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Original article

Magnetometry of enderbites in Gaisin block of Ukrainian shield

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The actual problems of detail studying and cartography of Ukrainian PreCambrian Shield were used. The aim of work was to werify possibility of check whether enderbity create high value of the magnetic field and how they can be visualized on the map. The magnetic susceptibility and thermomagnetic analysis of enderbytes were investigated. It is shown that enderbytes do not produce the great amounts of MagneticField, but they have a highest induction of magnetic field against the background of others weak-magnetic rose granites.

1. Introduction

In the structure of Ukrainian Shield the granites, basalts and other are distributed. Amoung granites, an enderbites are the one of more ancient. They were practically not investigated during State Geological Testing in 1960-1980 years (Katyuk et al., 1992) in order to lack of detected exposures. Now, an actual problem of re-carting of Ukrainian Shield is declared. In order to this, the more detailed investigation of enderbites limited area become actual. Ultimately, the basic question IS how enderbites are situed in Gaisin`s Block of Ukr. Shield (among rivers Dnestr and Boug). It is known (Lysek et al., 2006) that rocks in Gaisin`s Block were cardinally changed and enderbites rest the last more ancient rocks in this region. Therefore, studying of enderbites is important for investigation of geology of Precambrian rocks - that are result of appearance and first formation of Earth crust.

The rocks in the Ukr.Shield are mixed in a difficult correlation of each other. Is very difficult to set on map the boundaries of various rocks, because they very rarely come to the surface and are almost invisible. Almost all Ukr.Shield is hidden and covered by layers of chalk, clay, sandstone.

The geologists-cartographs detected the boards of various rocks thorough detection of MagneticField Induction. It is well known that magnetic field produced two basic minerals – magnetite and pyrotine. For example in chalk and clay sediments of magnetite and pyrotine is very little, therefore their rocks do not produced the own magnetic field. But the rocks of Ukrainian Shield can have a lot of magnetite/pyrotine. The boards of their expand area can measure by identical parameters of magnetic field of selected samples. At today, enderbytes of Gaisin Block are charting by Katuk I. et al. (1992).

In Gaisin Block, the areas of unchanged enderbytes are present conserved. Enderbyte consists practically from all granite-forming minerals. There are a quartz, hyperstene, biotite and feldspar. The difference is in content of feldspar – in enderbyte he not consist kaly K. This is why enderbyte have a black/green colour, whenever granites are gray-pink. Enderbyte has unikum makrostructures. In thus work, the enderbytes exposure on board of river Gorodishe (to nord of willage Sytkivci, Vinniza region Ukraine) is investigated (fig.1).

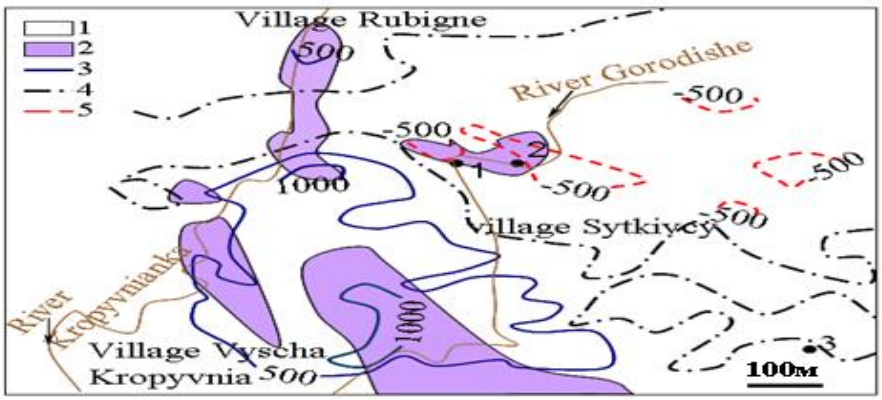

Fig. 1. Fragment of geological map and anomalous magnetic field T map of area among villages Vysha Kropyvnia, Rubigne and Sytkivcy according (Katyuk et al., 1992): 1 – rose granites, 2 – enderbytes, 3,4,5 – isolines of high and low T in nanoteslas nTl. The numerated points shows a sites of sampling.

Fig.1 shows that enderbytes are sited as in area of high anomalous magnetic field T (up to 1500 nTl) as of low T (-500 nTl). Thus, according (Katyuk et al., 1992), the source of negative and positive anomalies of magnetic field are same enerbytes. Therefore is actual to study the magnetic properties of enderbytes to determine the nature of such ambiguity reflected in the magnetic field.

