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PODIFORM CHROMITE FROM THE RAS SHAIT AND WADI IGLA ULTRAMAFIC ROCKS, CENTRAL EASTERN DESERT, EGYPT.

BY

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ABSTRACT

The present paper deals with two occurrences of chromite deposits and their host serpentinites from the central Eastern Desert of Egypt. Field work, petrography and chemistry of the chromite deposits and their host have been carried out. The study proved that chromite ore in both areas is of aluminian chromite and that it has podiform type which pertains to the alpine-type. The chromite bearing serpentinites have been derived from alpine-type harzburgite.

INTRODUCTION

About seventeen occurrences of chromite deposits from the central and southern parts of the Eastern Desert of Egypt are known. These occurrences were studied by many authors [2,3,4,5,8,12,14,15,16,23].

Anwar et al. [5] studied chromite ores in different localities in the Eastern Desert of Egypt and concluded that they are aluminian chromite and that the serpentinite country rocks were derived from ultrabasic rocks approaching peridotite. Hanafy [14] studied some chromite deposits in the central Eastern Desert and found that their paragenesis and sequence of crystallization may be represented by three stages: magmatic, mobile and pneumatolytic hydrothermal stages. Takla and Noweir [25] concluded that the chromite ore of the Rubshi serpentinite is alpine-type. Fasfous and Awad [12] considered the concentration of chromite within the host ultramafic rocks is due to two successive processes, a- magmatic stage (during which the chromite separates) and b- a later phase of metamorphism under stress accompanied by redistribution of the chromite crystals and its concentration in lenses near the shear zone. Amstutz et al. [4] studied the podiform chromite in the Rubshi ophiolite association, west of Quseir and concluded that the chromite is typically alpine-type. Ali [1] studied the mineralogy and chemistry of the Ras Shait chromite and concluded that the ore was formed by early magmatic segregation of the ultramafic magma.

This paper deals with the field, petrography and chemistry of the chromite ore bodies present in the ultramafics of the Ras Shait and Wadi Igla (Fig. 1). The chromite bodies at Wadi Igla have been studied here for the first time, whereas the chromite lenses at Ras Shait were previously studied by few geologists [1,14]. For the purpose of this study, a number of polished and thin sections of chromite and its enclosing serpentinite were examined. Thirteen samples were chemically analysed for major and trace elements in the Dokuz Eylul University, Izmir, Turkey, six of which are from Ras Shait chromite and four are from Wadi Igla chromite. The remaining three represent the chromite bearing-serpentinites from the two areas.

THE SERPENTINITE ROCKS

The serpentinite mass at Wadi Igla (Latit. 25° 10' and Long. 34° 42') forms small irregular body (about 0.6 km^2) and consists chiefly of serpentinite rocks. These rocks have dark green to black colour with bright-green antigorite and brown carbonate patches. Microscopically, they show relict textures and original outlines of both olivine grains and orthopyroxene prisms indicating harzburgite parent rocks.

The serpentinite mass at Ras Shait (Latit. 24° 45' and Long. 34° 23') forms an irregular elongate outcrop, about 2 km long by about 700 m wide. The mass consists essentially of talc carbonates commonly speckled with olive green and dark green spots of serpentinite relics. The talc carbonates are fine to medium-grained and have pale brown buff to light cream colours. Microscopically, they consist of carbonate minerals associated with talc and opaque minerals and variable amounts of antigorite.

Major and some trace element analyses for three serpentinite rock samples are listed in Table 1. According to their distribution in the $CaO-Al_2O_3-MgO$ diagram (Fig. 2) and the AFM diagram(Fig. 3), the present serpentinites fall well within the field of metamorphic peridotite. In the Al_2O_3-CaO diagram (Fig. 4), the two analyses from Ras Shait serpentinite fall within the field of low-temperature alpine ultramafics.

Table 1: Major element analyses (wt.%) and some trace elements (in ppm) of the serpentinite rocks.

