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CONDUCTIMETRIC PLANT TESTS AT McINTYRE PORCUPINE MINES LTD.

by

G. G. EICHHOLZ & G. E. ALEXANDER

MINERAL SCIENCES DIVISION

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G.G. Eichholz* and G.E. Alexander**

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SUMMARY OF RESULTS

Conductimetric tests have been done in the flotation and cyanidation circuits of the McIntyre mill, using the Mines Branch and Foxboro conductivity probes, to test their potential application to the measurement and control of lime levels. The tests showed that lime control would be quite feasible in the cyanidation circuit, but in the flotation circuit the pH levels were too low at the two locations tried to apply the conductimetric systems usefully. The probes stood up well to all mechanical requirements.

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* Head and ** Technical Officer, Physics and Radiotracer Subdivision, Mineral Sciences Division, Mines Branch, Department of Mines and Technical Surveys, Ottawa, Canada.

INTRODUCTION

At the request of Mr. E.W. Johnson, mill superintendent, tests were conducted at McIntyre Porcupine Mines Limited, on February 6-8, 1963, to test the potential usefulness of conductimetric probes of the immersion type for the measurement and control of lime concentrations in the flotation and cyanidation circuits of the McIntyre mill. Some previous beaker-scale tests had been done at the Mines Branch laboratories and had shown that adequate sensitivities could be obtained for the leach solutions submitted. The present tests followed immediately some similar plant tests done in the concentrator of Noranda Mines Ltd. and reported in Mines Branch Investigation Report IR 63-13. The work there had shown that, with the equipment available, it was possible to measure and, by inference, to control the lime level in the pyrite regrind circuit and in the cyanidation circuit, at pH levels around 12.

Two sets of equipment were available for the tests:

1) The Foxboro system, consisting of a slightly modified "Dynalog" controller and a stainless-steel probe, based on the Mines Branch probe specifications. This equipment was on loan from the Foxboro Company, Lasalle, Que.

2) The Mines Branch system, consisting of a high-sensitivity, epoxy resin-coated probe (No. 5), a transistor oscillator, an amplifier consisting of a Hewlett-Packard voltmeter and a Philbrick operational amplifier, and a power supply. Since there was no suitable chart recorder available at McIntyre, a YSI miniature strip chart recorder was used; however, for most of the tests the readings on the Hewlett-Packard voltmeter were utilized.

The previous tests had established the inherent reliability of the Foxboro system and had shown the slightly higher sensitivity of the Mines Branch system. For this reason it was decided from the start to use the two systems independently to explore possible applications of the probes for lime level or pH controls, particularly under conditions where pulp densities or mechanical conditions were such as to make the use of pH electrodes problematical.

DETAILS OF TEST WORK

1. Cyanidation Circuit

The Foxboro unit was installed in the No. 1 agitator of the cyanidation circuit, where the pH was expected to be around 12. The liquid was moving fairly calmly, in contrast to the very turbulent conditions of the corresponding Noranda test. The solution was sampled at regular intervals and titrated for NaCN and CaO. The lime feed was varied deliberately to provide an indication of probe sensitivity.

Table 1 lists the titration and pH readings obtained. Figure 1 shows the recorder chart record and Figure 2 shows a comparison of the chart reading and the pH determinations. It is evident, that close correlation between pH and conductivity indication was obtained. In agreement with results obtained in Ottawa and Noranda, it was found that about double the deflection sensitivity would be preferable for positive control within the pH limits desired; this could be attained readily by increasing the turns ratio in the probe. It should be noted that the lime levels obtained by titration would seem to be rather low for the pH levels indicated; this would explain the small variation in conductivity indicated on the chart (Figure 1), compared with the results obtained in similar tests in Ottawa and Noranda.

