Research Note

Arctic turquoise of Pai-Khoy (USSR)

A. A. BELYAEV AND A. A. IEVLEV

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A. A. Belyaev and A. A. Ievlev, Institute of the Komi Scientific Centre of the Ural Department of the USSR Academy of Sciences, 24 Kommunisticheskaya St., 167610 Syktyvkar, USSR; *March 1989 (revised September 1989).*

The first manifestation of turquoise in the European part of the USSR was discovered in 1979 (Belyaev 1984). It is situated on the Yugorskiy peninsula in the middle stream region of the Silova-yaha river (Pai-Khoy mountain range) (Fig. 1). The manifestation is located in the north limb of the Middle-Silovskaya syncline structure and attracted to the zone of altered rocks of upper-Devonian age. The rocks are clay shales, fine-grained silicic and jasper-like rocks. Turquoise is located in three zones sub-concordant with the stratification, with a thickness of 1–3 metres, controlled by jointing and stratum separation. Fine impregnations of sulphide minerals (chalcopyrite, pyrite, covelline, sphalerite) and an abnormally high content of phosphorus (P_2O_5 0.1–0.2%) are noted in unaltered rocks.

Turquoise locates in the form of small veins. The main body of mineral is present by spherical aggregates with radiate structure (Fig. 2a). The admixture of quartz and micas is noted on the border of spherolites and in the interspaces between them. In the open pores, the turquoise is replaced on the surface by ferrous hydro-oxides, which gradually penetrate into the centre of spherolites.

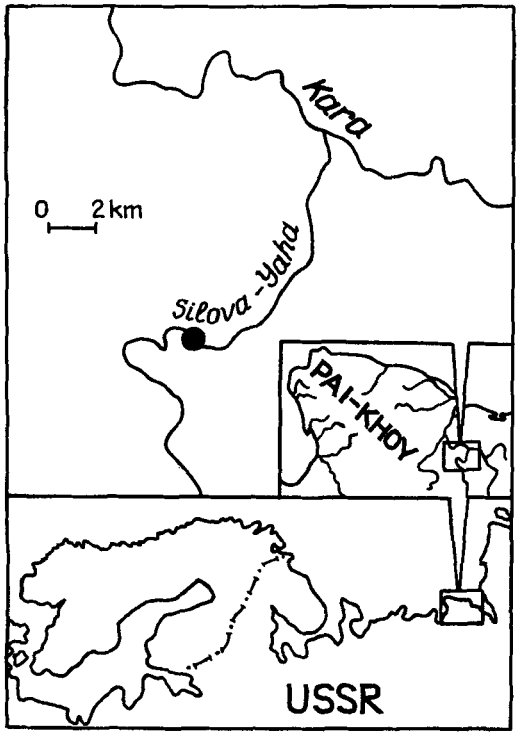

Fig. 1. Map of turquoise location in Pai-Khoy. Black circle points out the turquoise manifestation.

Table 1. Microprobe analysis data (%) of Pai-Khoy turquoise.

Sample	1	2	3	4	5	6
Al_2O_3	36.03	35.47	35.90	35.80	36.41	35.30
P_2O_5	37.17	38.89	37.76	37.73	37.90	38.75
FeO	2.27	2.63	2.19	2.29	2.04	2.52
MnO	0.07	—	0.01	—	—	0.01
CuO	3.70	3.11	3.68	6.71	7.04	6.97
ZnO	1.64	2.03	1.77	0.56	0.60	0.45
Na_2O			0.06	0.11		
MgO			0.02	0.03		
SiO_2			0.02	0.02		
K_2O			0.08	0.11		
CaO			0.10	0.15		
Cr_2O_3			0.06	—		
TiO_2			—	—		

