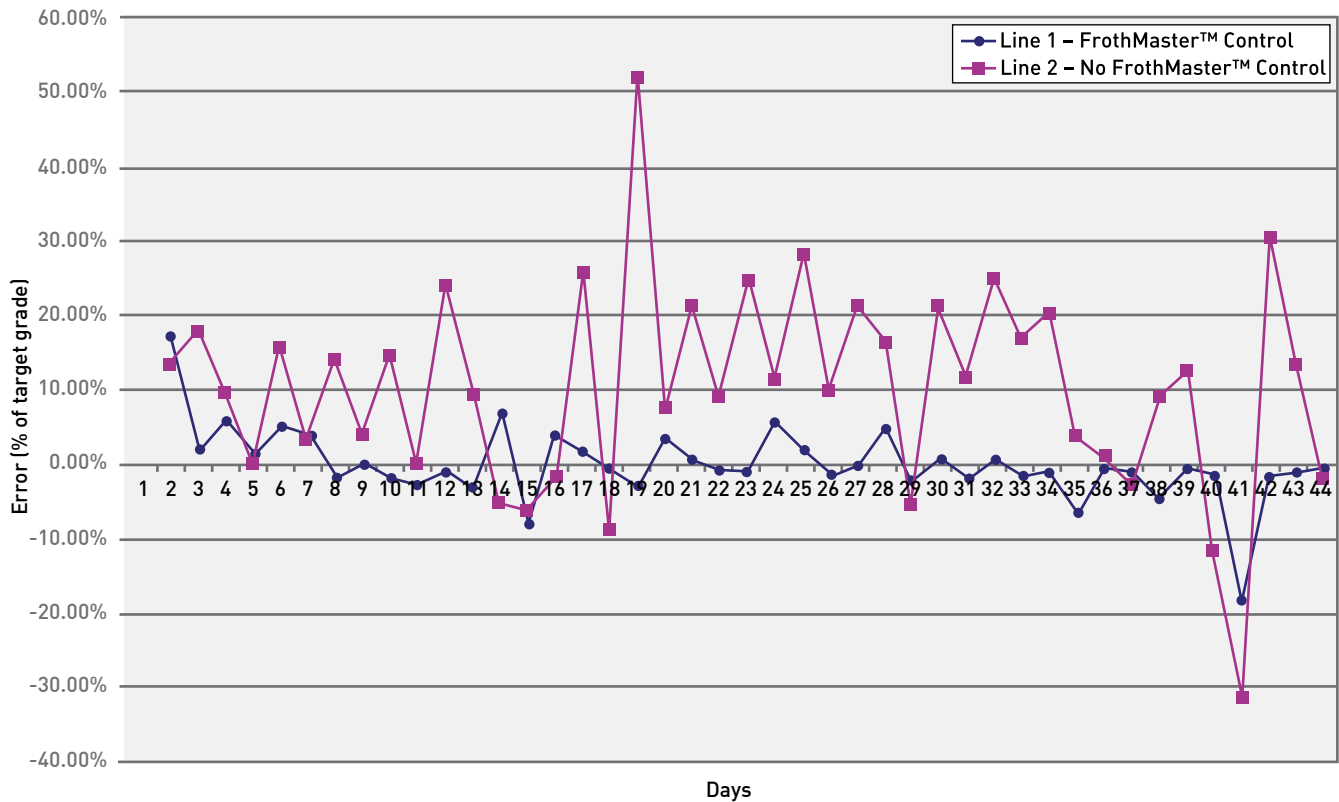


Fig. 2: FrothMaster™ grade control vs. setpoint grade for Lines 1 and 2.

## Results of comparison trials

For the purposes of the trial, the three FrothMaster™ units were installed in the first three cells of Line 1, enabling the performance of those cells (in terms of grade and recovery) to be accurately compared with that of their manually controlled counterparts in Line 2. As shown in Fig 3, the results achieved in Line 1 showed significant improvements in both grade control and product recovery.

Fig 2 demonstrates dramatically the effectiveness of the FrothMaster™ system in controlling concentrate grade during a 44-day trial period. Also, during August 2000, it was noted that the average grade error in Line 1 as a percentage of target remained within 0.03%, while the average grade error recorded in Line 2 was 9.99%.

Fig 3 compares the performances of Lines 1 and 2 in product recovery, with the performances of the FrothMaster™ - controlled cells again significantly better than those of their manually controlled counterparts. Copper recovery from the Line 1 first rougher circuit was 5.28% higher than from the corresponding cells in Line 2, while gold recovery was 5.14% higher.