TABLE 1

Solution Variables, No. 1 Agitator
February 7-8, 1963

Time	pH	Conductivity (mV)	NaCN (lb/ton)	CaO (lb/ton)
9:20 am	12.0 (?)	49.5		
9:55	12.3			
10:20	12.3			
10:30	12.3	49.5	1.3	0.09
10:45	12.3			
11:15	12.3	49.8		
11:30			1.35	0.11
11:40	12.3	49.9		
12:05 pm	12.3			
12:30	12.3	50.0	1.15	0.07
1:00	12.3			
1:25	12.2			
1:30		50.2	1.25	0.09
2:00	12.23			
2:35	12.35	49.9	1.3	0.16
3:15	12.10			
3:30	12.0	49.0	1.15	0.07
4:00	12.0		1.2	0.09
4:30	11.95	48.6		
5:00		48.1	1.3	0.09
5:10	11.9			
5:45	11.9	47.6		
6:30	11.9	47.2	1.3	0.11
7:00	11.85	47.1		
7:30	11.85	47.0	1.25	0.11
8:00	11.85	47.2		
8:45	11.8	47.7	1.3	0.11
9:20	11.85	47.5	1.2	0.09
10:00	11.9	47.8	1.3	0.11
10:40	11.95	48.6	1.35	0.13
8:00 am	12.10	50.7	1.25	0.16
8:30	12.10	50.9	1.3	0.16

