

Paradoxical character of fracture neotectonics in Saamsky open pit (Khibiny)

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Khibiny massif is the largest alkaline massif in the world. Numerous of world class (proved resources 0.1-1 billion t. of P₂O₅) deposits of apatite-nephelin ores are connected with the ijolite-urtite arch which is the most contrast part of Khibiny. These deposits are exploited over 75 years. Several open pits are already closed and now the extraction of ore proceeds by the mining. The monitoring in places of joining of underground mines and quarries was put into practice because the dangerous dynamic phenomena in these places increased. Within one of such region (Saamsky open pit) the monitoring of the modern differentiated movements has revealed their paradoxical character. Saamsky open pit is crossed by the fracture of the same name. This structure is the radial fault of the massif and one has fell vertically across the strike of the ore bodies. The fracture is a non-uniform zone of crushing, cataclasm and mylonitization and has size (within the open pit) up to 130 m. There numerous rudaceous blocks and lenses of various size rocks are inside inclusions of the fracture. The drop of fracture is traced on distance more than 200 m in open pit and Kirovsky underground mine. Plicated structures inside of zone are not detected. Within the Saamsky open pit and underground mines the Mining Institute and JSC "Apatite" have organized geodesic polygon for the measurement of the vertical and horizontal differentiated movements across the strike of the fracture. The measurements have been begun in 1991 and carried out by rerunning of levelling and by phototachymeter method. The long-term observations have revealed the stable uplift tendency of the internal fracture zone above surrounding non-crashed rocks with insignificant variable fluctuations. The total relative vertical displacement of the central part of the fracture during the period of the observations (1991 - 2006) was + 8 mm for the western profile and more + 14 mm for east one. Velocity of uplift was 0.48 and 0.72 mm/years accordingly. At the same time the phototachymeter measurements have not detected essential displacements in horizontal components between the benches. Also the considerable vertical displacements of fault walls are not found. Thus, character of the neotectonic movements of internal fracture zone is characterized by stable uplift of the central crushed part relative to non-crashed massif of rocks. Such paradoxical mechanism cannot be completely explained by the significant tectonic pressures having as a rule the subhorizontal position of main tensor within Khibiny massif. This mechanism cannot be also explained only by the man-caused influence, i.e. the excavation and moving of the huge volumes of rocks. The model of extrusion of the crashed rocks due to redistribution of pressure in the fracture zone as a result of complex interaction of the just listed factors can be temporarily accepted. The research was supported by RFBR fund (grant ¹ 07-05-13579-ofi_ts).