	Ras Shait Serpentinite		Wadi Igla Serpentinite
	311	323	504
SiO_2	25.36	27.04	43.20
Al_2O_3	0.52	0.37	0.44
Fe_2O_3	3.53	4.88	5.80
FeO	0.90	1.50	1.22
MgO	37.52	32.31	35.14
CaO	0.36	0.18	2.54
Na_2O	0.09	0.05	-
K_2O	0.007	0.005	0.002
TiO_2	0.03	0.03	0.03
L.O.I.	29.79	33.46	10.74
Total	98.107	99.825	99.112
Ba	-	1.8	10.4
Zn	-	-	1.7
Cu	15.1	4.9	14.7
Ni	2038.0	1400.0	1176.0
Cr	2127.0	1810.0	2863.0

THE CHROMITE ORES

Mode of Occurrence:

The chromite ores in the Ras Shait and Wadi Igla areas occur as small lensoidal bodies, disseminated grains and as accessory crystals in talc carbonate and serpentinite rocks. The chromite of Wadi Igla occurs at the foot of the serpentinite rocks, while that of Ras Shait occupies the upper parts of the country bearing. At Wadi Igla, the chromite is weakly to moderately fractured and enclosed in moderately sheared and poorly foliated serpentinites. In Ras Shait, the chromite is intensely fractured, brecciated and enclosed mainly in talc carbonate rocks. Fractures cutting through the lenses are commonly filled with quartz, talc, carbonates and serpentine minerals.

The chromite lenses are generally variable in sizes and shapes. They range between 25 cm to 2 m thick and 1 to 5 m long with a distance between them varying from 50 cm to 3 m. The lenses are generally aligned with their long axes parallel to the foliation of the host rocks. The contact between the chromite and country rocks is sharp. The disseminated chromite grains are abundant and are commonly subrounded, moderately to intensely fractured and have black to dark brown colour.

Microscopic Investigations :

The chromite ores in the two areas consist mainly of chromite together with subordinate amounts of magnetite, martite, goethite, chalcopyrite. The commonest gangue minerals are antigorite, chlorite, talc, calcite, magnesite and quartz. Most of these minerals seem to be the products of serpentinization process. In thin sections, the Ras Shait ore is rich in silicate gangue, whereas Wadi Igla ore is massive and contains subordinate amount of gangue.

Chromite forms more than 95% of the opaque minerals and occurs as subrounded to subangular elongated crystals up to 3 mm in diameter (Fig. 5). The recognition of the original grain boundaries is very difficult due to cataclasis and extensive replacement by serpentine. The spaces between the crystals and along fractures and cracks are occupied by serpentine, chlorite quartz and carbonate (Figs. 6&7). Chromite is rarely altered into ferritchromit which is observed as irregular zones around a dark grey homogeneous core of chromite or along cracks and fractures. The alteration of chromite into ferritchromit is attributed to either serpentinization process [9,21,22] or magmatic processes [20].

Delta J. Sci. 12 (2) 1988

The textures encountered in the present chromite are dissemination; massive; nodular; banded and brecciated textures. The disseminated texture is characterized by a fine grained single crystals evenly scattered in the host silicates. The massive texture is well represented in the Igla chromite and occurs as compact granular aggregates of coarse grained chromite (Fig. 8). The coarse size is apparently magmatic, not due to recrystallization products as stated by Greenbaum [13]. The nodular texture occurs in Wadi Igla chromite as a spherical, elliptical and subrounded crystals up to 3 mm in diameter (Fig. 9). The banded texture is recorded in Ras Shait chromite and is composed of an alternating chromite and serpentine bands (Fig. 10). The banding is usually parallel to the elongation of the ore body and may show small scale faulting and cataclasis. The brecciated texture is more frequent in Ras Shait chromite (Fig. 11) than in Wadi Igla (Fig. 12). The chromite grains at Ras Shait are highly cracked and fractured into minute small particles. The fractures are irregular and vary in dimensions and are frequently filled by quartz, talc, carbonate and serpentine.

Chemistry

- Major elements:

The results of the major element analyses from Ras Shait and Wadi Igla chromite together with the various elemental ratios and cations per unit cell, computed on the basis of 32 oxygen, are all listed in Table 2.

The major element chemistry of the Ras Shait chromite varies as follows: SiO_2(1.68-6.90%); Cr_2O_3 (40.31-47.30%); Al_2O_3(11.81-17.57%); Fe_2O_3 (4.16-6.44%); FeO(14.58-16.90%); MgO (12.30-17.82%); Cr/Fe_t (1.67-2.27) and Cr/Al (1.59-2.82). For Wadi Igla chromite the major element chemistry varies as follows: SiO_2 (2.09-4.73%); Cr_2O_3(45.61-49.44%); Al_2O_3 (11.76-14.54%); Fe_2O_3(2.96-7.06%); FeO (12.84-16.68%); MgO (13.28-17.02%); Cr/Fe_t(1.87-2.27) and Cr/Al (2.21-2,67). These values indicate that the Igla chromite contains relatively higher Cr_2O_3 and Fe_2O_3, whereas the chromite of Ras Shait has high SiO_2 and Al_2O_3. The two ores are relatively similar in FeO, MgO, Cr/Fe_t and Cr/Al. According to Thayer [28] and based on the present chromium content, the chemical composition of the present ores are low grade.

