

**The petrography and geochemistry of the Platreef on the farm  
Townlands, near Potgietersrus, northern Bushveld Complex**

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## TABLE OF CONTENTS

### ABSTRACT

1.	INTRODUCTION	1
	1.1. Introduction and Aims	1
	1.2. General Geology	3
	1.3. Methodology	5
	1.4. Previous Work	7
2.	OVERVIEW OF THE BUSHVELD COMPLEX	11
	2.1. General	11
	2.2. The Rustenburg Layered Suite	13
	2.3. PGE Mineralisation	16
3.	STRATIGRAPHY	19
4.	PETROGRAPHY	27
	4.1. Sedimentary Rocks	27
	4.2. Platreef	28
	4.2.1 Lower Platreef	29
	4.2.2 Middle Platreef	30
	4.2.3 Upper Platreef	40
	4.3. Other Intrusive Rocks	44
	4.4. Sulphides	44
5.	MINERAL CHEMISTRY	46
	5.1. Introduction	46
	5.2. Orthopyroxene	46
	5.3. Clinopyroxene	50
	5.4. Olivine	52
	5.5. Plagioclase	55
6.	WHOLE ROCK CHEMISTRY	56
	6.1. Introduction	56
	6.1. Major Elements	56
	6.2. Trace Elements	61
	6.3. Platinum Group Elements	67
7.	S-ISOTOPES	76
8.	DISCUSSION AND CONCLUSIONS	81
	8.1. Nomenclature	81
	8.2. Lithophile Major and Trace Element Data	81
	8.3. Contamination	82
	8.4. Platinum-Group Elements	83
	8.5. Sulphur Saturation and Magma Emplacement	84
9.	ACKNOWLEDGEMENTS	85
10.	REFERENCES	86



APPENDIX I:	Analytical Methods
APPENDIX II:	Thin Section Sample List
APPENDIX III:	XRF Sample List
APPENDIX IV:	Mineral Chemistry
APPENDIX V:	Major Element, Trace Element and PGE
APPENDIX VI:	TL1-03 Borehole Log

## ABSTRACT

The Platreef is a platinum group element (PGE) and base metal enriched mafic/ultramafic layer situated along the base of the northern (Potgietersrus) limb of the Bushveld Complex. It represents an important resource of PGE which is only in its early stages of exploitation. The present study contains a detailed petrographic and geochemical investigation of a borehole core drilled on the farm Townlands. At this locality, the Platreef rests on metasedimentary rocks of the Silverton Formation of the Transvaal Supergroup, and is comprised of three medium grained units of gabbro-norite/feldspathic pyroxenite that are separated by hornfels interlayers. I refer to the three platiniferous layers as the Lower, Middle and Upper Platreef. The Middle Platreef is the main mineralised layer, with total PGE contents up to 4 ppm. The Lower and Upper Platreefs are less well mineralised (up to 1.5 ppm).

Trace element and S-isotope data show compositional breaks between the different platiniferous layers suggesting that they represent distinct sill-like intrusions. The study also reveals a reversed differentiation trend of more primitive rocks towards the top of the succession. For example, pyroxene shows an increase in  $\text{Cr}_2\text{O}_3$  with height coupled with a decrease in  $\text{TiO}_2$ . Olivine from the Upper Platreef has Fo contents between 80-83 (averaging  $\text{Fo}_{81}$ ) and those from the Middle Platreef have Fo from 78-83 (averaging  $\text{Fo}_{79}$ ).

The Upper and Lower Platreefs have  $\delta^{34}\text{S}$  values averaging 8 ‰ while the Middle Platreef has  $\delta^{34}\text{S}$  values averaging 4 ‰. All three Platreef layers have elevated  $\delta^{34}\text{S}$  values, indicating addition of  $^{34}\text{S}$ -enriched crustal sulphur. The model of contamination is supported by elevated K, Ca, Zr and Y contents in the Platreef relative to Critical Zone rocks from elsewhere in the Bushveld Complex, and by high Zr/Y ratios.

Well defined correlations between concentrations of the individual PGE, and between the PGE and S suggest that the concentration of the PGE was controlled by segregating sulphide melt. Alteration of the rocks, possibly due to infiltration by fluids derived from the floor rocks, caused localized redistribution of Cu and, to a lesser degree, the PGE.

A model is proposed whereby the Platreef magma assimilated calcsilicate and hornfels from the country rocks. The hornfels and calcsilicate of the Silverton Formation that forms the floor rocks to the Platreef on the farm Townlands constitute a possible source of the crustal sulphur. Release of S from the floor rocks caused S-supersaturation in the magma, followed by segregation of an immiscible sulphide melt. The sulphide melt scavenged the PGE from the silicate magma. The sulphides and the xenoliths were entrained by successive, metal-undepleted magma flows, causing high metal tenors in the sulphides and undepleted Ni contents in associated olivine.