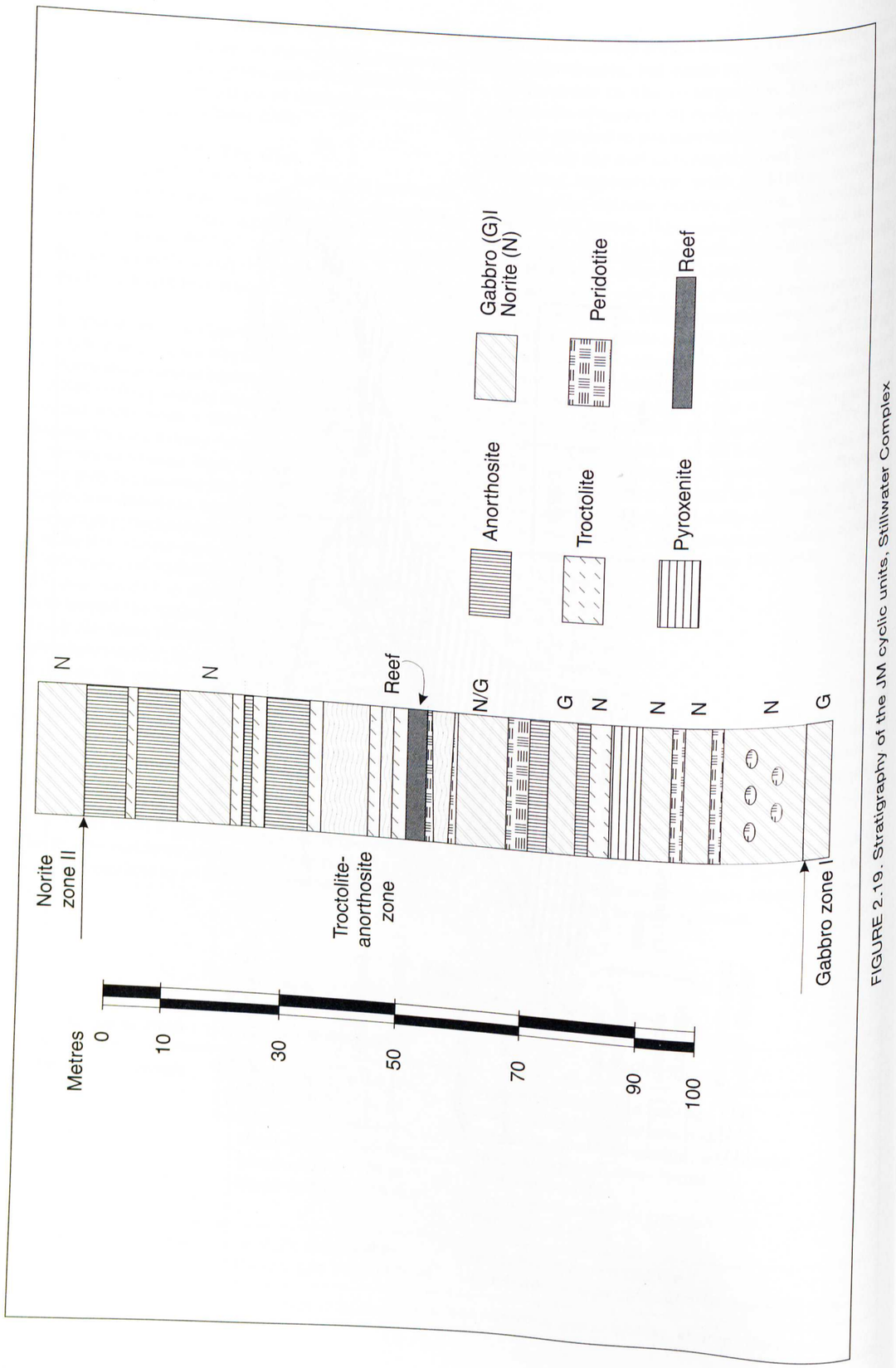

FIGURE 2.19. Stratigraphy of the JM cyclic units, Stillwater Complex

Table 2.20
PGE reserves and provisional resources of the USA

Reserves: Stillwater (to 1200 m depth)						
	Pt	**Pd**	**Ru**	**Rh**	**Ir**	**Os**
In-situ, kg	1 403 820	5 058 525	33 803	86 827	31 152	13 919
Thousand oz	45 133,8	162 635,1	1 086,8	2 791,5	1 001,6	447,5
Millhead, kg	1 123 193	4 047 313	27 046	69 470	24 924	11 136
Thousand oz	36 111,4	130 123,9	869,5	2 233,5	801,3	358,0
Provisional *in-situ* resources: Duluth and Crillion-Perouse complexes						
	Pt	**Pd**	**Ru**	**Rh**	**Ir**	**Os**
Duluth	279 893	1 042 505	16 095	19 369	2 319	3 819
Crillion	24 184	30 236	–	–	–	–
Total, kg	304 077	1 072 741	16 095	19 369	2 319	3 819
Thousand oz	9 776,3	34 489,4	517,5	622,7	74,6	122,8

(a) The basal zone contains large sulphide concentrations of at least 150 Mt, but the total could be three times that amount (Page and Dohernwend, 1973). A bulk sample of a mineralized granite stock and Stillwater contact rock yielded 7,17 g/t platinum, 3,4 g/t palladium, and 0,4 g/t rhodium.
(b) The chromitites of the Complex did not show PGE values above 5 ppb (0,005 g/t) as determined by Page *et al.* (1969).
(c) Near the upper contact of the bronzitite zone, a coarse-grained unit yielded 2,7 g/t Pt+Pd over a limited area (Conn, 1979).
(d) A lens of what appeared to be a large cognate zenolith in the banded succession assayed 7 g/t Pt+Pd over 1,5 to 3 m (Conn, 1979).

2.5.2. *Other PGE Deposits in the USA*

1. *The Duluth Complex* is a large ultramafic to mafic lopolithic mass which extends in a wide half-ellipsoidal arc, 280 km along its northeast axis and 45 km along its northwest axis, from the town of Duluth on Lake Superior through the Boundary Waters Canoe area of northwestern Minnesota to the Canadian border. Naldrett (1989) has related this complex (aged 1100 My) and its comagmatic mineralization to the major Keweenawan rift zone, which contains the intrusive phase of the thick Keweenawan flood basalt province of the Lake Superior region — much like the comagmagtic intrusions and extrusions in the Noril'sk-Talnakh area of Russia. Naldrett points to gravity and magnetic