The different elemental ratios for both Ras Shait and Wadi Igla chromite are shown in Table 2. Both ores have the same range in the $Mg/Mg+Fe^{+2}$ ratio, but their Cr/Cr+Al

Delta J. Sci. 12 (2)1988

Table 2: Major element analyses (wt.%), elemental ratios and cation per unit cell computed on the basis of 32 oxygen for chromite from Ras Shait and Igla chromite ores.

	Ras Shait chromite						Wadi Igla chromite			
	306	309	310	315	316	317	500	501	502	503
SiO_2	2.36	5.29	2.24	6.90	5.55	1.68	2.09	4.73	3.89	2.19
Al_2O_3	17.57	12.17	11.81	15.26	14.18	13.85	14.54	11.76	13.66	11.84
FeO	16.90	15.84	16.59	16.14	14.96	14.58	16.56	16.68	15.66	12.84
Fe_2O_3	4.82	6.17	5.10	4.33	6.44	4.16	5.93	3.27	2.96	7.06
Cr_2O_3	40.31	45.42	46.87	44.22	42.94	47.30	46.58	48.21	45.61	49.44
MgO	15.91	13.93	16.24	12.30	14.89	17.82	13.28	14.12	17.02	16.16
CaO	1.88	0.91	0.95	0.65	0.34	0.16	0.78	0.52	0.81	0.22
TiO_2	0.05	0.05	0.04	0.05	0.08	0.07	0.05	0.04	0.04	0.02
Na_2O	0.07	0.09	0.08	0.06	0.09	0.05	0.03	0.05	0.03	0.02
K_2O	0.01	0.01	0.01	0.01	0.02	0.08	0.06	0.03	0.05	0.08
Total	99.88	99.88	0.93	99.92	99.56	99.75	99.90	99.41	99.73	99.87
Fe_t	16.51	16.64	16.47	15.58	16.14	14.25	17.03	15.26	14.25	14.92
Elemental ratios										
Cr/Fe_t	1.67	1.87	1.95	1.94	1.82	2.27	1.87	2.16	2.19	2.27
Cr_2O_3/Al_2O_3	2.29	3.73	3.97	2.90	3.03	3.41	3.20	4.10	3.34	4.17
Cr/Al	1.59	2.50	2.82	1.93	2.00	2.22	2.21	2.67	2.31	2.66
MgO/FeO	0.94	0.88	0.98	0.76	0.99	1.22	0.80	0.85	1.09	1.26
$Mg/Mg+Fe^{+2}$	0.63	0.61	0.64	0.58	0.64	0.69	0.59	0.60	0.67	0.69
$Fe^{+2}/Fe^{+2}+Mg$	0.36	0.39	0.36	0.41	0.36	0.31	0.41	0.43	0.33	0.31
$Fe^{+3}/Fe^{+3}+Al+Cr$	.06	0.09	0.07	0.06	0.09	0.06	0.08	0.04	0.02	0.08
Cr/Cr+Al	0.61	0.71	0.74	0.66	0.67	0.69	0.69	0.73	0.70	0.73
Cation per unit cell										
Si	0.59	1.34	0.61	1.62	1.34	0.45	0.46	1.20	0.90	0.61
Al	5.05	3.57	3.36	4.42	4.16	4.17	4.26	3.60	3.92	3.65
Fe^{+2}	3.42	3.27	3.52	3.24	3.12	2.98	3.50	3.45	3.16	2.74
Fe^{+3}	0.89	1.19	0.92	0.88	1.19	0.89	1.22	0.60	0.30	1.22
Cr	8.02	8.92	9.48	8.54	8.32	9.24	9.43	9.60	9.04	9.73
Mg	5.94	5.20	6.27	4.56	5.50	6.56	5.02	5.25	6.33	6.08
Ca	0.45	0.30	0.30	0.15	0.15	0.04	0.15	0.15	0.15	0.06
Ti	0.01	0.01	0.01	0.01	0.01	0.01	0.03	0.03	0.01	0.003
Na	0.03	0.03	0.03	0.03	0.03	0.03	0.01	0.01	0.01	0.009
K	0.003	0.003	0.003	0.003	0.006	0.03	0.01	0.004	0.03	0.03

ratio are significantly different, with much higher values being found in the Igla chromite than in Ras Shait. The Ras Shait chromite generally has higher Fe^{+3} / Fe^{+3}+Al+Cr ratio than chromite from the Igla ore.