2. Materials and methods

In this work the new complexing detalisated magnitometric method is using by enderbytes investigation. It is method of magnetic scanning (MMS) which let use a new possibilities of mapping for high-differenciated sectors of precamdrian basement. Magnetic Scanning – it is a complex petro-magnetic method of detail investigation of rocks exposures as we described earlier (Reshetnyk, 2012). In this method, laboratoric and "in field" magnetometric investigations are carried out in direct interrelation with each other. At the first stage autors analyzed and correlations "magnetic field - geological structure" appears (fig.1).

At the second stage, magnetometric investigations "in field" are carried out. The detailed measuring of magnetic susceptibility MS were executed by capameter RN-5 (Czech production). The modern counterparts of KT-5 is KT-9 (http://users.monash.edu.au/~rjarmit/Mag_sus_meter_instructions/KappaMeter_KT9/KT9_manual.pdf). The templates of rose granites and enderbytes were selected. The magnetic susceptibility of their templates were measured on astatic laboratory magnetometer LAM-24 (Czech production) (https://sites.google.com/a/g.unibuc.ro/paleomag/home/old-paleomagnetic-laboratory). The principle of the sensor is a magnetic field of pattern shifts magnets of astatic system from the equilibrium. It is need to measure in 12 direction and how much deviated astatic system. These measurements allow to calculate the value of the natural remanent magnetization of the sample, its magnetic susceptibility and orientation of remanent magnetization vector.

The magnetic minerals in rocks are definite by thermomagnetic analysis. It consists in consequent measuring of MS of heated template. The laboratoric magnetometer KLY-2 fixes a change MS of sample which heated in an oven. The modern counterparts of KLY-2 is MFK1 Kappabridges of compani AGICO (http://agico.com). The density of sample was measured by method of hydrostatic gravimetry. The dynamic of change of magnetic minerals was investigated by rock microscopy.

3. Results and discussion

In rocks Gorodishe near village Sytkivci the enderbites are exposed (fig.1). In order to this, for T are characteristic changes in interval -650 – +100 nTl. The data for MS are very differentiated. The change of petrographic differences of granitoids (enderbites and granites) on area with diameter 10-30 m, and essential change of MS were fixed. For enderbites the high dispersion of MS on surface of carrier wall is characteristic (fig.2).

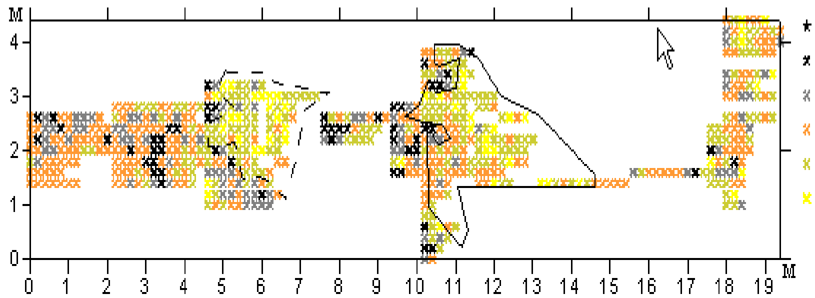

Fig. 2. Fragment of a map of allocation MS on enerbites exposition near v.Sytkivci. Black cross – MS>30 $\cdot 10^{-3}$ units SI.

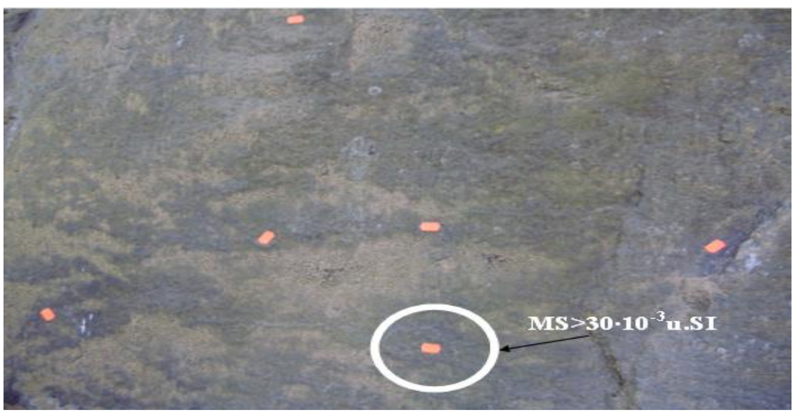

Fig. 3. Fragment of wall of enderbite-s carrier with markers of sites with high MS. The blue ring show a surface of measurement (working area of KT-5).

