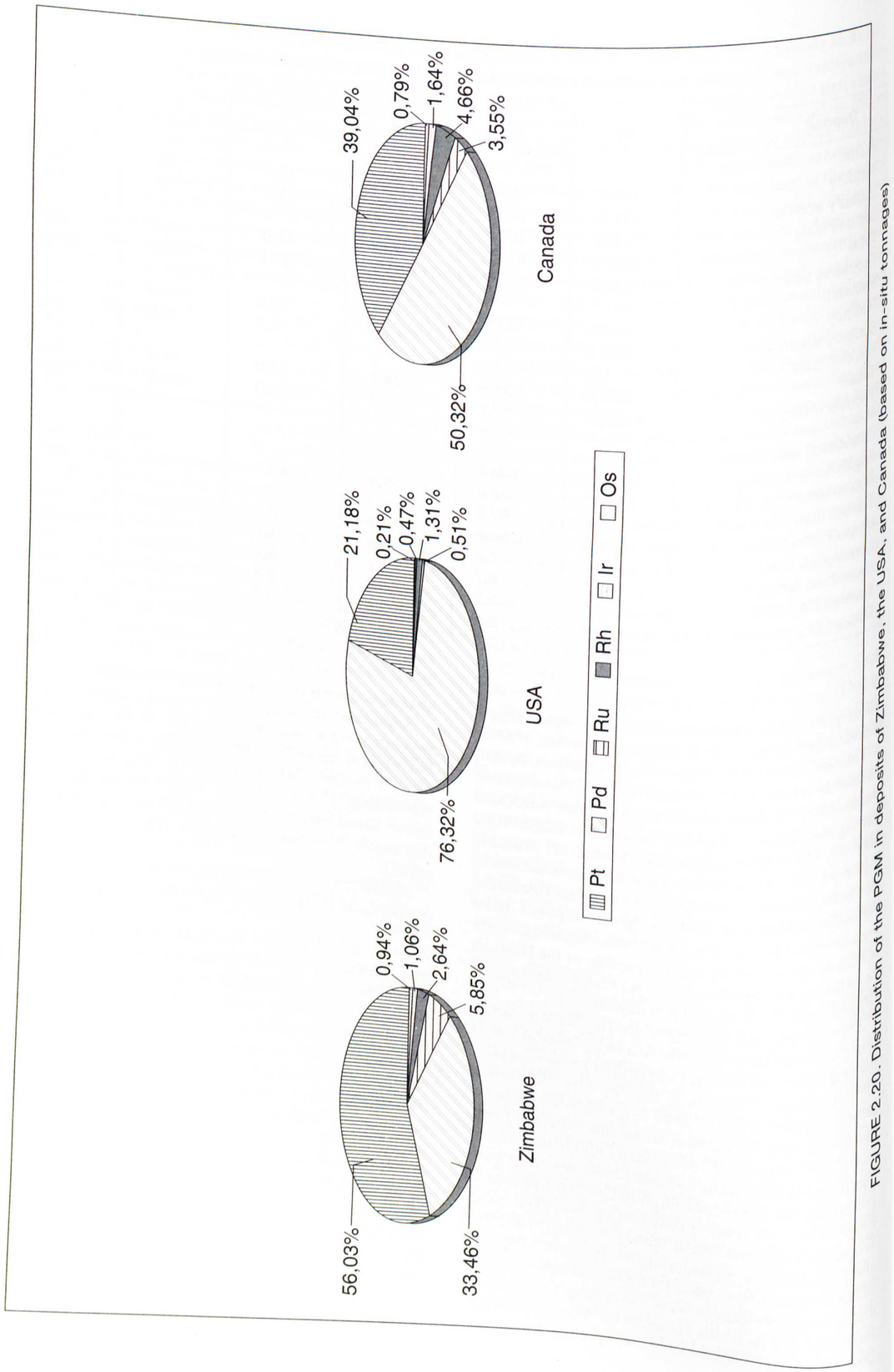

FIGURE 2.20. Distribution of the PGM in deposits of Zimbabwe, the USA, and Canada (based on in-situ tonnages)