1–3: green turquoise
4–6: blue turquoise

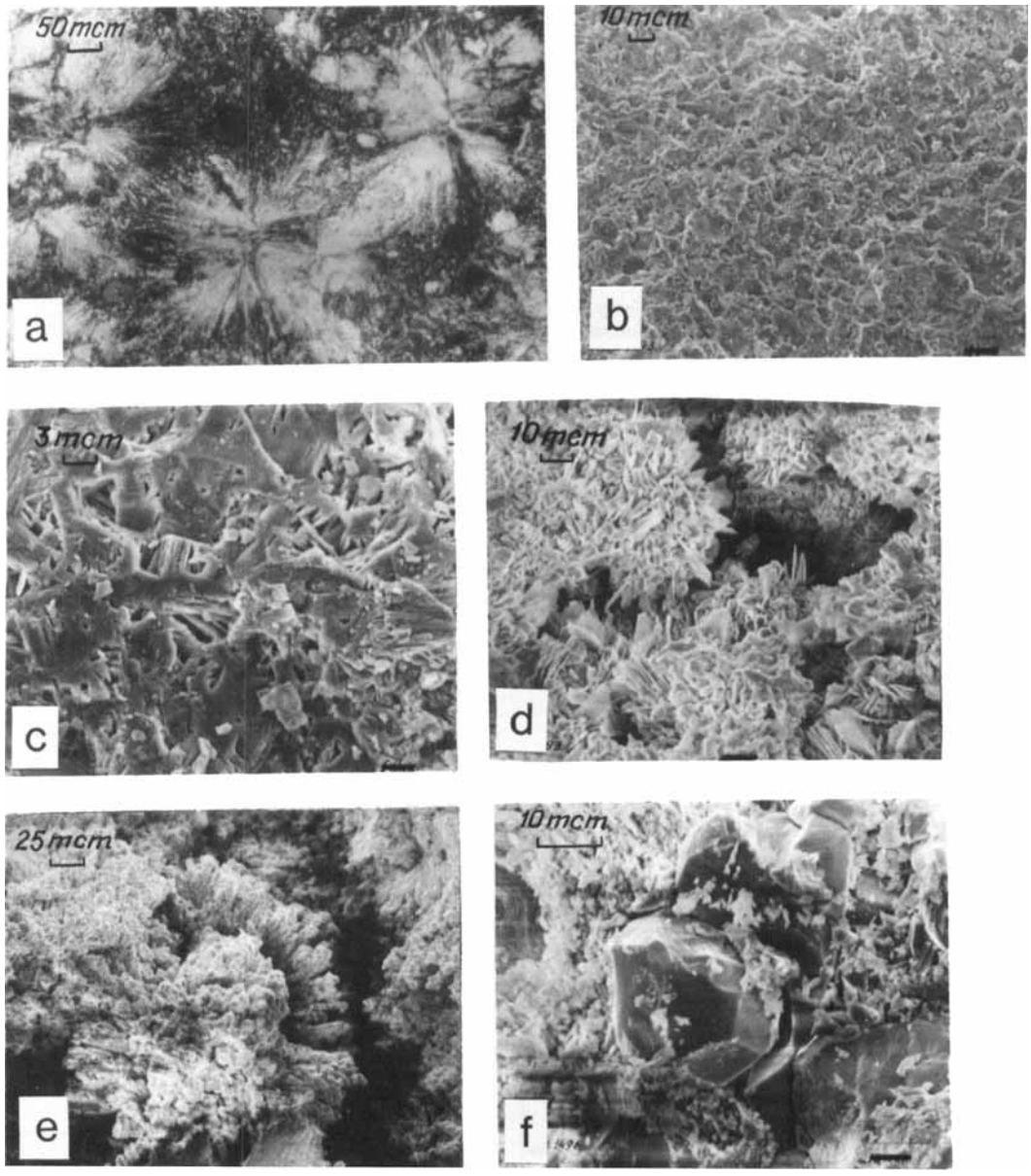

Fig. 2. Morphology of turquoise aggregates. Thin section (a), scanning electron micrographs (b-f).

The electron micrographs of some platy aggregates of turquoise reveal a dense collomorphous surface of this mineral (Fig. 2b). The aggregates are composed of plate particles of irregular form with jagged borders (Fig. 2c) and splitting of peripheral parts into co-directional fragments is noted for many particles. The porous parts of platy turquoise are characterized by globular-plate aggregates (Fig. 2d). The main body of Pai-Khoy turquoise is present by spherical aggregates of radial structure (Fig. 2e). The intergrowth of quartz is discovered in the dense parts of the mineral (Fig. 2f).

The results of microprobe analyses of the mineral are shown in Table 1. According to semi-quantitative spectral analysis data, it possesses

(%): V 0.003, Y < 0.004, Co and Nb 0.001 each, Be 0.0006, Ni and Yb 0.0004 each, Sc 0.0003, Sn 0.0002, Mo < 0.0001, Ag 0.00001. Mossbauer spectroscopy gives the correlation between the ferrous ions content: $Fe^{3+}/Fe^{2+} = 5.41$.

According to X-ray and IR-spectrum data, the characteristics of the studied material completely coincide with those of turquoise. Quartz and kaolinite are also detected.

The DTA-curve is characterized by intense endothermic effect at 352°C, weak endoeffect at 515°C and exothermic effect at 800°C. The unremitting loss of weight is fixed in the interval between 90 and 750°C. The total weight loss is equal to 17.85%, which correlates well with the theoretic content of water in turquoise (17.72%).

The examination described above shows that the studied mineral is a turquoise with variable content of admixtures of quartz and kaolinite. In the authors' opinion, the occurrences of turquoise indicate a hydrothermal-metasomatic genesis of the mineral, coeval with the main phase of folding.

Reference

Belyaev, A. A. 1984: *Trans. Inst. Geol. Komi Branch USSR Academy Sci. 45*, 87–91 (in Russian).