Composition of the chromite in the two areas can be shown graphically on the spinel triangular prism (Fig. 13) constructed by Stevens [24]. From this figure, it is clear that all samples fall well within the aluminian chromite field.

The relationship between Cr / Cr + Al vs Mg / Mg + Fe^{+2} in the analysed samples are shown in Fig. 14, where the samples fall in the overlapped area between alpine-type and stratiform chromite. Irvine [17] used the elemental ratio Fe^{+3} / Cr+Al+Fe^{+3} vs Mg / Mg+Fe^{+2} to discriminate between chromite formed in alpine-type ophiolite complexes or stratiform intrusions. The behaviour of the chromite in the two areas on Irvine's diagram (Fig. 15) shows that all samples in the alpine-type.

Table 3 gives the weight percentage and formula percentage cf the four end members for the chemical analysis of the Ras Shait and Wadi Igla chromite as suggested by Stevens [24].

Delta J. Sci. 12 (2) 1988
I.S. Salem and A.M. Abu El-Ela

Table 3: Weight percentage of the end members of Ras Shait and Wadi Igla chromites

Normative minerals \ Sample No.	Ras Shait chromite						Wadi Igla chromite			
	306	309	310	315	316	317	500	501	502	503
Magnesichromite	48.99	50.07	66.71	33.96	50.00	62.74	38.79	50.00	65.91	58.44
Ferrochromite	8.45	15.23	2.18	27.74	10.82	1.96	24.43	19.56	2.26	8.23
Spinel	36.10	26.06	24.42	31.26	30.41	29.13	28.59	26.09	29.56	24.96
Magnetite	6.45	8.84	6.69	6.36	8.77	6.16	8.19	4.34	2.26	8.37

From the table it is noticed that the magnesichromite contents are higher than ferrochromite in all the analyses and the magnesichromite generally increases with the decrease of ferrochromite. This would indicate that Mg replaces Fe^{+2}. The composition of the Ras Shait and Igla chromites are thus mainly magnesichromite with subordinate spinel and minor ferrochromite and magnetite.

- Trace elements:

Nine samples from Ras Shait and Wadi Igla chromite were chemically analysed for the trace elements, Ba, Zn, Cu and Ni using the X-ray fluorescence. The results are given in Table 4.

Table 4: Distribution of some trace elements (in ppm) in Ras Shait and Wadi Igla chromites.

Sample No. / Trace elements	Ras Shait chromite					Wadi Igla chromite			
	306	309	310	316	317	500	501	502	503
Ba	3.5	2.0	5.0	46.0	15.0	3.5	3.0	5.0	2.5
Zn	12.0	18.0	19.0	4.5	5.5	14.5	8.0	7.5	6.5
Cu	-	0.15	3.5	-	-	-	-	-	-
Ni	822	676	484	717	636	322	259	428	275

The Ba-values in Ras Shait chromite vary from 2 to 46 ppm with an average of 14.3 ppm. In Wadi Igla Ba is low and varies from 2.5 to 5 ppm (average 3.5 ppm). The geochemistry of Ba(1.43 A°) in igneous rocks is characterized by its close relation to K(1.33 A°). The presence of Ba points to its close connection to the gangue minerals.

The Zn in Ras Shait chromite has higher values (4.5 to 19 ppm) than in the Igla (7.5 to 14 ppm). The amount of Zn is probably partly present in spinel structure as suggested by Thayer [26].

Delta J. Sci. 12 (2) 1988
I.S. Salem and A.M. Abu El-Ela

Ni contents in Ras Shait chromite range between 484 and 822 ppm and averaged about 667 ppm. In the Igla chromite the Ni is considerably lower, and varies from 259 to 428 ppm with an average of 321 ppm. Ni may replaces Fe^{+2} in the tetrahedral structure of the chromite spinel and magnetite. It also replaces Mg^{+2} in the silicate gangue.

Cu has not been detected in all the chromite samples of both ores except in two samples from Ras Shait chromite. The presence of sparce copper reflects the presence of rare sulphide minerals (chalcopyrite). This was confirmed using the ore-microscopic study.

The differences in Ba,Zn,Cu and Ni contents in the two investigated ores suggest slight differences in the composition of the original local magmas.

DISCUSSION AND CONCLUSIONS

Based on petrographic and chemical characteristics of the chromite ores and the enclosing serpentinites we can conclude that:

1. The various chromite textures found in the two investigated areas include disseminated, massive and nodular textures, These textures are often considered as originating in the initial magma chambers by fractional crystallization [13,27].Banded and brecciated textures, in the present

study has been explained by shearing as suggested by Thayer [27] and Greenbaum [13].

