

SPOTLIGHT

on a visit to the Rand Refinery

by DAVID J. HADDOCK*

On Wednesday, 6th July, 1988, 28 members of the Johannesburg Branch of The South African Institute of Mining and Metallurgy and their guests assembled at the Rand Refinery Sports Club, which is situated within the Refinery complex, to hear Dr Daniel Pollnow, General Manager of the Refinery, give a very interesting lecture on the Rand Refinery Complex and its activities.

About the Refinery

At the time that gold was discovered on the Witwatersrand, in 1886, the gold was sent to London for refining. This called for a local refinery, and the Rand Refinery fulfilled that requirement in 1920. The year 1923 saw the first full year of refining, in which 9 million ounces (285 tons) of fine gold were produced. By 1959, the output had reached 20 million ounces (624 tons) and, by 1970, a peak year in South African gold production, 32 million ounces (1000 tons).

The Rand Refinery is an associated company to the Chamber of Mines of South Africa, and refines gold and silver on a co-operative basis for mines that are members of the Chamber.

Dr Pollnow spoke further on the refining process, and how the bullion is received from the mines, weighed,

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melted, sampled, and assayed. The traditional method of fire assay is gradually being replaced by X-ray-fluorescence spectrometry, which increases the turn-around time dramatically. The assay laboratory undertakes over 10 000 assays per month, which gives results in minutes rather than in hours.

In the refining process, gold is melted in an induction furnace in lots of up to 400 kilograms. Chlorine is blown through the melt, and the base metals and silver are converted to chlorides, which either rise to the surface and are skimmed off or, being volatile, are removed with the off-gas. The process takes 60 to 90 minutes, and the purity of the remaining gold is at least 99,5 per cent.

The gold is sampled at each stage or process, and is then cast manually into bars weighing 400 ounces (12 kilograms), which are stamped, weighed, and packed. Every bar has its own number. There is a legal requirement that all newly mined gold must be offered to the South African Reserve Bank within 30 days of production.

The other refinery process is an electrolytic process. Gold refined to a purity of 99,5 per cent is not always pure enough for certain industrial and technical applications, or for the production of small investment bars. To obtain a purity of 99,99 per cent, the gold is further refined electrolytically. This process was shown to the visiting party during their conducted tour of the Refinery.



The group who visited the Rand Refinery

Another interesting aspect was the silver process by the electrolytic method that is used to produce silver crystals of 99,9 per cent purity, which are then melted and cast into bars weighing 1000 ounces (31 kilograms).

The Refinery also makes blanks for the minting of Krugerrands, in coins of one, half, quarter, and one-tenth ounce. The use of gold and copper produces a 22-carat alloy. The alloy is cast into a strip on a continuous-casting machine, which produces two parallel coils of up to 600 kilograms each. The strip is rolled to the exact thickness required, and blanks are punched.

The blanks are inspected and weighed individually to ensure that each contains not less than the amount of gold indicated on the face of the coin. The blanks are sent to the South African Mint in Pretoria, where they are struck into coins. The newly minted Krugerrands are then returned to the Rand Refinery for storage and sale to

selected distributors.

Words of Appreciation

On behalf of The South African Institute of Mining and Metallurgy, Dave Haddock thanked Dr Pollnow (Rand Refinery General Manager), Mr Graham Fisher (Refinery Manager), and Miss Gloria Ford (Industrial Chemist) for their courtesy and kindness, as well as for the cocktails and luncheon provided after the tour. Mr Fisher then thanked the Institute members for their interest in the Refinery.

A special word of thanks is due to Mr Don Milella, Secretary of the Johannesburg Branch, and Dr Evan Kirby, Treasurer of the Branch, for their assistance in making the visit successful and enjoyable. Another visit will possibly be scheduled in the near future.

Accounting for gold

The South African Institute of Mining and Metallurgy will be holding a 3- or 4-day school in the third week of May 1989 on the topic 'Accounting for Gold'.

The objective of this school is to present the theory and practice of sampling and mass measurement in surface plants and underground as they apply to the flow of gold from the stope face to final products; the purpose is to isolate the source of imbalances, first to surface or underground, and then to particular processes or mining units.

New procedures to divide the mine call factor, which has traditionally been used as a measure of the accountability of gold from stope face to final products, into its surface and underground components will be presented. These procedures also enable the contribution of individual shafts to overall gold production to be assessed.

The course will be of interest to survey, planning, and production personnel, and to metallurgical engineers associated with the accounting of gold.

The course will cover the following:

- Overview of accounting from stope face to final products
- Statistical concepts as they apply to the practical situation
- Analysis of gold accounting underground
- Face sampling; the techniques, their precision, and the effect of this precision on the confidence of underground grade estimation

- Tonnage and grade calculations for the mine call factor
- Broken ore sampling
- New sampling techniques for area accounting underground
- Use of scintillation counting of uranium to estimate gold content—calibrated methods
- Portable gold analyser for face sampling
- Head-grade sampling—the pivot point between underground and surface
- Mechanical sampling equipment in plants
- Sample preparation
- Sampling of bullion, slag, and loaded carbon
- Mass-measurement techniques and practice
- Assay techniques and the precision of assay
- Metallurgical accounting on gold plants
- Computer techniques applied to mass balancing.

A one-day excursion to a Witwatersrand gold mine to see sampling underground and to visit a metallurgical plant fitted with well-designed modern sampling and mass-measurement equipment is planned.

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