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The Orebody Character of Pt-Pd Deposits in the Great Dyke, Zimbabwe

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1 Introduction

The Great Dyke is a layered mafic-ultramafic body intruded into Archaean granites and greenstone belts. The Dyke is 550km long, north-north-east trending with a maximum width of 12 km.

The Dyke developed as a series of initially discrete magma chamber compartments, which coalesced as the chambers filled. Each sub-chamber is divided into two major stratigraphic successions, a lower ultramafic sequence dominated from the base upwards by dunite, harzburgite and pyroxenite, and an upper mafic sequence consisting mainly of gabbro and gabbronorite.

There are four remnants of complex (Fig. 1) and the largest one is the Hartley Complex which contains approximately 80% of Zimbabwe's PGM mineral resources.

There are four Pt-Pd mines in Zimbabwe and distribute on the three remaining complex. Mimosa mine is located in the south of Wedza Complex, Unki mine is located in the southern Selukwe Complex, Hartley and Ngezi mines are located in the middle of the Hartley Complex .

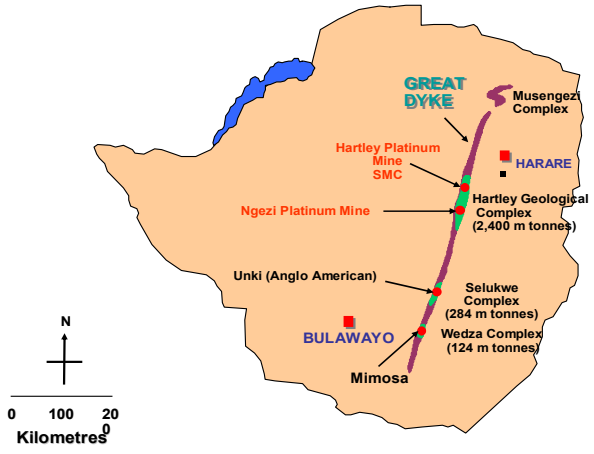

Fig. 1. Four complex remaining in the Great Dyke.

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2 The Main Sulphide Zone Character

The platinum-bearing Main Sulphide Zone (MSZ) is a continuous and stable layer with stratiform textures. It exists in the magmatic rocks in the nearly SN direction (NNE direction) synform structure, in pyroxenite some 5m to 50m bellow the lower bounding surface of gabbro. MSZ has dip angle of 5 º to 27 º, it is steeper at both eastern and western edges of the synform and flatter in the core of the synform (Fig.2).

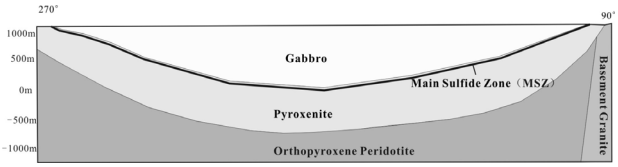

Fig. 2. Cross profile of the Great Dyke, Zimbabwe).
(G—Basement Granite; P1—Pyroxenite; D^{Q}—Dolerite; MSZ—Main Sulfide Zone; S^{H}—Orthopyroxene peridotite; N—Gabbro)

The thickness of MSZ is about 1.58~12m. The thickness in the west shallow part is about 2~5m; While in east shallow part, the thickness is about 1.58~4.79m. The thickness of the middle part is relatively large: 4~12m. Metal sulfides include pyrrhotite, chalcopyrite, pentlandite and pyrite, which have disseminated and sporadic distribution. The content is about 2~8%. Through careful observation of drilling cores, MSZ can be visually identified with naked eyes.

The platinum group elements in the mineralization zone have stable distribution. When there are obvious peak values of Cu and Ni, platinum group elements will be peak values soon afterwards.

3 The orebody's character and ore's quality

3.1 The orebody's character

Platinum and palladium orebody is located near the

Table 1 Major elements analytical results of ores ($\times 10^{-2}$)

SiO_2	Al_2O_3	Fe_2O_3	MgO	CaO
47.96	4.44	18.07	20.20	3.79
Na_2O	K_2O	MnO	TiO_2	P_2O_5
0.50	0.19	0.34	0.30	0.02
LOI	S	Total		
2.99	0.69	99.49		

Table 2 Trace elements analytical results of ores (×10-6)

Li	Be	Sc	V	Cr	Co
11.63	0.19	26.60	136.72	2089.81	151.36
Ni	Cu	Zn	Ga	Rb	Sr
2642.78	1865.97	83.95	5.91	10.47	42.94
Y	Nb	Mo	Cd	In	Sb
4.18	0.87	1.32	0.20	0.04	0.13
Cs	Ba	La	Ce	Pr	Nd
1.43	48.28	2.58	4.96	0.57	2.34
Sm	Eu	Gd	Tb	Dy	Ho
0.53	0.18	0.57	0.12	0.71	0.15
Er	Tm	Yb	Lu	Ta	W
0.48	0.08	0.55	0.09	0.07	1.22
Re	Tl	Pb	Bi	Th	U
0.01	0.23	16.01	1.92	1.02	0.34
Zr	Hf				
21.04	0.58				

middle-low part of MSZ and the host rock is the ultramafic pyroxenite. Typically, there is only one main orebody in the deposit, the platinum group metal resource amount is always up to more than 100 tons. Orebody is layered and the thickness is stable, with an average thickness of about 1.8 m, dip angle of 5 ° ~ 20 °. Platinum's average grade is about 1.8 g / t and palladium's average grade is 1.6 g / t.

3.2 Ore's mineral components

The ores are dark grey and have hypautomorphic granular-sideronitic, sparse disseminated and mottled textures. Major metal minerals are pyrrhotite, pentlandite, chalcopyrite, pyrite and platinum-group minerals(PGM). The content is about 2-5%. The gangue minerals are orthopyroxene (75-85%), clinopyroxene (5-15%), plagioclase (5-15%) and a little biotite and hornblende.

3.3 Ore's texture and structure

The ore's textures are mainly automorphic-hypautomorphic, allotriomorphic granular, slabby, bladed, plumose, edging, inclusion, unmixing of solid solution, fascircular and fibreblastic, piercing replacement, imbricate, pelletoid, emulsion droplet, knot, corrosion, sieve like replacement and replacement remainder textures.

The types of ore structure are simple, commonly widely-spaced disseminated structure, a little dense disseminated structure.

3.4 Ore's chemical composition

The chemical composition of major elements and trace elements in Platinum-Palladium ores are listed in Table 1 and table 2.

3.5 Ore's useful components

Ore's major useful component is platinum, coexisting useful component is palladium, and associated useful components are rhodium, gold, ruthenium, iridium, copper, cobalt and nickel. These useful components could be comprehensively utilized. Other beneficial components, like Cr, Se and Te, have low content that could not reach the standards of composite utilization.

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