The Cadia trials highlighted another cost benefit to users of FrothMaster™ technology. At the conclusion of the trial period, average frother consumption in Line 1 was reduced by 7.1%, representing a significant saving in annual processing costs.

Given the results obtained from the three-unit pilot installation in April 2000, Cadia process engineers installed four more units some six months later, enabling them to confirm their preliminary findings and to properly compare the performances of both lines, with Line 1 fully FrothMaster™ -controlled and Line 2 continuing under visual supervision and manual operation.

## “A worthwhile investment ...”

Once again, the results spoke for themselves. Shortly after, Cadia placed an order for an additional seven units and the entire 14-cell rougher circuit was subsequently converted to FrothMaster™ system control.

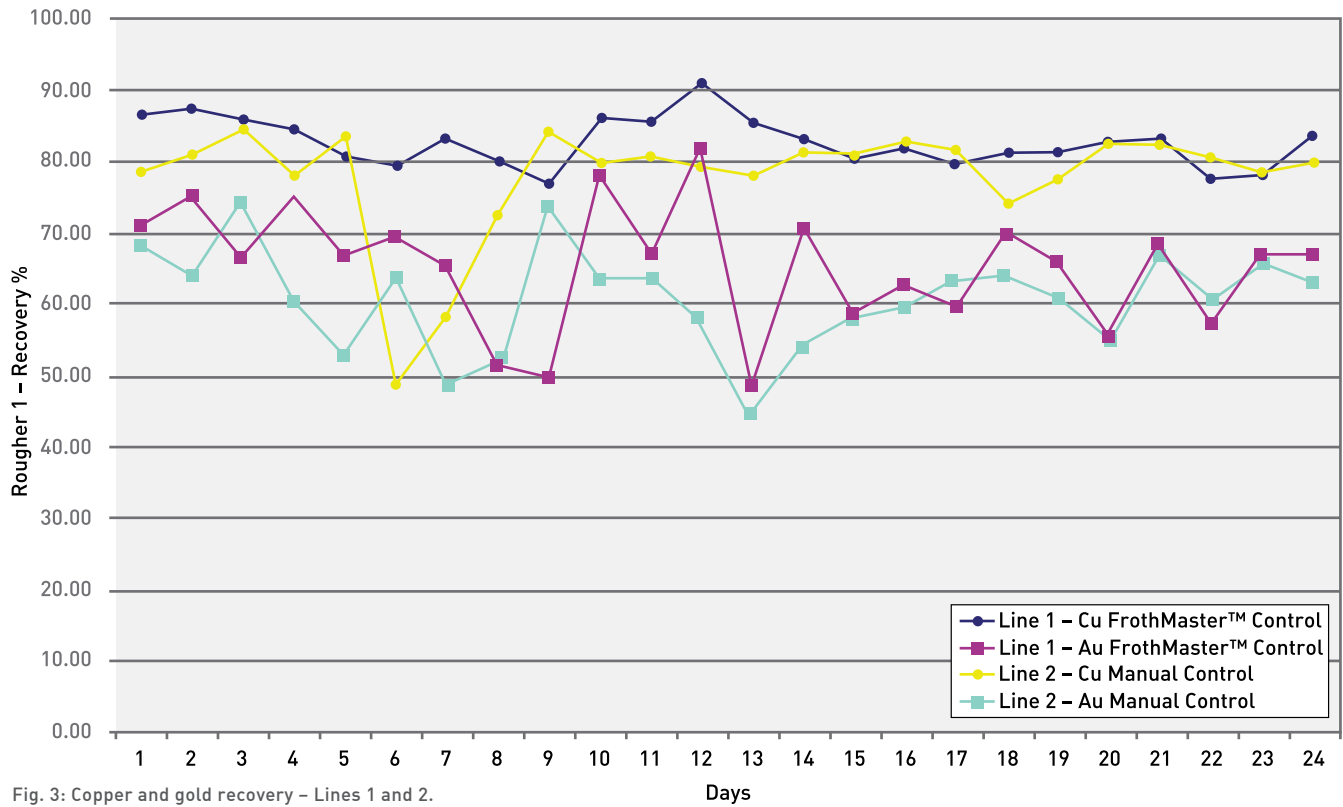


Fig. 3: Copper and gold recovery – Lines 1 and 2.

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