2. The composition of the present chromite ores is aluminian chromite. When the analyses are expressed in terms of end-members, the composition is mainly magnesichromite with subordinate spinel and minor ferrochromite and magnetite.

3. The petrography and chemical characteristics of the chromite bearing-serpentinite rocks reveal that they were derived from alpine-type harzburgite.

4. The chromite analyses of the two investigated areas have high content of magnesium oxide. The higher Mg-values of the chromite ores indicate higher oxygen fugacity and temperature conditions during their formation [6, 29].

5. The chromite chemistry performed in the present study points to a strong similarity of these chromites with other podiform deposits of the world which pertain to alpine-type. The following chemical parameters used to establish this resemblance are based on the studies given by Thayer [26,27,28], Irvine [17], Dickey [11] and Malpas and Strong [19]. These parameters include: a) MgO / FeO ratios tend to be greater in podiform chromite (1 to 2.3) than in layered chromites (0.6 to 1); b) Fe_2O_3

tend to be lower (<8 wt. %) and Cr/Fe_t ratios higher (~1.5 to 4.5) in podiform chromite than in layers chromite (~10 to 24 wt.% Fe_2O_3 and 0.75 to 1.75 Cr/Fe_t ratios, respectively); c) Al_2O_3/Cr_2O_3 ratios tend to be higher in podiform chromite and d) low TiO_2 content in most analyses below 0.3 percent.

REFERENCES

1- Ali, F.I., 1986: Geology, mineralogy of the chromite deposits at Gebel Ras Shait, southern Eastern Desert, A. R.E.M.Sc. Thesis, Alexandria Univ. 247p.

2- Amin, M.S., 1948: Origin and alteration of chromite from Egypt. Econ. Geol. 43, 133-153.

3- Amin, M.S., 1955: Geological features of some mineral deposits in Egypt. Bull. Desert Inst. Egypt. 5(1); 209-240.

4- Amstutz, G.C., El-Gaby, S., Ahmed, A.A., Habib, M.E. and Khudeir, A.A.,1984: Podiform chromites in the Rubshi ophiolite association, west of Quseir, Egypt. Bull. Fac. Sci. Assuit Univ, 13, 75-94.

5- Anwar, Y., Kotb, H. and Zohny, N., 1969: Geochemistry of Egyptian chromites. Bull. Fac. Sci. Alexandria Univ., 9, 143-183.

6- Arculus, R.J. and Delano, J.W., 1981: Intrinsic oxygen fugacity measurements: Techniques and results for spinels from upper mantle peridotite and megacryst assemblage. Geochim. et Cosmochim.

Acta, 45, 899-913.

7- Ammento, F. and Laubat, H., 1971: The Mid-Atlantic ridge near 45°N. XVI. Serpentinized ultramafic intrusions. Con. Jour. Earth Sci., 8, 831-663.

8- Basta, E.Z. and Hanafy, M.H., 1971: Alteration of some Egyptian chromites. Proc. Egypt. Acad.Sci. Cairo, 22, 1-8.

9- Beeson, M.H. and Jackson, E.D., 1969: Chemical composition of altered chromites from Stillwater complex, Montana, Am. Mineral. 54, 1084-1100.

10- Coleman, R.G., 1977: Ophiolites. Springer-Verlag. New York, 229p.

11- Dickey, J.J., 1975: A hypothesis of origin for podiform chromite deposits. Geoch. Cosmoch. Acta, 39, 1061-1074.

12- Fasfous, B.R.B. and Awad, N.T., 1983: Petrographical and ore-microscopical studies on some chromite occurrences, Eastern Desert Egypt, Chem. Erde, 42, 57-62.

13- Greenbaum, D., 1977: The chromitiferous rocks of the Troodos ophiolite complex, Cyprus. Econ. Geol. 72, 1175-1194.

14- Hanafy, M.H., 1970: Mineralogy and origin of some chromite deposits, Eastern Desert, Egypt.M.Sc. Thesis, Cairo Univ.

15- Hussein, M.K., Kolta, G.A., and Abdel Aal, O., 1069:

Analysis and investigation of chromite ores from Baramiya Eastern Desert. J. Geol. U.A.R. 1, 17-24.

16- Ibrahim, M.M., 1950: The chromite deposits of Egypt. Trans. Mining Petrol. Assoc. Egypt,5, 49-62.

17- Irvine, I.N. 1967: Chromian spinel as a petrogenetic indicator. Part 2. Petrologic applications, Can, J. Earth Sci., 4,71-103.

