Mineralogical Analysis of Glacial Deposits and Titanium Paleoplacers of the East European Part of Russia

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Abstract. Mineralogical analysis is one of the main methods to determine sources for paleoplacers and location of source glacial provinces. Our studies defined location of source glacier provinces and sources for titanium paleoplacers of the East European Part of Russia.

Keywords: Minerals · Reconstruction · Glacial deposits · Titanium paleoplacers

1 Introduction

Mineralogical analysis is the most significant method in reconstructing sources paleoplacers and glacial deposits (boulder loams), determining location of source for glacial provinces. The paper presents two objects - glacial deposits of polar and vychegda horizons, Middle Devonian and Middle Triassic titanium paleoplacers.

2 Results and Discussion

Quaternary deposits have been studied in two areas of Pechora lowland: in the northeast in the basin of the Padymeytyvys river and northwest in the basin of the Kui river. Titanium paleoplacers were studied at the Kyzdarysy river (Preural Foredeep) and Middle Timan (Pizhma paleoplacer).

Relations between mineral composition of Quaternary deposits and underlying bedrocks are very important. During active exaration activity of the glacier, the underlying rocks controlled composition of boulder loams. The formation of heteroaged horizons of boulder loams is associated with the Northeastern (Paykhoy-Ural-Novaya Zemlya) and Northwestern (Fennoscandia) terrigenous-mineralogical source provinces. The rocks of the eastern province are characterized by higher levels of epidote and ilmenite fraction, and the northwestern ones - amphiboles and garnets.

In the basin of the Padymeytyvys river two horizons of boulder loams were drilled. In the lower (Vychegodsky) horizon, epidote (19.9%) and siderite (21.2%) dominate in the heavy fraction. In the composition of the heavy fraction of the upper (polar) horizon, pyrite (22.1%) and epidote (20.7%) have maximum concentrations, siderite content (11.7%) and ilmenite (14.7%) are high. Pyrite and siderite indicates the relation between the glacier and Triassic and Permian underlying rocks, and ilmenite may be associated with Uralian rocks.

In the valley of the Kui river one horizon of boulder loam – polar – was drilled. The heavy fraction is represented by amphibole (13.6%) - garnet (18%) - epidote (20.8%) associations with the increased content of pyrite (7.7%). High concentrations of amphiboles (13.6%) and garnets (18%) may indicate the relation between the glacier and the rocks of Fennoscandia.

The number of amphiboles in boulder loams decreases from west to east and amounts to the first percent. High total contents of pyrite and siderite in the north-east of Pechora lowland are typical of local Mesozoic source province.

Heavy fraction of the paleoplacer at the Kydrasyu river is represented by ilmenite (45.19%), epidote (23.21%), magnetite (15.76%), amphibole (6.69%), chrome spinel (5.65%), garnets (2.06%). Also zircon, leucoxene, rutile, hematite, kyanite, martite, pumpellyite, staurolite are present (0.04–0.4%). The high content of ilmenite indicates the relation between the paleoplacer and igneous rocks. Epidote, garnet, kyanite, staurolite, and pumpellyite found in the heavy fraction are of metamorphic origin. The morphology of zircons is characteristic of minerals formed in igneous rocks of medium composition. The peculiarity of these minerals is their good preservation. This may be due to the nearby source. The mineral composition indicates that the source of minerals was not far from its burial. Titanium minerals and satellite minerals were most likely of magmatic and metamorphic origin.

The mineral composition of titanium placers often contains stable minerals and there are no unstable ones, although both are present in the bedrocks. The main reason is that the paleoplacer formed due to erosion of the weathering crust. An example of a paleoplacer formed that way can be Pizhma paleoplacer (Middle Timan) formed due to erosion and redeposition of weathering crusts on Riphean shales. Its mineral composition in contrast to the paleoplacer at the Kydrasyu river, is very poor. The main part is represented by leucoxenized ilmenite and leucoxene. Tourmaline, garnet and zircon are found in single units.

3 Conclusions

We determined location of the source glacier provinces and sources for the titanium paleoplacers of the East European part of Russia by the mineralogical analysis.

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