INTERGROWTH TWINS OF MAGNETITE IN ORES OF KURZHUNKUL DEPOSIT, KAZAKHSTAN

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Rare intergrowth twin crystals of magnetite from Kurzhunkul deposit were described along with composition of magnetite and chlorite in zoned botryoidal aggregate.
1 table, 1 figure, 3 references.
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Magnetite twin crystals on {111} usually occur as a flattened contact twins. Intergrowth twins are rarely found in natural magnetite (Minerals, 1967). The find of a druse of magnetite interpenetration twins in the open pit of Kurzhunkul deposit can be considered as a unique discovery.

Kurzhunkul deposit is located 120 km South-Southwest from Kustonay in the limits of Tyumen'-Kustonay paleo rift valley in Valerianovsky iron ore belt (Ovchinnikov, 1998). Iron ore forms stockworks composed of complex veins and veinlets hosted in Visean volcanics and limestone. Ores have variable structures including brecciated. Breccia cement is formed by fine grained botryoidal magnetite (Dymkin, Permyakov, 1984).

The found hand specimens have reniform chlorite-magnetite aggregate with terminations of medium-coarse grained magnetite and chlorite crystal druses on the top of fine pyrite-magnetite aggregates. Some parts of the druse were formed with magnetite crystals with well developed faces of rhomb dodecahedron {110} and small ones of octahedron {111}. Another parts of the druse were composed of twin magnetite crystals (see the figure). Chlorite forms tabular crystals and thick plates and has compromise surfaces with magnetite. Later spherulitic chlorite grew on the top of some magnetite crystals.

Reniform aggregate has zoning noticeable in section and stressed with sporadic chlorite inclusions. Composition of magnetite from different zones is shown in the table. Some admixture of Al, Si and Mg appear in magnetite due to fine chlorite inclusions as well as from its own composition. Calculated formulae of magnetite from consequent zones show that the composition of magnetite in latter zones in reniform aggregate had been cleared from the impurities.

Chlorite of high aluminous chlynochlore composition grew together with magnetite in early zones. It has a trygonal habit, higher magnesium and low Cr and Ni content. Pyrite from the association has up to 0.1% of Ni. Late chlorite has even higher aluminum content and its composition corresponds to high iron sudoite.

It is hard to prove that the change in magnetite composition caused appearance of intergrowth twin crystals. Nevertheless, up to 5 and more mol.% of magnesiofferrite content in magnetite could possibly influence growth mechanisms of the crystals.

Magnetite intergrowth twins were found in similar mineralogical environment on Teyskoye and Korshunovskoye iron deposits (Dymkin, Permyakov, 1984). Their occurrence was explained as a result of initially skeletal crys-

Table 1. **Composition of magnetite and chlorite from the reniform aggregate**

Components, wt.%	1	2	3	4
FeO	93.18	94.50	4.07	9.30
MnO	–	0.16	0.39	0.08
MgO	0.82	0.25	29.18	22.93
TiO_2	0.25	0.74	0.95	–
SiO_2	0.44	–	23.81	22.36
Al_2O_3	0.29	0.42	32.18	32.89
Total	94.98	95.97	90.58	87.56

Calculated formulae

Grain 1 – $(Fe_{0.95}Mg_{0.05})_{1.00}(Fe_{1.98}Al_{0.01}Ti_{0.01})_{2.00}O_4$;

Grain 2 – $(Fe_{0.98}Mg_{0.02}Mn_{0.01})_{1.01}(Fe_{1.93}Al_{0.02}Ti_{0.03}Cr_{0.01})_{1.99}O_4$;

Grain 3 – $(Mg_{3.95}Al_{0.68}Fe_{0.31}Mn_{0.03}Cr_{0.02})_{4.99}Al(Si_{2.17}Al_{1.77}Ti_{0.06})_{4.00}O_{10}(OH)_8$;

Grain 4 – $(Mg_{3.31}Al_{0.93}Fe_{0.75}Mn_{0.01})_{5.00}Al(Si_{2.17}Al_{1.83})_{4.00}O_{10}(OH)_8$

Note: 1, 2 – magnetite from early to latter zones of the aggregate, 3 – aluminous clinochlore from early zone, 4 – sudoite of late zone. JXA-733 microprobe, operator E.I. Churin (grains 1, 2, 3) and REMMA-202M microprobe, operator V.A. Kotlyarov. Grains 2 and 3 have also 0.11 and 0.24 wt.% of Cr_2O_3 correspondingly. Dash – component was not detected.

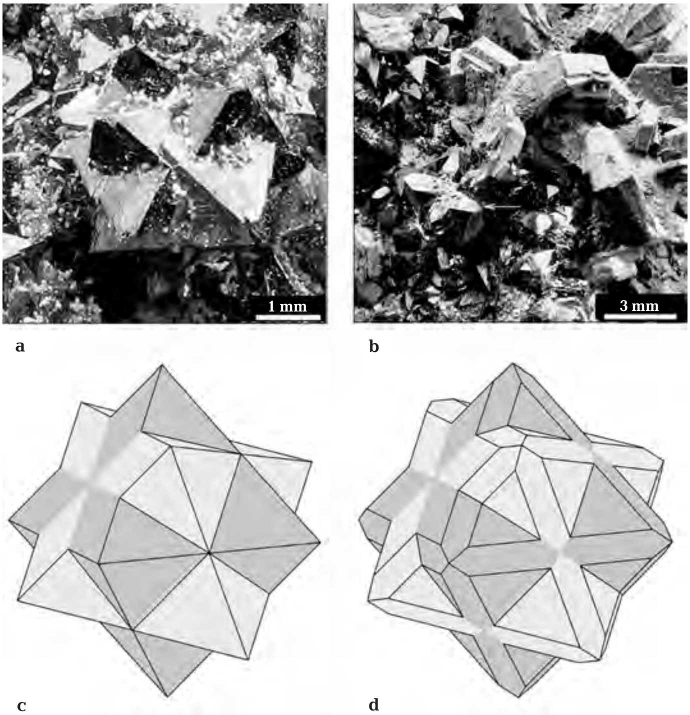

Fig. 1. Magnetite twin crystals from Kurzhunkul deposit: a — octahedral crystals, b — combination of rhomb dodecahedron and octahedron shapes (shown with arrow), c, d — idealized shape of twin crystals.

tal growth. There were no signs of initial skeletal growth observed in the samples we studied. We found only multiple changes of dominate crystal shape from octahedron to rhomb dodecahedron. The nature of preferential formation of intergrowth or contact twin crystals is not clear.

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