

# The centenary of the discovery of platinum in the Bushveld Complex (10th November, 1906)

R.G. CAWTHORN

*School of Geosciences, University of the Witwatersrand, South Africa*

The earliest authenticated scientific report of the occurrence of platinum in rocks from the Bushveld Complex appears to be by William Bettel on 10th November 1906. Thereafter, prospecting of the chromite-rich rocks for platinum proved frustrating. I suggest that the resurgence of interest shown by Dr Hans Merensky in 1924 resulted from his realization that newly-panned platinum had a different grain size from that in the chromite layers and indicated a different source rock, which he located and it became known as the Merensky Reef.

## Merensky's discoveries

The story of Dr. Hans Merensky's discoveries of the platinum-rich pipes and the Merensky Reef itself in 1924 have been well documented (Cawthorn, 1999; Scoon and Mitchell, 2004, and references therein), but the events that preceded it have not been summarized. In the probable centenary year of the first report of platinum in the Bushveld it is appropriate to review the events between 1906–1924.

## Bushveld platinum reported on 10 Nov 1906

In geology it is dangerous to claim when the 'first' documentation of anything occurred, but I suggest that the first documentation of platinum in the Bushveld Complex can reasonably be considered to have been made by William Bettel on 10 November 1906, in an article in *South African Mines, Commerce and Industries*, a weekly journal published in Johannesburg.

## Platinum in South Africa

To cover an alternative first date, I should mention a reference to a sample of 'platina' (the old name for platinum), together with assorted other geological samples, which was displayed on Church Square, Pretoria, by a prospector, Dick Hart, who had collected them from an area of 80 by 50 miles around Pretoria. The event was recorded in the Pretoria newspaper, *Die Volkstem*, on 27th July 1885 (and referred to in *Payable Gold* by J. Gray, 1936, published by Central News Agency, Johannesburg, South Africa). There is no reason to doubt the prospector's identification (platina had little value then), or the probability that it came from the Bushveld Complex, but the display had no impact on the mining community.

But back to Bettel, who was chief chemist on Robertson gold mine in Johannesburg. His story began in 1890, when he analysed a 'black sand' concentrate from a stamp battery (used for crushing gold ore) from a gold mine in Klerksdorp (a mere four years after the first discovery of the gold reef

in Johannesburg). He found it contained 'silver, gold, platinum and iridium (with osmium)'. Hence, the presence of the platinum-group elements (PGE) in South Africa in minor amounts was well-established by the end of the nineteenth century.

## *In situ* platinum

In his article Bettel reported that he had 'recently' (i.e. prior to November 1906) analysed a half-dozen samples of chromite-bearing rock that he described as olivine gabbro, and found them to contain platinum. He regarded this as documenting the first instance of platinum *in situ* in South Africa. He described the samples as being from the Transvaal, but did not have permission to divulge exact details of the locality. His description is sufficiently precise to allow us to consider these samples as coming from the Bushveld Complex, and so this report represents the first published documentation of platinum in the Bushveld Complex.

## The Russian analogy

Bettel commented on analogies between the South African and the Russian occurrences of platinum, which were the major source of platinum at that time. This analogy was to cause SA geologists to make assumptions that were later shown to be mistaken. In 1925 Percy Wagner wrote, 'The professional geologist made only one mistake. He followed too closely the experience gained in the Urals, where platinum is always associated with chromite.'

The Russian deposits were all alluvial, but the source rock was known to be chromitite, occurring in peridotite. It was only the decomposition of the peridotite and chromitite, and the upgrading of the dense minerals by river action that made the alluvial Russian occurrences economically viable. So closely was the Russian analogue followed that once Merensky had found the first outcrops of dunite pipes and the Merensky Reef in the eastern Bushveld in 1924, he focused a great deal of his attention on

exploring alluvium in the confluence of two perennial rivers downstream from the outcrop, where he thought that there might be major concentrations of easily-worked alluvial platinum derived from these outcrops. The absence of any concentration of PGE downstream is probably because the valleys now seen in the eastern Bushveld have not been eroded by the current rivers, but were carved by the Dwyka glaciation 300 my ago (Cawthorn, 2001)

### **Chromitite in the Bushveld**

The South African geologists followed this Russian model closely and began investigations into the chromite-rich rocks of the Bushveld Complex, whereas ‘the rocks associated with the chromite ..... were neglected’ (Wagner, 1925). Geologists employed by the Geological Survey of South Africa, including Wagner, made a study of the chromite-rich rocks of the Bushveld Complex, and Hall and Humphrey reported the occurrence of platinum in them in 1908, in a publication that is often referred to as the first reference to platinum in the Bushveld Complex. Fifteen years later (1923), Wagner reviewed all the information available on platinum in chromite, and concluded ‘that it would never pay to work the chromite rock for that metal (platinum) alone’. The highest grade quoted was about 2 g/t.

During the years 1906–1923, it can be assumed that it was not only the Geological Survey that was actively evaluating the platinum potential in chromite. It would appear that considerable exploration was also being undertaken. The extent can only be guessed, but the biography of Dr. Hans Merensky, *Look Beyond the Wind*, by Olga Lehmann in 1959 contains an interesting few sentences. Referring to the period before 1924, she wrote ‘Many prospectors, including Merensky, found copious chromite ...’, but that there had been ‘four or five disastrous platinum discoveries of former years that had not covered their finders in glory.’ If Merensky had been involved in previous unsuccessful exploration projects in the eastern Bushveld, why should he try to raise money again in 1924 for yet another prospecting campaign?

### **‘Look Beyond the Wind’**

The above review is based entirely on published documents. I now speculate on why Merensky would contemplate a subsequent exploration project when the previous attempts had been unsuccessful. Admittedly, the first platinum mine in South Africa had just opened in 1923, near Naboomspruit, 150 km away from Maandagshoek. However, Merensky knew well that the host to the platinum there was in quartz veins, geologically apparently totally unrelated to the Bushveld Complex, so that was not the incentive.

