3. MINERAL TYPES OF ALKALINE PEGMATITES

Owing to long-term development of fracture systems (including cleavage), complex telescoped (combined) types of mineralization were generated within the Vishnevye Mountains block of the Earth crust. It was partly described in the previous Chapter. The relationships of veins differed in structure and mineralogy are described below.

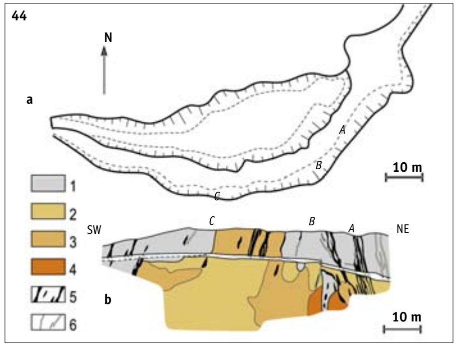
Two identical pegmatite veins or two identical sections within one vein are difficult to be found; this causes problems in classification of bodies, among which pegmatite are the largest. Most veins were multiple plastic and brittle deformed with input of late mineralization and primary genetic features of vein aggregates are masked in varying degree. Our predecessors described some veins (Bonshtedt-Kupletskaya, 1951; Es'kova *et al.*, 1964). In the Vishnevye Mountains, miaskite (nepheline-feldspar) and syenite (nepheline-free) pegmatites are the most abundant; various types of carbonatite and glimmerite veins are less common. Late mineralization fills open space of fractures, including cross-cutting alkaline pegmatites.

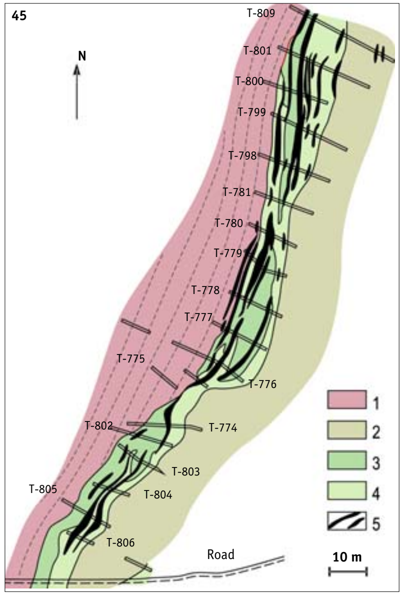
The relationships and formation sequence of various veins in the Vishnevye Mountains are similar to those located toward the south in the Ilmeny Mountains. They are differed in lower abundance of corundum-bearing syenite pegmatites and absence of amazonite-bearing in the Vishnevye Mountains (they were found at Mt. Uspenskaya south of the Muak River). The general sequence of vein formation taking into account published and our data on the structure and intersections of the different veins is:

1. Early (pre-miaskite) granite pegmatites with magnetite, rare allanite (orthite), zircon, and titanite (sphene) among syenite were reported by Bonshtedt-Kupltetskaya (1951)

42. Aegirine-microcline vein hosted by banded fenite. Northwestern contact of the Central massif. Field of view 50 cm. Photo: V.A. Popov.

43. Miaskite cutted by nepheline-feldspar veinlets. Field of view 12 cm. Specimen and photo: V.A. Popov.





44. Outline of the vein no. 1 open pit (a) and sketch structure of the southern vein side (b, view from the north, mirror image), modified after Bonshtedt-Kupletskaya (1951).
(1) miaskite, (2) nepheline-feldspar pegmatite,
(3) microcline-albite zones, (4) vishnevite-cancrinite zones,
(5) calcite-biotite veins, (6) calcite veins.
Letters A, B, and C depict documented sites.

45. Location and shape of the aeschynite-bearing vein series no. 133 at Mt. Mokhnataya, modified after Isakov *et al.* (1961*ofr*).
(1) granite gneiss; (2) miaskite;
(3, 4) syenite: (3) pyroxene, (4) biotite;
(5) aeschynite-bearing veins.
Letter T with number (e.g., T-806) denotes trench and its number.

in the vein system no. 36. Ronenson (1959) expected granite pegmatites, which were fenitized later among granitic gneiss. Later, Es'kova *et al.* (1964) attributed also vein nos. 36 and 37-B-C to such type. In 1983, V.A. Popov identified zones of recrystallized ("granulated") quartz in aggregates with feldspars within these veins. Previously, veins of subgraphic and small-block biotite-muscovite granite pegmatite (*Fig*. 32) with rare inclusions of orthite, zircon, columbite, samarskite, euxenite, and monazite were documented in granitic gneiss of the eastern outer contact of the alkaline massif during geological survey (Es'kova *et al.*, 1964); we did not study these veins.

2. Pyroxene-microcline veins at some places constituting up to 30–40 vol.% of fenite (Es'kova *et al.*, 1964) form lenticular bodies ranging from a few cm to 2 m in thickness; these bodies are concordant to the fenite banding and less frequent cross-cut it. These veins range from a few to 15–20 m in length and more. In the aegirine (aegirine-augite) to microcline ratio, these veins are microcline-pyroxene with the microcline content of 60–80% (*Figs*. 33, 42). Veins with predominant alkali pyroxene (85–90%) and microcline veins are less common. Fluorapatite, titanite, ilmenite, pyrochlore, and less frequent quartz (in some druse cavities are accessory minerals in these veins. These vein varieties frequently graduate each other. Pyroxene-plagioclase veins are cross-cut by alkaline pegmatite veins (Es'kova *et al.*, 1964).

3. Biotite-feldspar and feldspar-biotite veins variable in length and thickness are observed in miaskite of the Central massif and fenite of its north-northeastern contact and Sedlovidnaya body. V.A. Popov reported zircon-bearing feldspar pegmatite cross-cut by miaskite pegmatite in the vicinity of vein no. 35; on the northern wall of the open pit of this vein, he observed feldspar vein with corundum and zircon cross-cutting amphibolite and fenite. In vein no. 138 ("mixed pegmatite") of 75 m long cross-cutting banded gneiss, pyroxene fenite, and amphibolite, the near contact zone of this pegmatite body is corundum-feldspar and the central (predominant) zone is nepheline-feldspar (Es'kova *et al.*, 1964). The complex combination of different vein aggregates in amphibolite was found on the northeastern wall of the open pit of the vein no. 129, where E.P. Makagonov identified asymmetric succession of vein aggregates from northeast to southwest (*Fig*. 34): corundum-feldspar pegmatite with disseminated pyrochlore → small- to medium-