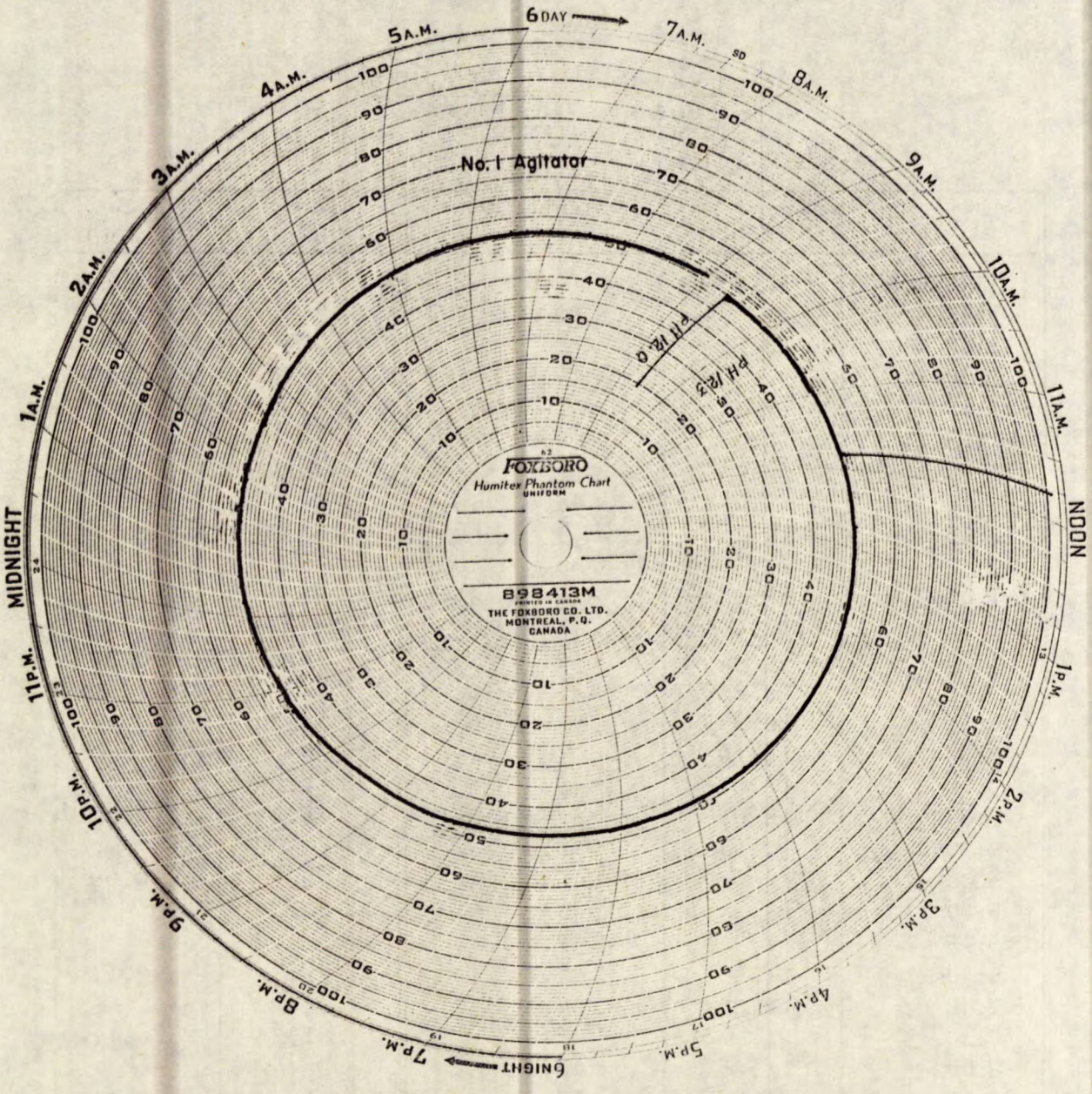

Figure 1. Chart record of conductivity run - No. 1 agitator. Foxboro unit.

