HEAVY MINERAL ASSEMBLAGES FROM RECENT STREAM ALLUVIA IN THE TATRA MTS.

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Abstract: Heavy minerals from the recent alluvia in the upper parts of valleys in the Tatra Mts. were studied. Heavy mineral assemblages generally reflect the mineral composition of source rocks. Heavy fractions seem to be relatively enriched in some minerals comparing to source rocks. Morphology of numerous grains can be related to glacial transport and their subsequent extraction from moraines. Activity of humic acids in alluvia causes leaching porosity of less stable minerals. Relatively high content of oxidised sulphide grains in heavy mineral assemblages in the Western Tatra indicates influence of old mining activities.

Key words: heavy minerals, Tatra Mts., alluvia

Introduction

Heavy minerals assemblages in recent alluvia in the Tatra Mts. were studied by several authors (e.g. Krysowska 1961, Kiebała et al. 2001). Application of new methods of studies allows to identify higher number of mineral species. Characteristics of heavy minerals in the Tatra Mts. is very important in interpretation of the provenance of detrital material of the Quaternary deposits in the Podhale and Orava. Selective extraction of accessory minerals can be discussed basing on the study of heavy minerals in sediments deposited close to their source rocks. Influence of climatic conditions typical of high mountains, transport in morains and weathering in environment rich in organic acids related to podzolization processes can be also discussed.

Geological setting

About 10 kg samples were collected from the Quaternary alluvia of several stream valleys on the northern slopes of the Western and High Tatra Mts.: the Chochołowski Potok stream;

the Jarząbczy Potok stream, the Starorobociański Potok stream, the Goryczkowy Potok stream, the Roztoka stream, the Rybi Potok stream (*for details see* Kiebała 2001, Ladenberger 2001). Samples were taken in the upper parts of valleys where only igneous and metamorphic rocks crop out. The source area in the Western Tatras is built predominantly of several types of granitoids and metamorphic rocks (e.g. gneisses, migmatites, amphibolites) whereas in the High Tatras the most abundant are granitoids of various types (granodiorites, tonalites, granites).

Methods of study

Samples were sieved and <0.32 mm fractions was subjected to magnetic and magnetohydrostatic separation. Three fractions were extracted from each sample according to magnetic susceptibility („magnetic", „paramagnetic", „nonmagnetic"). Polished thin sections of heavy mineral fractions were prepared and studied in optical microscope in transmitting and reflected light and examined in scanning electron microscope fitted with dispersive energy spectrometer (SEM-EDS).

Heavy minerals assemblages

Heavy minerals assemblages obtained from recent alluvia in the Western Tatra are composed of garnet, magnetite, hematite, pyrite, ilmenite, amphiboles, zircon, tourmaline, rutile, xenotime, monazite, Fe-Cu sulphides, Cu-Zn alloy grain. Staurolite, apatite and sillimanite are present as minor components. Garnet grains are characterised by high content of almandine end-member (Alm 45-75%); spessartite is also present in significant amount (Sps 5-55%). Amphiboles are represented by magnesio-hornblende. Gedrite and tschermakite end-member rich amphiboles are present in minor amounts. All sulphide grains (pyrite, Fe-Cu sulphides) are strongly oxidised. Grains are surrounded by Fe-oxide rims. The Fe-oxide rim thickness is often greater than diameter of sulphide core.

In the High Tatras apatite and epidote are the most abundant. Monazite is less abundant. Zircon, ilmenite, chlorite, titanite rutile, magnetite, hematite, sillimanite were found in minor amounts. Amphibole, prehnite, xenotime, allanite, barite and pyrite are scarce. Apatite grains exhibit variations in chemical composition (Mn and Cl content). Fe-Ti oxide grains are present in form of complex intergrowths (rutile and titanite in hemoilmenite-

ilmenohematite) typical of the High Tatra granitoids. In a few monazite grains exsolutions of Th-U oxides are present. Intergrowths of monazite and xenotime were also noticed.

Micas and intergrowths of heavy minerals with rock-forming minerals are present in all heavy fractions extracted from all samples.

Heavy minerals asemblages from different streams alluvia from the Western Tatras are very similar. Also in the High Tatras such differences are negligible.

Heavy mineral forms are variable. All heavy fractions are rich in crushed, irregular, and angular grains. Grain margins are often porous (e.g. titanite, ilmenite, epidote, monazite).

Discussion and conclusions

Heavy mineral assemblages generally reflect the composition of accessory minerals (both primary and formed during hydrothermal alterations) present in source rocks. Although more precise study is needed, it seems that the heavy mineral fraction is relatively enriched in some minerals (e.g. monazite) comparing to source rocks (e.g. The High Tatra granites). It indicates that in close vicinity to the source rock numerous accessory minerals (e.g. zircon) are present in gravel or coarse-grained sand fraction rock fragments or as inclusions in mica flakes.

High abundance of crushed and irregular grains can be related to glacial transport and subsequent extraction of grains from moraines. Presence of grains with porous margins indicates intense leaching related probably to the activity of humic acids in alluvia. Scarcity of sulphide veins in the Western Tatras suggests that relatively high content of oxidised sulphide grains in heavy mineral assemblages is related to their removal from old mines tailing present in upper parts of valleys.

Results of heavy minerals from alluvia in the Tatra Mts. can be important in the discussion on the origin of young clastic deposits in the Podhale and Orava basins (e.g. Klimaszewski 1988, Baumgart-Kotarba et al. 1996).

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