Fig.3 show a chaotic distribution of high X in enderbytes. The correspondence among MS of template and MS of near environment is not regular. This can be explained by not- homogenous distribution of magnetite that have a several agglomerates in rock. The results of laboratory investigations are shown in tab.1.

Table 1
Magnetic properties of enderbites.

No	No of template	MS$\cdot 10^{-3}$,unit SI	In,A/m	Q	J,°	D,°	?,g/cm^3
1	**2**	**3**	**4**	**5**	**6**	**7**	**8**
1	11.06.3.5	0,2	3,20	0,4	14	132	2,88
2	07.09.23.29	70,4	1,28	0,5	32	51	2,87
3	07.09.08.15	73,8	1,41	0,6	47	224	2,73
4	11.06.3.6	0,1	2,07	0,6	17	55	2,88
5	07.09.08.03	52,8	1,43	0,8	47	22	2,72
6	11.06.4.1	0,1	2,24	0,8	69	354	2,71
7	07.09.08.07	34,4	1,09	0,9	20	35	2,74

8	07.09.08.04	28,0	0,89	0,9	15	68	2,64
9	07.09.08.12	22,6	0,72	0,9	30	62	2,68
10	07.09.08.13	14,7	0,56	1,1	58	352	2,71
11	07.09.08.14	47,3	1,79	1,1	36	292	2,70
12	07.09.23.26	10,5	0,55	1,5	41	106	2,76
13	07.09.23.23	9,9	0,59	1,8	57	15	2,77
14	07.09.23.24	8,6	0,53	1,8	51	13	2,81
15	07.09.23.22	8,8	0,61	2,0	-58	216	2,76
16	07.09.23.21	7,0	0,51	2,2	31	356	2,79
17	07.09.08.01	6,4	0,48	2,2	40	12	2,69
18	07.09.08.10	6,3	0,50	2,3	19	41	2,67
19	07.09.23.34	6,6	0,54	2,4	56	234	2,76
20	07.09.23.25	11,6	1,05	2,6	55	25	2,74
21	07.09.23.27	2,6	0,26	2,9	49	11	2,70
22	26.20.07.08	3,1	0,32	3,0	-13	33	2,76
23	20.20.07.08	11,6	1,21	3,0	46	297	2,73
24	18.20.07.08	6,0	0,63	3,1	-33	28	2,78
25	07.09.23.35	1,6	0,17	3,2	66	339	2,70
26	22.20.07.08	6,7	0,74	3,2	-20	24	2,77
27	07.09.08.09	7,5	0,85	3,3	6	46	2,81
28	07.09.23.33	2,8	0,32	3,3	51	38	2,77
29	14.20.07.08	9,4	1,12	3,5	-39	70	2,72
30	11.06.3.4	0,0	0,43	3,8	58	38	2,81
31	9.20.07.08	7,3	1,01	4,1	-60	28	2,71
32	27.20.07.08	9,7	1,48	4,5	18	22	2,72
33	07.09.23.28	1,8	0,28	4,5	71	15	2,72
34	07.09.23.31	3,0	0,47	4,6	74	95	2,73
35	07.09.23.30	2,7	0,43	4,7	67	355	2,76
36	07.09.23.32	2,5	0,43	5,0	63	134	2,74
37	13.20.07.08p	6,5	1,21	5,5	35	297	2,64
38	12.20.07.08	2,1	0,49	6,8	46	345	2,66
39	11.20.07.08	5,6	1,37	7,1	4	321	2,75
40	23.20.07.08	1,9	0,48	7,4	56	27	2,83
41	7a.20.07.08	5,6	1,60	8,4	6	243	2,77
42	17.20.07.08	3,0	0,91	8,7	48	284	2,67
43	15.20.07.08	3,8	1,16	8,9	-71	221	2,63
44	25.20.07.08	7,7	2,42	9,2	27	306	2,73
45	6.20.07.08	4,4	1,49	9,8	7	97	2,69
46	7.20.07.08	4,4	1,60	10,5	-6	13	2,71
47	11.06.4.2	25,0	10,26	12,0	45	55	2,75
48	24.20.07.08	2,8	1,35	14,3	46	261	2,78
49	21.20.07.08	2,1	1,11	15,3	-50	151	2,69
50	16.20.07.08	2,6	1,37	15,7	52	53	2,66
51	10.20.07.08p	1,6	0,86	15,9	-17	22	2,70
52	07.09.08.02	0,8	0,60	21,8	-19	240	2,64

