of the critical zone across the floor rocks. The critical zone has magmatically eroded the upper rocks of the lower zone, and contains xenoliths of the ultrabasic rocks at the contact (Hulbert, 1983). In the north, the critical zone is up to 400 m thick, and contains the main mineralized sequence of the basal unit, which is discordant and transgressive of its own layers and those of its sedimentary or granitic floor. This sequence is called the Platreef, a term now universally accepted but originally coined by Van der Merwe during his work in the area. As will be indicated later, the Platreef contact includes a suite of exotic hybrid rocks that have either been totally ingested by the magma or exist as xenoliths in various stages of chemical dissolution and or mechanical attrition, thus seriously contaminating the parental Bushveld liquid. The top of the Platreef is sharp and unmistakable, consisting of leuconorites or anorthosites interspersed with thin harzburgite, lherzolite, and anorthosite layers of the overlying, essentially gabbroic to troctolitic, main zone (1100 to 2200 m thick). The 1100 m thick upper zone, which contains 20 magnetite layers, magnetite gabbros, gabbro, anorthosite and olivine diorite, is capped by the Bushveld-related felsites, granophyres, and granites of the roof.

From north to south, geological mapping has shown the Platreef to exist over a strike length of 61,7 km. It covers the farms Elandsfontein 766 LR, Stirum 787 LR, Dorstland 768 LR, Holland 773 LR, Witriver 777 LR (for which no economic details are available), Drenthe 778 LR, Overysel 815 LR, Zwartfontein 818 LR, Vaalkop 819 LR, Sandsloot 236 KR, Tweefontein 238 KR (the main mineralized strike), Rietfontein 240 KR, Macalacaskop 242 KR (no economic details available), Piet Potgietersrus Townlands 44 KS (where the results of the considerable amount of excellent exploration work, undertaken by Southplats have been kindly made available by Dr N. Stravakis — reports by Gain in 1991), Oorlogsfontein 45 KS, Rooipoort 46 KS (no economic details available), Grasvally 293 KR, and Zoetveld 294 KR. Platreef as such, has been recognized on Grasvally, but details of the critical zone have been provided by Hulbert, 1983, including the lower-zone mineralization on Volspruit 326 KR.

The main economically viable Platreef, occurs over some 20,8 km of strike on the farms listed. It was described in detail by Wagner (1929), who attempted to unravel the abnormal and non-systematic stratigraphy of recognizable but disturbed igneous rocks, from a study of their intensely metasomatized metasedimentary counterparts (diopside-grossularite 'parapyroxenites', dark calc-silicates, metaserpentinites etc.). These, particularly on Vaalkop and Zwartfontein, can persist as xenoliths or contaminants for up to 2 km into the Complex. Wagner recognized three types of PGE deposits: those that occur as disconformable intrusions in the floor, those that occur along the basal contact, and those that occur some distance above the floor. He suggested that the latter, best-mineralized layer was the equivalent of the Merensky reef in other parts of the Complex.

Considerable exploration, trenching, and drilling followed Wagner's original assessment. However, the high degree of confidentiality imposed by the major companies prevented any further detailed disclosures on the Platreef. Nevertheless, excellent work on Drenthe in the north (Gain and Mostert, 1982) and to the south on Potgietersrus townlands (Gain, 1991) has become available. These studies, together with those on the intervening farms (Buchanan *et al.*, 1983; White, 1983; and Cawthorne *et al.*, 1985, along with my personal observation) have sought to identify stratigraphically persistent and economically consistent layers among the jumble of rocks and the apparently scattered mineralization that they contain.

The basic lithology of the igneous rocks appears to be quite simple. However, the changing footwall lithology and the degree of contamination serve to complicate the sequence considerably. A fine-grained, contaminated heterogeneous rock that can change along strike from a felspathic pyroxenite to a melanorite or a norite forms the basal unit (reef A). This is followed by a coarse felspathic pyroxenite to pegmatoidal melanorite, which is host to an impersistent chromite stringer (B reef), thus possibly confirming Wagner's correlation with the Merensky reef. It may be overlain by a lenticular, seemingly barren felspathic pyroxenite (C reef), before the unmistakable upper contact of the Platreef with the anorthositic rocks of the main zone is encountered.

All these rocks contain varying amounts of either large dolomitic xenoliths (which are surrounded by calc-silicate reaction rims) or masses of small xenoliths completely surrounded by coarse calc-silicates or parapyroxenites, which in turn are enveloped by metaserpentinites. The layered sequence may, however, also be interfingered by conformable to semi-conformable layers or lenses of parapyroxenites, calc-silicates, or metaserpentinites, depending on the degree of metamorphic alteration. In weathered rocks it is almost impossible to distinguish the contaminated hybrids from their igneous counterparts, and this has led to considerable frustration in surface exploration trenching. On Tweefontein, Wagner reported that massive sulphides occur within steeply dipping, brecciated fault zones in the banded ironstones, filled with graphic granite. On Sandsloot, a fold in the dolomite gives rise to a discordant finger or tongue of that rock that transgresses the strike of the layered Bushveld rocks. Northward, the footwall may be either dolomite or the basal norite. According to Lee (1981) and White (1983) massive sulphides occur sporadically at the footwall contact in that area (Sandsloot, Vaalkop, Zwartfontein, and Overysel). From Overysel northwards, the Platreef is in contact with the basement granites, but Cawthorne *et al.* (1985) recognized a mineralized gneissic granofelsic body intervening between the granites of the floor and the Bushveld rocks, which has (possibly rheomorphically) been intruded by the footwall granite. On Drenthe, boreholes have indicated that the footwall contact is steeper than the Bushveld layering; yet, even there, the Platreef contains dolomite xenoliths, suggesting either dolomite at depth or a self-transporting reaction of dolomite xenoliths along the floor — much as in the well-known way that sodium metal transports itself during its reaction with water.