anomalies that define the mid-continental Keweenawan rift zone of North America, with the Duluth Complex at its northern extremity. Many authors, such as Taylor (1964), have described parts of the Complex, while Weiblin and Morey (1975) and Bonnichsen and Tyson (1975) have provided details of its overall geology. New work by Martineau (1988), however, has changed many earlier concepts of the intrusive phases of the Duluth complex. More than 40 separate sheetlike to cone-shaped intrusions, ranging in composition from anorthosite to troctolite to ferrogabbro, are now recognized. The floor consists of Archaean granites and felsic volcanics in the northwest, which gradually changes southwards to sedimentary rocks consisting of the older Biwabic banded iron formation and the younger Virginia formation (greywackes, shales and siltstones, with minor sulphide-rich black shales and slates and a sulphide-facies iron formation). Martineau (*op. cit.*) recognizes an early barren anorthosite and troctolite series (which now occupies the top two-thirds of the complex), which is transgressed and undercut by later intrusions. Six of the later intrusions (designated Thunder Bay, lower Nathan's series, Tuscorara, Kiwishiwi, Birch Lake, and Babbit) are enriched in iron and carbon, and possess a volatile-rich basal phase with unusual variable pegmatoidal textures. A further six barren intrusives are designated upper Nathan's series, Snow Lake, Dunka River, Allan, Moose Mountain, and an unnamed and undifferentiated gabbroic intrusion. These consist of troctolitic magmas that commonly cross-cut the mineralized intrusions and terminate them along strike and down dip. All the copper–nickel mineralization occurs at or near the base of the Complex, which has general dips of 15 to 20°, but 50 to 75° near the edge, within a 100 m sequence of ferrogabbros that is located within or below a chill zone and beneath a laminated gabbro-anorthosite sequence.

According to Martineau (*op. cit.*), the main mineralized bodies of the Duluth Complex contain known and inferred resources of 11 000 Mt of copper–nickel ores (Table 2.21). The mineralization is thickest and the sulphide content highest where the