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Geochemistry and provenance of some detrital heavy minerals of alluvial sediments from Neagra S, arului River, Eastern Carpathians, Romania

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The present work focuses on the analyses of a selection of heavy mineral assemblages sampled from the Neagra Șarului River's alluvia, in order to determine their provenance and distribution, using their geochemical and physical characteristics. The study focused on a mountain river of about 30 km long, located in the north-western part of the Eastern Carpathians, an important tributary of the Bistrița River. The bedrocks in the river drainage basin are constituted mainly by igneous rocks from Călimani Volcanic Complex in the west, and secondarily by a small area of low to medium grade metamorphic rocks, part of Crystalline-Mesozoic Zone, in the east. In order to trace the source of each individual mineral species, we prepared our samples via field separation and subsequent laboratory sieving using 8 different size fractions. An electromagnetic separator (Frantz Isodynamic) was used to separate and classify each heavy minerals species, depending on their magnetic susceptibility. Thus prepared, more than 500 grains per samples (from the 0.5-1 mm size fraction) were mounted on thin sections and analyzed using a Cambridge Microscan M9 with EDS system. These analyses served for mineral identification and relative abundance determination. The classification of the minerals and the nature of their inclusions are derived from the major element compositions computed from SEM-EDX analysis. We also used a stereo microscope in order to determine complementary properties of the grains, such as: color, degree of roundness and degree of alteration. In order of abundance, the main heavy minerals are magnetite, hematite, pyroxene, pyrite, manganese oxides, garnet, apatite, titanium oxides (ilmenite, titanite and rutile/anatase), chlorite, olivine, epidote, biotite and rhodochrosite. A particularity of the studied area is the presence of an altered magnetite caused first by the hydrothermal alteration and strong weathering of the source rocks and second by the river's acid water. Manganese oxides are present only in grain fractions greater than 0.25 mm due to higher susceptibility to weathering and dissolution of the Mn aggregates in the river bed. Despite low distribution of the metamorphic units in the river's studied basin, the garnets almandine (Alm 13-88%) and spessartine (Sps 0.5-87%), specific to the medium grade metamorphic rocks, have a relative high frequency. In this study, heavy mineral assemblages generally reflect the composition of primary (augite, almandine) and accessory minerals present in source rocks. The last ones are both primary (apatite) and secondary, which are mainly derived from hydrothermal deposition (e. g. pyrite) and from supergene alterations (e. g. manganese, iron oxides/ hydroxides, and other altered product of magnetite). Therefore, the mineral analyses were not limited to only tracking the source of each mineral species, but they also revealed the characteristics of their parent rocks.