Wagner (1929) suggested that the Platreef mineralization occurs as large lenticular pods with the following lengths and thicknesses:

- Sandsloot–Vaalkop–Zwartfontein South 3000 m × 20 to 50 m, dip 55° W
- Zwartfontein Central 1200 m × 30 m, dip 70° W
- Zwartfontein North 330 m × 20 m, dip 35° W.

On Drente, Gain and Mostert (1982) found a small mineralized body in the B 'reef'. This pod-like mineralization is enigmatic, as is the occurrence of well- and lesser-mineralized pods. It can be assumed that all the mineralization was terminated either by a late movement of the hybrid layers, by minor tectonic shifts not recognized in similar rock-types on either side of the faulting, or by localized late-stage degassing of the footwall and the consequent removal of the sulphides. The tectonic shifts may have been caused by the mass of the Bushveld magma and the differential settling of the floor sediments.

Mapping on Townlands (Gain, *op. cit.*) shows that the folded and faulted Platreef is much more complicated here than elsewhere in the area (Gain, 1991). The footwall is more argillaceous (hornfelses, carbonaceous and calcareous shales, limestones, dolomites, and ferruginous to clean quartzites) and their steeply dipping (60° to 70°) metamorphic equivalents. In one area, the Platreef is split by a folded raft of quartzite uplifted from the floor. On its footwall side the Platreef contains many dolomite xenoliths, but on its hanging-wall side, the Platreef is largely an uncontaminated pyroxenite and melanorite. The Platreef itself is much more mafic (with dunites, harzburgites, and pyroxenites), but is also very variable. It contains the ubiquitous dolomitic rafts as in all the best mineralized areas but, rather inexplicably, the overall tenor of the ore is low.

In the southern extremity of the Potgietersrus limb (Grasvally, Zoetveld, and Volspruit), Hulbert *(op. cit.)* described the mineralization in the critical and lower zones as follows.

a. He found that the top of the lower zone has been terminated abruptly by magmatic erosion, and that the overlying critical zone transgresses its normal lower-zone footwall (of which it contains xenoliths) to rest on the Pretoria sediments. The fine-grained basal rocks of the critical zone are continuous over some 18 to 20 km, but are mineralized only when they rest on a lower-zone footwall; but, unlike in their northerly counterparts, the mineralization ceases when they rest on sedimentary lithologies. The base metals and PGE increase upwards over the 36 m thickness of fine-grained gabbronorites and pigeonite gabbros at the base of the critical zone. The following layer (10 m thick) again consists of coarse gabbronorite, which is pegmatoidal towards the top. The pegmatoid is initially lower in base metals than the underlying fine-grained rocks, but upwards attains 3000 ppm nickel and 2000 ppm copper. Throughout these rocks, the PGE tenor never exceeds 1 g/t. The sequence, although thinner, is the same as the Platreef in the north. This fact probably makes any correlation with the Merensky untenable, should Hulbert's correlation of the layers to follow be correct.
b. The layers described above are overlain by 1,2 m of pyroxenite and 0,6 m of what Hulbert termed a 'UG2-like' chromitite layer (Cr: Fe ratio 1,2). The chromitite can contain up to 11 g/t Pt+Pd, but averages between 4 and 5 g/t. It is known to occur over some 10 km of strike length.
c. In the lower zone, Hulbert recognized mineralization in the so-called Volspruit pyroxenite, occurring over the lower 6 m of his cyclic unit 12 (about 1100 m below the top of the lower zone). This layer contains about 3 per cent base-metal sulphides (0,24 per cent nickel and 0,11 per cent copper), and averages 1,39 g/t platinum and 1,73 g/t palladium some 1 000 m from the sedimentary floor. However down-dip, the tenor improves (0,27 per cent nickel, 0,19 per cent copper) with 3,09 g/t platinum and 2,56 g/t palladium some 3 000 m from the contact. Rio Tinto explored this layer in 1970, but probably found it uneconomical.
d. A lower 0,47 m and an upper 0,285 m chromitite layer are found in cyclic units 24 and 26 (numbering and measuring datum from the top of the lower zone), situated respectively 546 m and 482 m below datum. Their Cr:Fe ratios are 2,46 and 2,10 respectively. These chromitites contain lower-tenor sulphides and PGE value; Hulbert regards these sulphides as secondary, resulting from the serpentinization of their harzburgite host rocks. Van der Merwe (1976) recognized similar chromitites near the top of the Zwartfontein satellite body, with Cr:Fe ratios of 2,99 and 2,69. These layers are thus high-magnesium metallurgical chromitites similar to those of the Great Dyke of Zimbabwe, and are unlike the chromitites of the critical zone of the main Bushveld Complex.

In assessing the tonnages of the Potgietersrus area, only the 20,8 km of the mineralized Platreef for which data on the grade are available, mostly from old publications coupled with some new data (Shuttleworth and others, see references), are used. A standard 10 m thickness for the mineralized layer on the footwall has been assumed, and all of the Platreef to the south of Tweefontein has been ignored as probably being below exploitable grade. Dips were measured from Van der Merwe's sections D, E, and F, and were found to average 30° to a depth of 1 200 m. The average PGE grade is 4,12 g/t, and the average distribution of the individual PGE (seven analyses) is: platinum 42,85 per cent, palladium 48,69 per cent, ruthenium 3,99 per cent, rhodium 2,76 per cent, iridium 0,91 per cent, and os-