

Centenary of the Discovery of Platinum in the Bushveld Complex

By R. Grant Cawthorn

School of Geosciences, University of the Witwatersrand, PO Wits, 2050, South Africa; E-mail: cawthorng@geosciences.wits.ac.za

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

The story of the discoveries by Dr Hans Merensky (Figure 1) of the platinum-rich pipes and the Merensky Reef itself in 1924 has been well documented (1). However, the events preceding the discoveries have not been summarised. In the probable centenary year of the first report of platinum in the Bushveld, it is appropriate to review those events from 1906 to 1924.



Fig. 1 Dr Hans Merensky, taken in 1917 at Pietermaritzburg (7)

Bushveld Platinum Reported on 10th November 1906

In geology it is risky to claim a date for the “first” documentation of any event. However, it is suggested that for the occurrence of platinum in the Bushveld Complex, this can reasonably be considered to have been a report (2) by William Bettel on 10th November 1906 in an article in *South African Mines, Commerce and Industries*, a weekly journal then published in Johannesburg.

Platinum in South Africa

To cover all possibilities concerning first dates, a reference to “platina” (the old name for platinum) should be mentioned. A specimen, together with assorted other geological samples, was displayed on Church Square, Pretoria, by a prospector, Dick Hart. It was collected from an area of ~ 130 km by 75 km around Pretoria. The event was recorded in the Pretoria newspaper *Die Volkstem* on 27th July 1885 (cited in (3), p. 52). 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.

To return to Bettel: he was the chief chemist at the Robertson gold mine in Johannesburg at the time. His story begins in 1890 when he analysed a “black sand” concentrate from a stamp battery (used for crushing gold ore) from a gold mine in Klerksdorp, 100 km southwest of Johannesburg (a mere four years after the first discovery of the gold reef in Johannesburg). Bettel found the concentrate to contain “silver, gold, platinum and iridium (with osmium)”. Hence, the presence of the platinum group elements in South Africa in minor amounts was well established by the end of the nineteenth century.

In Situ Platinum

Bettel stated in his article that he “recently” (i.e. before November 1906) analysed half-a-dozen

samples of chromite-bearing rock, which he described as “olivine gabbro”, and had found them to contain platinum. He regarded this documentation as marking the first instance of platinum *in situ* in South Africa. Bettel referred to the samples as being from the Transvaal, but did not have permission to divulge exact details of the locality. His description is sufficiently precise that these samples can safely be considered to be from the Bushveld Complex. This report therefore represents the first published documentation of platinum in the Bushveld Complex.

Russian Analogies

Bettel commented on analogies with the Russian occurrences of platinum, which were the major source of platinum at that time. Thus began a mistake or digression by South African geologists to which Percy Wagner referred. Wagner wrote (4): “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 (an olivine-rich rock). The rocks were all uneconomic to mine. It was only the decomposition of the peridotite and chromitite, and upgrading of the dense minerals by river action, that made the alluvial Russian occurrences payable. Indeed, so closely was the Russian analogue followed, that once Merensky 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. He incorrectly thought that there might be major concentrations of easily worked alluvial platinum derived from these outcrops.

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. By contrast, “the rocks associated with the chromite were neglected” (4). Geologists of

the Geological Survey of South Africa, Wagner’s employer at the time, made a study of the chromite-rich rocks of the Bushveld Complex. Hall and Humphrey reported the occurrence of platinum in these rocks in 1908 (5), a publication that is often quoted as the first reference to platinum in the Bushveld Complex. Fifteen years later, Wagner (6) 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⁻¹.

During the period 1906 to 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 of this can only be guessed, but the biography of Dr Hans Merensky by Olga Lehmann, “Look Beyond the Wind” (7), contains an interesting few sentences. Referring to the period before 1924, Lehmann wrote “Many prospectors, including Merensky, found copious chromite...”, but 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, but 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, but Merensky knew well that the host to the platinum there was in quartz veins, geologically apparently totally unrelated to the Bushveld Complex. That was therefore not the incentive.

To get inside Merensky’s mind, I must refer to another incident related by Olga Lehmann (7). Merensky had been contracted by a major mining house in Johannesburg to evaluate a reported gold

discovery in Madagascar. Several consultants joined ship in July 1905 en route to Madagascar, and were shown an area in which gold had been found. Merensky and others retraced this gold with their pans through several streams and small pits. Then Merensky “looked beyond the wind”. He turned in the opposite direction from his hotel and began panning other streams. He again found gold and realised that the area which the consultants were meant to investigate had been salted (illegal enrichment of an ore in an area or sample to be assayed). How? Merensky recognised that the gold grains panned in the area being promoted and the gold grains he found from elsewhere were of different shapes, and that the associated dense minerals in his pan were different in the two localities. Sadly, salting was not an unknown activity in those days, but Merensky had looked beyond the obvious, used his mineralogical acumen and recognised the fallacy!

