Table 2.11

Final mill recoveries from Noril'sk-Talnakh

Area/mine	Ore, Mt	Millhead feed × 1000 Ni, t	Cu, t	Pt, kg	Pd, kg	Recovery × 1000 Ni, t	Cu, t	Pt, kg	Pd, kg
Mayak	79,0	901	2 726	110,6	397,4	700	2 150	85,5	325,6
Komsomolsky	144,0	1 382	2 333	233,3	820,8	1 040	1 700	183,5	686,3
Oktya'brsky	80,0	1 928	7 432	332,8	1 359,2	1 540	5 800	280,0	1 088,6
Taimyr	17,0	595	901	31,8	169,2	470	720	28,0	146,2
Mass.	74,0	3 196	7 667	269,4	1 247,4	2 570	6 180	230,2	1 088,6
Diss/Intr.	161,0	882	1 772	200,6	632,2	640	1 240	152,4	485,2
Diss/C. rock	85,0	727	3 953	238,5	867,0	540	2 950	194,4	642,9
Talnakh	320,0	4 805	13 392	708,5	2 746,6	3 750	10 370	577,0	2 216,7
Noril'sk	450,0	1 395	2 700	742,5	2 128,5	1 100	2 100	684,3	1 866,2
Grand totals	**770,0**	**6 200**	**16 092**	**1 451,0**	**4 845,1**	**4 850**	**12 470**	**1 261,3**	**4 082,9**

Percentage recoveries

Area/mine	Ni	Cu	Pt	Pd	Ore type*	Ni	Cu	Pt	Pd
Mayak	77,69	78,87	77,31	81,93	Mass.	80,41	80,61	85,45	87,27
Komsomolsky	75,25	72,87	78,65	79,96	Diss./Intr.	72,56	69,93	75,97	76,75
Oktya'brsky	79,88	78,04	84,13	80,09	Diss./C.	74,28	74,63	81,51	74,15
Taimyr	78,99	79,91	88,05	86,41	rock				
Talnakh	78,04	77,43	81,44	80,71					
Noril'sk	78,85	77,78	92,16	87,68					
Overall	78,23	77,49	86,93	84,27					

*Mass. Massive
Diss. Disseminated
Intr. Intrusive
C. rock Country rock

Isahanni, 1985; Isohanni *et al.*, 1985; Alapieti *et al.*, 1988. It was clear from the symposium and the excursion guidebooks that either the prospecting of the deposits had been only very limited, or that only restricted exploration data had been released by Outokumpu. Moreover, all the analytical results were presented in graphic form, and required scaling of grades and thicknesses, which led to inevitable inaccuracies. Nevertheless, Vermaak (1989) undertook a preliminary economic assessment of the deposits from the information gleaned at the symposium, the results of which are presented below. Of the seven intrusions considered, four contain sub-economic PGE ores (which includes the Kemi chromite mine). Some ores of the remaining three layered intrusions are also sub-economic, with an average grade of 0,77 g/t PGE (platinum 31,7 per cent, palladium 47,4 per cent, ruthenium 7,9 per cent, rhodium 7,3 per cent, iridium 3,4 per cent, and osmium 2,3 per cent), and low nickel and copper values.