18- Irvine, T.N. and Findly, T.G. 1972: Alpine-type peridotite with particular reference to the Bay of Islands igneous complex. Publ. Earth Phys. Br. Dept. Ener. Min. Resour. 42, 97-140.

19- Malpas, J. and Strong, D.F., 1975: A comparison of chrome spinel in ophiolites and mantle diapirs of New-foundland. Geo. Chim. Cosmochim Acta, 39, 1045-1060.

20- Panagos, A and Ottemann, J., 1966: Chemical differentia-tion of chromite grains in the nodular-chromite from Rodiani-Greece. Miner. Dep. 1, 72-75.

21- Peters, T. and Kramers, J.D., 1974: Chromite deposits in the ophiolite complex of northern Oman. Miner. Dept. 9, 253-259.

22- Ramdohr, P., 1969: The ore mineral and their intergrowths. Pergamon Press. 1174p.

23- Shukri, N.M. and Lotfi, M., 1958: The geology of the Bir Barramiya area. Bull. Fac. Sci. Cairo 34, 83-130.

24- Stevens, R.E., 1944: Composition of some chromites of the western hemisphere. Am. Mineral. 29, 1-34.

25- Takla, M.A. and Noweir, A.M., 1980: Mineralogy and mineral chemistry of the ultramafic mass of El-Rubshi, Eastern Desert, Egypt. Jb. Miner. Abh. 140, 17-28.

26- Thayer, T.P., 1964: Principal features and origin of podiform chromite deposits and some observations on the Guleman-Soridag district, Turkey. Econ. Geol. 59, 1497-1524.

27- Thayer, T.P., 1969: Gravity differentiation and magmatic re-emplacement of podiform chromite deposits. In: H.D.B. Wilson (ed.), Magmatic ore deposits, Econ. Geol. Monogr. 4,132-146.

28- Thayer, T.P. 1970: Chromite segregations as petrogenetic indicators, Geol. Soci. South Africa, Sp. Publ. 1, 380-390.

29- Ulmer, G.C., 1969: Experimental investigation of chromite spinels. Econ. Geol. Mon. 4, 114-131.

Delta J. Sci. 12 (2) 1988
I.S.Salem and A.M. Abu El-Ela

FIGURE CAPTIONS

Fig. 1: Index map showing the location of the two investigated areas.

Fig. 2: $CaO-Al_2O_3-MgO$ triangular digram. The compositional fields are after Coleman (1977).

Fig. 3: AFM digram includes the serpentinite plots and the compositional fields of Coleman (1977).

Fig. 4: Al_2O_3-CaO diagram showing the distribution fields for the various types of ultramafics. Modified after Aumento and Laubat (1971).

Fig. 5: Triangular, elongated and anhedral crystals of chromite. Chromite grains (light) are corroded and rimmed by gangue minerals. Reflected light, X 40.

Fig. 6: Rounded to subrounded edges of chromite (black) due to corresion by serpentine, chlorite and carbonates (light grey). Crossed polarizers, X 35.

Fig. 7: Fractures and cracks within the chromite grains (black) filled with chlorite and quartz. Crossed polarizers, X 35.

Fig. 8: Massive texture at Wadi Igla chromite consisting of coarse crystals of subrounded chromite grains. Reflected light, X 40.

Fig. 9: Elongated chromite crystals surrounded by a matrix of serpentine minerals, forming the nodular texture. Reflected light, X 40.

Fig. 10: Banded texture of almost parallel bands of chromite alternating gangue minerals. Reflected light, X 40.

Fig.11: Intense fracturing and brecciation of chromite crystals at Ras Shait chromite. Reflected light, X 40.

Fig.12: Mild fracturing of chromite crystals at Wadi Igla. Reflected light, X 40.

Fig.13: Distribution of Ras Shait (closed circles) and Wadi Igla chromites (open circles) in the Cr_{16}-Al_{16}-Fe_{16} triangular classification (after Stevens, 1944).

Fig.14: Variation of Cr/Cr+Al and Mg/Mg_Fe^{+2} in chromite samples from Ras Shait and Wadi Igla chromite. Fields according to Irvine and Findly, 1972. Soild line represents field of alpine-type whereas dashed line is for field of straiform intrusions.

Fig.15: Fe^{+3} / $Cr+Al+Fe^{+3}$ - $Mg/Mg+Fe^{+2}$ diagram showing the composition of chromites of both areas (after Irvine, 1967). Solid curve: field of alpine-type, dashed curve: field of stratiform intrusions.