Merensky’s 1924 Exploration

The next question is how the Madagascar salting incident relates to Merensky’s 1924 visit to the eastern Bushveld. Previous exploration projects had focused on the chromitite layers. A great deal is now known about the platinum group minerals and their sizes in the chromitite layers, especially the Upper Group 2 chromitite layer. Their typical size is from 2 to (rarely) 30 μm (8). 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. Had he ever found any in his pan, it would have been almost submicroscopic. Presumably, platinum grades based on panning would not have agreed with chemical analyses of chromite ore samples. Lest modern mineralogists question the accuracy of such comparative tests, it should be noted that Merensky stated 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 in the eastern Bushveld, sent Merensky an “aspirin bottle” containing a white concentrate, panned from a stream on his farm, Maandagshoek. Merensky had

it chemically analysed to confirm that it was platinum. Merensky evidently used his experience in Madagascar to good effect. He looked at the particle size of the platinum group minerals in the concentrate, and realised that they were enormous by comparison with everything that had been found in the chromitite layers. Merkle and McKenzie (8) reported typical grain sizes from the Merensky Reef as 10–200 μm , and Wagner (9) reported a grain of 0.9 cm from the dunite pipes.

In 1998 the present author revisited the area on Maandagshoek from where Lombaard panned platinum. Some soil samples were analysed by Anglo Platinum (10). 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 μm size (11) (see Figure 2). Merensky performed both studies in a matter of a day in 1924, and came to the right conclusion. Merensky realised that the platinum grains on Maandagshoek were totally different from those found in the chromitite layers, and indicated a different source rock. The material was also coarse enough to be separable mechanically (the main extraction process in those days), with very good recovery of up to 85% (7). He commenced his often-documented exploration with Lombaard. This ultimately had enormous consequences for the world platinum industry.

Sceptics may claim that my suggestion cannot be verified. None of the reports written by Merensky himself contain any interpretation or rationale to his prospecting, merely very factual statements. However, the many and varied discoveries made by Merensky and documented by Olga Lehmann (7) demonstrate his remarkably astute geological sense. His appreciation of the significance of grain size would have been an obvious parameter in his prospecting skills.

References

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- 3 J. Gray, “Payable Gold: An Intimate Record of the History of the Discovery of the Payable Witwatersrand Goldfields and of Johannesburg in

Grains of platinum group minerals panned from the farm Maandagshoek in the eastern Bushveld Complex, where the Merensky Reef was found in 1924. These photographs were reported by Oberthür et al. (11), and are reproduced here by permission of the Editor of *The Canadian Mineralogist*. Note the scale, indicating that these are large grains (by platinum group mineral standards), and are very different from anything found in chromitite layers

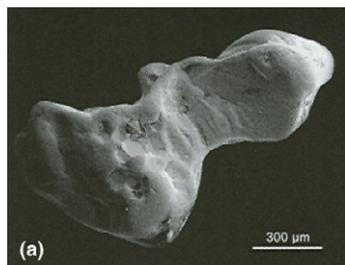


Fig. 2(a) Grain (a) is a well-rounded grain of platinum-iron alloy; its shape suggests that it has been transported over a long distance and rolled about in a river system

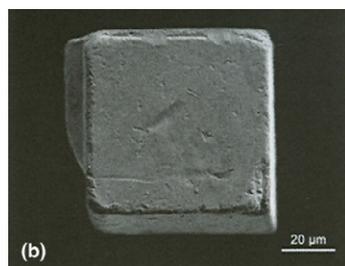


Fig. 2(b) Grain (b) is a near-perfect cube, also of platinum-iron alloy. The corners of grain (b) are still sharp, suggesting a very local derivation

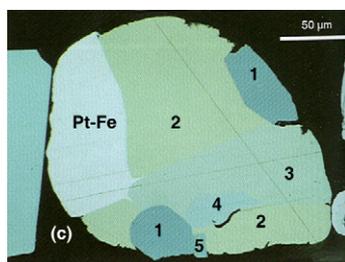


Fig. 2(c) Grain (c) has been cut through its centre and is photographed through a microscope. Its overall rounded shape suggests long transportation. It is made of several discrete minerals. The platinum alloy is labelled Pt-Fe, and other minerals are labelled as follows: 1: laurite (RuS_2); 2: an unnamed mineral ($Pd_{11}Te_2As_2$); 3: palladoarsenide (Pd_2As); 4: sperrylite ($PtAs_2$); 5: irarsite ($IrAsS$)

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The Author

Grant Cawthorn comes from England. He has degrees in geology from Durham and Edinburgh Universities. After a post-doctoral fellowship in Newfoundland, he now teaches igneous petrology in the Department of Geology at the University of the Witwatersrand, South Africa. His main interest is in the formation of the Bushveld Complex with its vast reserves of platinum, chromium and vanadium. His post at the University is supported by the mining industry, and he holds the title of the Platinum Industry’s Professor of Igneous Petrology.