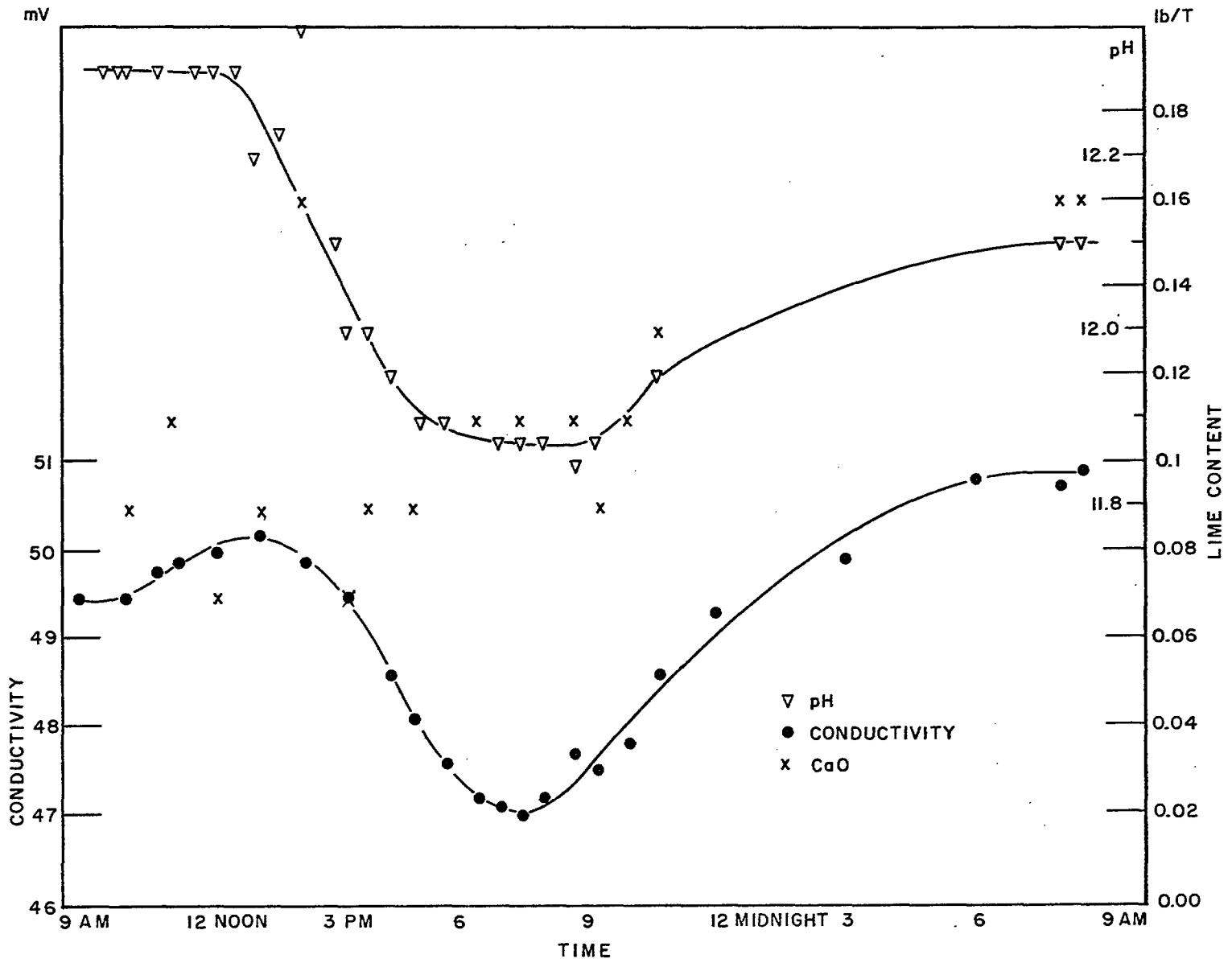

FIGURE 2 CONDUCTIVITY RUN - NO. 1 AGITATOR - FOXBORO UNIT.

2. Copper Flotation Circuit

Because of practical difficulties in controlling the lime content in the feed to the copper flotation circuit by means of pH electrodes, it was suggested to try the conductivity system. The Mines Branch system was, therefore, set up with the probe inside the conical feeder tank, which precedes the copper flotation circuits. The wall of this tank slopes at approximately 45° and the rim of the tank is about 6 ft in diameter. Some trouble was encountered because of excessive variation in the liquid level in the tank, which tended to surge. Half-hourly readings were taken, from 9:30 am to 1:30 pm on February 7, of pH and conductivity levels. The pH value fluctuated rather erratically between extremes of 8.8 and 10.3. This pH level, however, was too low to give any significant variation in the conductivity reading and this test was abandoned at 1:30 pm.

The Mines Branch system was then moved to another location and the probe was installed in the sluice box of the copper cleaner cell. Again pH values and conductivity readings were recorded and are listed in Table 2. The test continued until 9:00 pm when the development ore being processed was exhausted. The pH values varied considerably

TABLE 2

Test Results, Copper Cleaner Circuit
February 7, 1963

Time	pH	Conductivity (mV)	Lime (lb/ton)
1:35 pm	10.7	48	nil
2:10	10.9	47	nil
2:30	11.0	52	0.07
2:55	11.0	52	nil
3:20	10.5	49	0.04
3:50	10.95	53	0.02
4:30	10.8	54	0.04
5:00	10.4	54	0.04
5:50	10.8	55	0.02
6:30	10.9	53	0.02
7:00	10.9	54	0.02
7:30	10.8	55	0.02
8:00	10.4	-	0.02
8:30	10.8	53	0.02
9:00	10.9	54	0.02

because of difficulties with the lime feeder. It is seen that the conductivity values vary correspondingly, but the magnitude of this variation was too small to be practically useful. It is evident that at this pH level, about 10.8, a more sensitive conductivity probe would be required to compete satisfactorily with a pH instrument as a control device.

CONCLUSIONS

The tests have confirmed the results of plant tests elsewhere:

1) At pH levels around pH 12 the conductivity probe has adequate sensitivity to measure and control lime addition to the cyanidation circuit.

2) It would be preferable to double the turns ratio in the Foxboro probe for a wider margin of control.

3) In slurries and agitated solutions the conductimetric system is mechanically superior to pH electrodes and requires much less maintenance.

4) The conductimetric system, as it stands, is insufficiently sensitive to provide adequate control of lime levels in the copper flotation circuit at pH levels below pH 10. In the copper cleaner cell at pH 10.9 greater sensitivity may be achieved by a redesign of the conductimetric system.

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GGE:GEA:DV