Delta J. Sci. 12 (2)1988

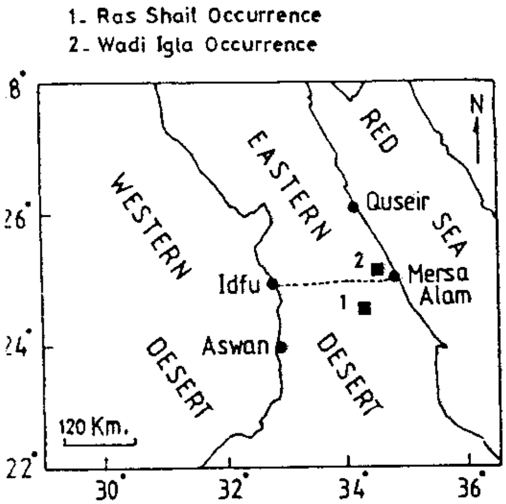

Fig. 1

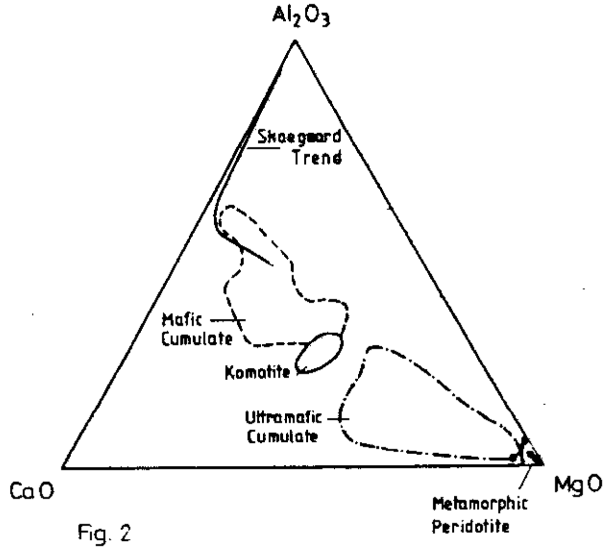

Fig. 2

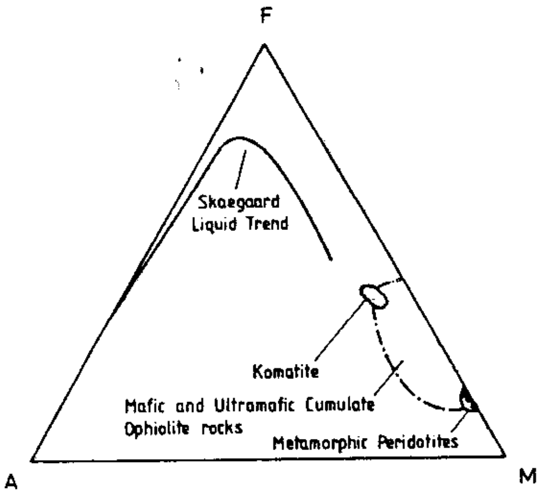

Fig. 3

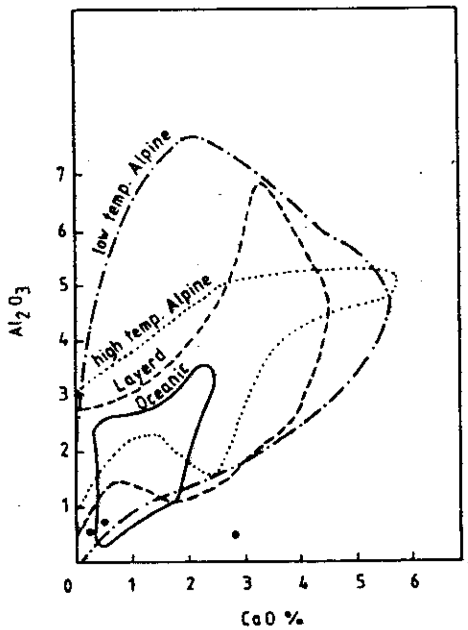

Fig. 4

Delta J. Sci. 12 (2)1988

Fig. 5

Fig 6

Fig 7

Fig 8

Delta J. Sci. 12 (2)1988

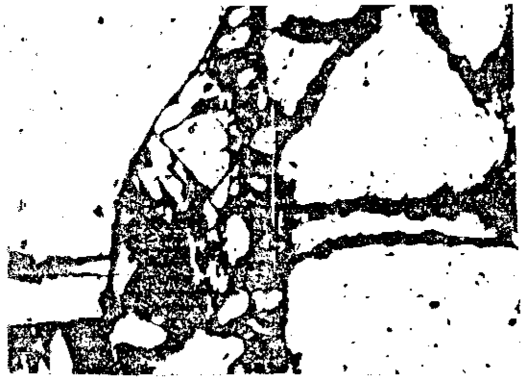

Fig. 9

Fig. 10

Fig. 11

Fig. 12

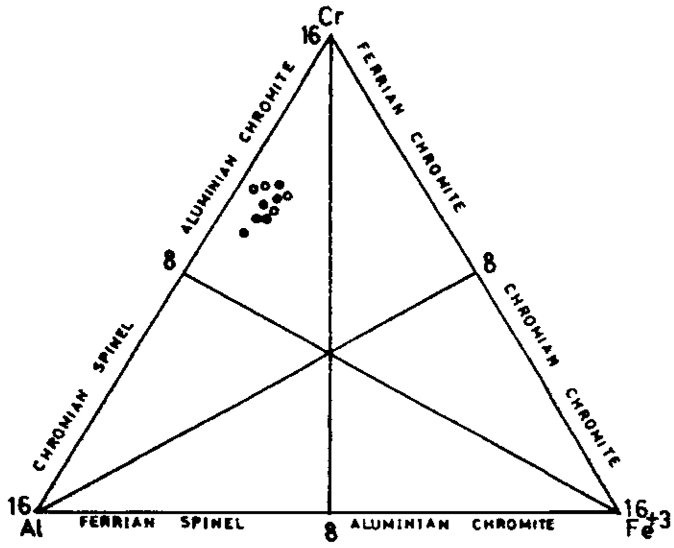

Fig. 13

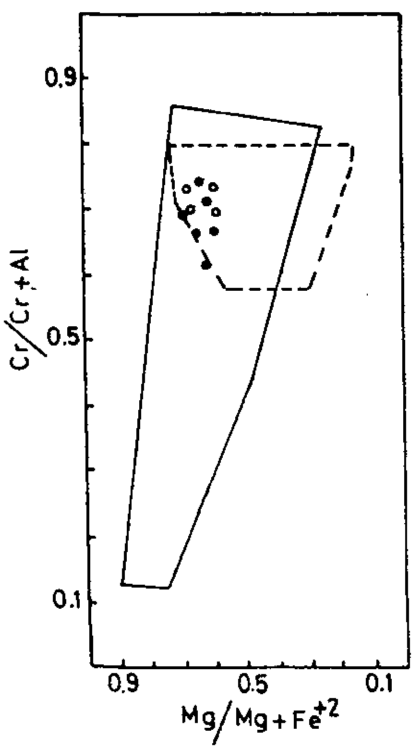

Fig. 14

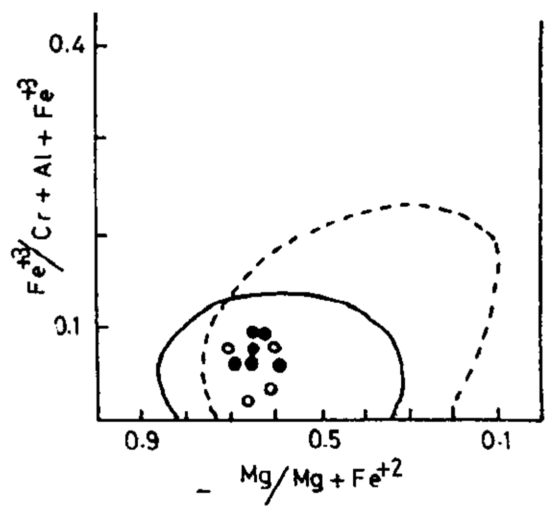

Fig. 15

الكروميت الالبى الموجود فى الصخور الفوق مافية بمنطقتى رأس شعيت ووادى عجلة بوسط الصحراء الشرقية،مصر

ابراهيم عبد الناجى سالم و عبد السلام محمد رشاد أبو العلا

يشتمل البحث على دراسة حقلية وبتروجرافية وكيميائية لرواسب الكروميت وصخور السربنتين العادية لها فى منطقتى راس شعيت ووادى عجلة بالجزء الاوسط فى الصحراء الشرقية لمصر.

وقد أثبتت الدراسات البتروجرافية والجيوكيميائية لصخور السربنتين العادية لرواسب الكروميت الى انها قد تكونت فى الاساس من صخور الهارزبرجيت والتى تنتمى الى النوع الالبى.

كما أوضحت الدراسات الحقلية والبتروجرافية والجيوكيميائيه أن رواسب الكروميت تنتمى الى النموذج الالبى وليس الى النموذج التراكمى الطبقى.