Another incident related by Olga Lehmann offers a means to get inside Merensky’s mind. Merensky had been contracted by a major mining house in Johannesburg to evaluate a gold discovery reported in Madagascar. A number of consultants embarked in July 1905 on a ship en route to Madagascar. Once arrived, they were shown an area in which gold had been found. Using pans, Merensky and others traced this gold through several streams and

small pits. Then Merensky ‘looked beyond the wind’. He turned in the opposite direction from the hotel, and began panning other streams. He again found gold and realized that the area they were meant to investigate had been salted. How? He recognized that the gold grains panned in the area being promoted and the gold grains he found elsewhere were of different shapes, and that the associated dense minerals in his pan from the two localities were different. (Sadly, salting was not unknown in those days.) Merensky had looked beyond the obvious, used his mineralogical acumen and recognized the fallacy!

### **Merensky’s 1924 exploration**

So how does that event relate to Merensky’s visit to the eastern Bushveld in 1924? Previous exploration projects had focused on the chromitite layers. We now know a great deal about the platinum-group minerals and their sizes in the chromite layers, especially the Upper Group 2 chromitite layer. Their typical size is from 2 to (rarely) 30 microns (Merkle and McKenzie, 2002). Merensky would have known that panning in the field from crushed chromitite yielded very little platinum, because it was so fine-grained that it was washed out of the pan. If he had ever found any in his pan, it would have been almost submicroscopic. Presumably, a comparison of platinum grades based on panning and chemical analyses of chromite ore samples would not have agreed. Lest modern mineralogists question the accuracy of such comparative tests, Merensky states in his early reports that panning and chemical analysis of samples from the Merensky Reef gave remarkably similar grades.

In 1924, Andries Lombaard, a farmer on Maandagshoek in the eastern Bushveld, sent Merensky an ‘aspirin bottle’ containing a white concentrate that had been panned from a stream on his farm. Merensky had it chemically analysed to confirm that it was platinum. I believe that Merensky used his experience in Madagascar to good effect. He looked at the size of the platinum-group minerals in the concentrate, and realized that they were enormous in comparison with everything that had been found in the chromitite layers. Merkle and McKenzie (2002) reported typical grain sizes from the Merensky Reef as 10–200 microns, and Wagner (1929) had reported a grain of 0.9 cm from the dunite pipes. In 1998 I visited the area on Maandagshoek where Lombaard had panned platinum and took some soil samples which were analysed by Angloplatinum (Cawthorn, 2001). Subsequently some German colleagues undertook a mineralogical study of the same area, and found grains of various platinum-group minerals in excess of 0.2 mm or 200 microns (Oberthür *et al.*, 2003). Dr. Hans Merensky did the same two studies in one day in 1924, and came to the right conclusion. The platinum grains on Maandagshoek were totally different from platinum grains found in the chromitite layers, and indicated a different source rock. It was also coarse enough to be separable by mechanical means (the main extraction process in those days), with very good recovery up to 85% (Wagner, 1929). Merensky realized that the source of this platinum was fundamentally different from the chromitite occurrences, and commenced his well-documented exploration with Lombaard, with its enormous consequences for the global platinum industry.

Skeptics will claim that this suggestion cannot be verified. None of the reports written by Merensky himself contain any interpretation or rationale for his prospecting, merely very factual statements. However, the many and varied discoveries made by Merensky and documented by Olga Lehmann demonstrate his remarkably astute geological sense, and the significance of grain size would have been an obvious parameter for interpreting the results of his prospecting.

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### References

- BETTEL, W. Occurrence of platinum in the Transvaal. *South African Mines, Commerce and Industries*, 10 Nov. 1906, p. 206.
- CAWTHORN, R.G. Seventy-fifth anniversary of the discovery of the platiniferous Merensky Reef. *Platinum Metals Review*, vol. 43, 1998. pp. 146–148.
- CAWTHORN, R.G. A stream sediment geochemical re-investigation of the discovery of the platiniferous Merensky Reef, Bushveld Complex. *Journal of Geochemical Exploration*, vol. 72, 2001. pp. 59–69.
- LEHMANN, O. *Look Beyond the Wind*. Howard Timmins, Cape Town, 1959. 183 pp.
- MERKLE, R.K.W. and MCKENZIE, A.D. The mining and beneficiation of South African PGE ores—an overview. In *The Geology, Geochemistry, Mineralogy and Mineral Beneficiation of the Platinum-Group Elements*, (ed.) L.J. Cabri, Canadian Institute of mining, Metallurgy and Petroleum, vol. 54, 2002, pp. 793–809.
- OBERTHÜR, T., MELCHER, F., GAST, L., WÖHRL, C., and LODZIAK, J. Detrital platinum-group minerals in rivers draining the eastern Bushveld Complex. *Canadian Mineralogist*, vol. 42, 2004. pp. 563–582.
- SCOON, R.N. and MITCHELL, A.A. The platiniferous dunite pipes in the eastern limb of the Bushveld Complex: review and comparison with unmineralized discordant ultramafic bodies. *South African Journal of Geology*, vol. 107, 2001. pp. 505–520.
- WAGNER, P.A. The chromite of the Bushveld Igneous Complex. *South African Journal of Science*, vol. 20, 1923. pp. 223–235.
- WAGNER, P.A. The platinum deposits in the western part of the Lydenburg District, Transvaal. *South African Journal of Industries*, vol. 8, 1925. pp. 90–113.
- WAGNER, P.A. *Platinum Deposits and Mines of South Africa*. Oliver and Boyd, Edinburgh, 1929, 326 pp.