1. The *Penikat intrusion* is 23 km long, has a width between 1,5 and 3,5 km and a thickness of 1900 m, and is subdivided into five peridotite–bronzite–gabbronorite–anorthosite megacyclic units containing 12 chromitite layers. The intrusion has been severely faulted into five westward-dipping (40° to 55°) blocks). Three types of mineralization exist.
   (a) The SJ (Sompujärvi) erratic mineralization occurs some 622 m above the base of the intrusion, with sulphide and chromite disseminations in a 1 m thick desilicified chlorite schist (possibly a fault zone). The mineralization is prone to 'wander' into the hangingwall ultrabasics (mega-unit IV) or the footwall pegmatoidal oikocrystic gabbro (mega-unit III), which could present mining problems. The strike of the SJ layer is 23 km, with a grade of 147,7 g/t PGE (nine samples). The dip is 50° W.
   (b) The AP (Ala-Penikaa) type is represented by two mineralized zones, designated API (0,35 m thick, 6,44 g/t PGE) and APII (0,35 m thick, 15,10 g/t PGE average). These zones are respectively 800 and 979 m above the basal contact of the intrusion. Both occur in mineralized anorthosites with a 19 km strike length, dipping 50° W.
   (c) The PV (Paasivaara) sulphides occur within a 1,5 m well-mineralized anorthosite near the top of a 36 m transition zone of rapidly changing lithology, between megacyclic units IV and V (1869 m above the base of the intrusion), grading 6,67 g/t PGE. The dip remains 50° W.
2. The *Suhhanko-Kontiijärvi* intrusions (15 and 0,3 km² in area) are two of seven dismembered blocks of the Portimo layered complex that have undergone amphibolite-grade metamorphism. Few original minerals of the lower ultrabasic and upper gabbroic rocks have been preserved. Massive and disseminated sulphide ores occur at the base of the intrusions or in the footwall rocks (Suhhanko 6 m thick, dip 30°, grade average 4,00 g/t PGE over 15 km of strike; Konttijärvi 30 m thick, dip 50°, grade average 4,85 g/t PGE, strike 900 m). Further RT (Rytikangas) mineralization occurs 170 m above the base of the Suhanko intrusion in a pegmatoidal anorthosite (0,4 m thick, dip 30°, average grade 9,13 g/t PGE, 10 km strike).
3. The *Naukas intrusions* in the northern part of the Portimo layered complex are also disrupted by faulting into six separate blocks that are named after landmarks within them. The 600 m thick Kilenjärvi block is the type area, and consists of a rapidly alternating peridotite–pyridotite–pyroxenite–gabbro–anorthosite sequence with the following ore types.
   (a) Zoned massive offset-type veins, lenses or tabular bodies or disseminated mineralization extend from the base of the intrusion into the footwall but also occur in the marginal rocks. The zoning consists of copper-rich upper portions containing massive sulphides (58,28 g/t PGE, 98% palladium) and a lower ore containing less copper and PGE. In the Kilenjärvi block, with a strike of 3150 m, an ore thickness of 43,25 m was measured in a borehole. In the present work, a 10 m thickness has been assumed over the whole 15 km strike length of the intrusion (dipping 50° N). Two samples of both the ores indicated an average grade of 4,89 g/t PGE.
   (b) Erratic SK (Siika-Kämä) mineralization occurs some 564 m above the base of four of the blocks of the intrusion, having suffered magmatic erosion in the other blocks. Copper-rich sulphides occur in a 5 m pyroxenite layer over a 15 km strike length dipping 50° N, with an average grade of 5,80 g/t PGE.

Because of the uncertainties involved in the information concerning the Finnish deposits, the data in Tables

Table 2.12

Measured and estimated average details of the Noril'sk-Talnakh deposits

Mine	Area km²	Ore thickness, m	PGE, g/t *In-situ*	PGE, g/t Millhead	Ore Mt*
Massive ore (density 4,5)					
Mayak	1,736	1,67	16,78	13,43	13,046
Komsmomolsky	3,250	0,96	20,80	16,64	14,040
Oktyabr'sk	3,209	0,90	46,37	37,10	30,036
Taimir	4,443	0,36	17,11	13,68	16,995
Glubokij	3,571	0,80	15,00	12,00	12,856
Skalisti	1,991	0,80	12,50	10,00	7,168
Severnij	0,823	0,80	12,50	10,00	2,963
Totals/av.	**19,023**	**0,89**	**25,89**	**20,71**	**97,104**
Disseminated ore (density 3,2)					
Mayak	8,635	2,47	7,55	6,08	66,040
Komsomolsky	11,511	3,53	10,99	8,79	130,028
Oktyabr'sk	3,291	15,98	11,09	8,87	199,987
Taimir	6,767	19,00	9,30	7,44	411,434
Glubokij	11,454	5,71	7,50	6,00	211,120
Skalisti	5,381	3,19	5,50	4,40	54,886
Severnij	5,781	3,19	5,50	4,40	58,966
Remainder	7,500	2,63	4,00	3,20	63,000
Totals/av.					
Talnakh	**60,320**	**11,18**	**8,73**	**6,98**	**1 195,461**
Noril'sk	**n.a.**	**n.a.**	**16,19**	**12,95**	**450,000**
Grand total	**–**	**–**	**10,77**	**8,61**	**1 645,461**

*To nearest 1000 t
n.a. Not available

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