sists of a dunite core surrounded by successive envelopes of lherzolite and olivine pyroxenite. The tabular no. 24 orebody is sub-parallel to the wall of the intrusive and extends along its entire length. The deeper west-central subchamber, which hosts the largest no. 1 orebody, is 1700 m long and extends from 500 m below surface to 1000 m depth, but the orebody itself is 1500 m long and 150 m thick, extending from 200 m below surface to a depth of over 1100 m. The faulted, shallower, and thicker trumpet-shaped eastern intrusive subchamber hosts the smaller no. 2 orebody, measuring 1300 m long and 118 m wide. Massive ore is found only in this orebody (4 to 9 per cent nickel). The most common ore type throughout is a continuous network of base-metal sulphides filling the interstitial spaces between the olivine cumulates (about 2 per cent nickel). This makes up the greater part of orebody no. 1, about 10 per cent of orebody no. 24, and the lower part of orebody no. 2. Disseminated ores surround the extremities of the net-textured ore. The average PGE content of the net-textured ore is 1 g/t, which is about 2 to 3 times that in the disseminated ores. Fracture zones in the orebodies are extremely enriched in copper and PGE, and one such fracture in no. 24 orebody attains 6,15 g/t platinum and 1,83 g/t palladium. Contact metasomatic orebodies are associated with the footwall marbles or with fractured zenolithic rocks. Based on a strike-section plan of the orebodies, their area contribution (taken as being equal to their ore contribution of the whole) amounted to no. 24, 26 per cent; no. 1, 55 per cent; and no. 2, 19 per cent. Extensive sampling of the orebodies by Chai and Naldrett (1992) gave the results shown in Table 2.23.

The same authors suggest that the deposit contains 500 Mt of ore grading 1,2 per cent nickel, 0,7 per cent copper, and 1 g/t PGE + Au (PGE 0,85 g/t), which I have accepted in calculating the reserves to 1200 m, shown in Table 2.24.

2.8. The PGE in the Sedimentary Cycle

Owing to the extreme rarity of the PGE, and the minute fraction of the earth's crust that they constitute, the knowledge of their geochemistry is extremely scanty. Some of the enigmas concerning the fundamental geochemistry of the PGE are:

(1) the absolute abundances of the PGE in the earth's crust and other terrestrial materials
(2) factors influencing the behaviour of the PGE in mafic and ultramafic melts
(3) the mechanisms whereby the PGE become concentrated in differentiated magmas and thus within the resulting layered complexes
(4) the role of chromite as a concentrating phase for the PGE
(5) the controls responsible for the markedly different mineralogies of the PGE in various sulphide ores and their position in zone deposits
(6) the causes determining the PGE ratios in different ore deposits
(7) The factors controlling the proportion of PGE in solid solution in sulphide or other minerals, in comparison to their occurrence as discrete PGE minerals
(8) the mechanisms that determine the behaviour of the PGE in hydrothermal solutions
(9) the method of the PGE release from their primary hosts, their transport in aqueous media, and their eventual growth in placer deposits
(10) the mode of transport and concentration of the PGE in layered sediments having no apparent magmatic source in their provenance areas.

In the sections following, I shall examine the latter two questions.

2.8.1. The PGE in Gold and Heavy-mineral Placers

In prehistoric and the earliest historical times, placers were the only source of the PGE. In the more modern

Table 2.23
Average grades of the Jinchuang deposit

Orebody	Ni, %	Cu, %	Co, %	PGE, g/t	Pt, %	Pd, %	Ru, %	Rh, %	Ir, %	Os, %
No. 24	0,77	0,56	0,03	0,53	58,79	31,18	3,16	1,35	2,87	2,65
No. 1	1,81	1,25	0,06	1,55	74,93	17,23	2,35	1,27	2,13	2,09
No. 2	2,54	1,77	0,06	1,21	34,50	43,87	6,02	4,08	6,00	5,53
Weighted	**1,68**	**1,17**	**0,05**	**1,03**	**63,05**	**25,92**	**3,26**	**1,82**	**3,06**	**2,89**

Table 2.24
Total PGE reserves of the Jinchuang deposit of north-west China, kg
(The depth does not exceed 1200 m)

PGE	Pt	Pd	Ru	Rh	Ir	Os
In-situ:	267 963	110 160	13 855	7 735	13 005	12 282
Thousand oz	8 615,2	3 541,7	445,4	248,7	418,1	394,9
Millhead:	189 150	97 760	9 780	5 460	9 180	8 670
Thousand oz	6 081,3	2 500,0	314,4	165,5	295,1	278,7