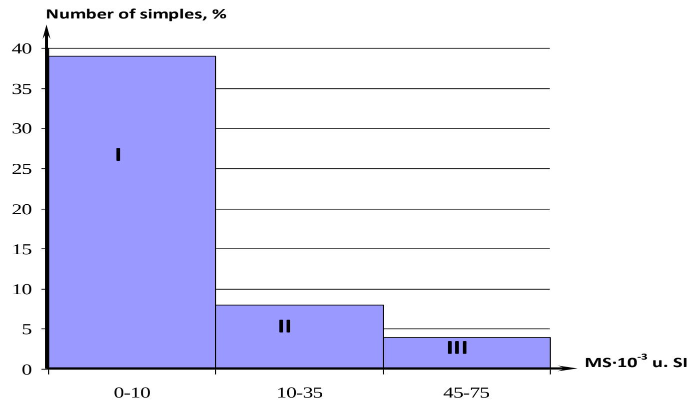

Fig. 4. The distribution of templates by their MS.

The fig.4 shows a 3 groups of enderbite templates with various MS. The most group has low MS (0 – 10 *10-3 units SI) – there have a low percent of magnetite. Such templates cannot form a high volumes of magnetic field. In the same time, thermomagnetic analysis shows that their templates have magnetite and pyrotine (fig.5). The sharp decline in values of MS after heating to 3800C indicates the presence pirotynu. Microphoto of magnetite and pyrotine grains shows there minerals appeared in enderbites simultaneously and do not replace each other (fig.6).

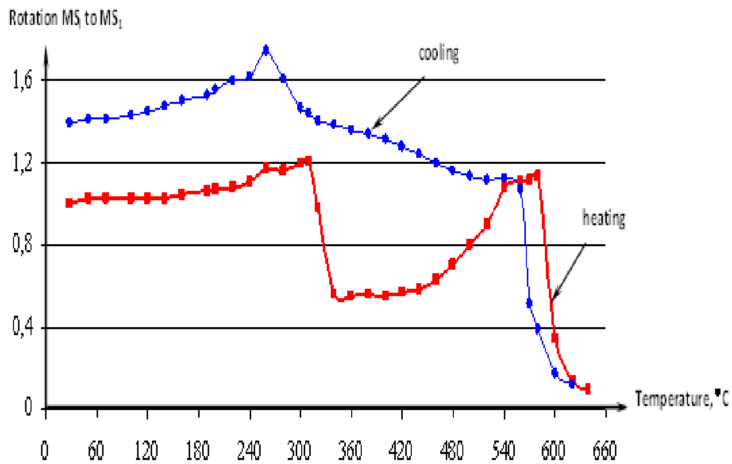

Fig. 5. Thermomagnetic curves of templates.

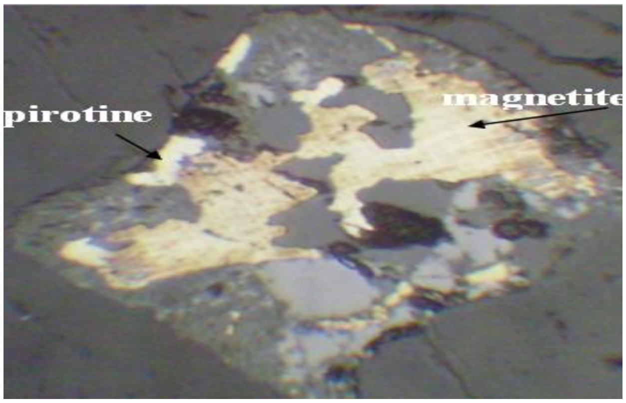

Fig. 6. Microscopic photoimage of template.

The twice group (fig.4) is formed by templates with relative high MS (10 – 35 *10-3 units SI). Such templates has a magnetite in noticeable quantities. The third group – there are a high-magnetic with MS>45 10-3 . Thus, enderbites despite visual macro-homogeneity can diffe. The rose granites near enderbites are weak-magnetic (MS<10·10-3 units SI). The thermomagnetic analysis shows a presence in granites of magnetite (without pyrotine).

The results of investigations shows that enderbites are non-homogenous by his magnetic susceptibility. The more part of enderbites are weak-magnetic, but sometimes they have a high volume of magnetite. Thus they differ It differs from the surrounding pink granite by comparative highest MS. Also enderbites contains a pyrotine, which is absent in rose granites.

4. Conclusion

The magnetic susceptibility of tnderbites in Gaisin Block are investigated in the first time. It is established that enderbites are non-homohenous by her magnetic susceptibility. The tree groups of enderbites are selected magnetic, weak-magnetic with msgnetite and wek-magnetic with magnetite+pyrotine. Experimental data can show that enderbites cannot produce a high induction of magnetic field.

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