More than 300 km raft on the ice floe. Dumortierite and clinohumite from the Bohemian Massif in Dunavarsány, Middle Hungary

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The glaciations events and the periods between them during the Pleistocene caused a big surface shaping effect in the Carpathian-Pannonian region. In the higher topographical regions, the erosion had a greater effect, so the debris transported downwards and accumulated on terrains with lower relief (basins, plains). The origin of the pebble assemblage on the plain south from Budapest can be explained with the same process. From the end of the 19th century, the proper way of transport, the structure and composition of terraces has been studied. Getting known about these processes, the surface-forming behaviour of the fluvial systems and climate conditions of that age can be revealed. Petrographic examination of pebbles and boulders is an excellent way to find the source area of fluvial debris. The place of origin of unique rocks with lower abundance can be better located.

In the gravel pits around Dunavarsány the upper Pleistocene alluvium of the Danube is mined intensively. This formation can be well located: under these fluvial sediments there are Pannonian limnic and swamp formations with the complete lack of coarse-grained alluvium. Meanwhile, thin Holocene sediments cover the area. The alluvium in the vicinity of Dunavarsány belongs to the Csepel Member of the Pestvidék Pebble Formation. Why is this pebble formation interesting? It contains mainly (more, than 90%) classical fluvial-formed coarse-grained pebbles, but there are some bigger (even more, than 1 m in diameter), sometimes almost completely angular blocks in it.

Two special rock types from the latter range are in the centre of our research. In each of these rock types, we described characteristic minerals, which have been unknown from Hungary before. The clinohumite (general form: $Mg_9(SiO_4)_4(OH,F)_2$) was found in one dolomitic marble block in which besides clinohumite calcite, dolomite, olivine, spinel, apatite, tremolite, chlorite and phlogopite appear also. The other key mineral is the dumortierite (general form: $AlAl_6(BO_3)Si_3O_{13}(O,OH)_2$) which was detected in two different gneiss types. The main rock forming minerals in these gneiss types are quartz, feldspar, biotite (partially chloritized) and muscovite. Besides dumortierite, smaller amount of cordierite, tourmaline, andalusite, sillimanite, garnet, apatite and zircon also appear. We examined these rocks in thin sections with polarising and scanning electron microscope, too. A test with Raman-spectroscopy verified the identification of dumortierite and clinohumite. Afterwards, we searched for possible source regions, where the two studied special rock types occur close to each other. In Wachau, Austria these two rock types (Gföhl Gneiss and the marble of the Drosendorf Series) with key minerals (dumortierite and clinohumite) occur within few kilometres, in the vicinity of the recent (and former) bed of the River Danube. In the framework of a field trip, we collected rock samples from 22 outcrops. Two big quarries close to the Danube (Klein-Pöchlarn–Ebersdorf and Loja) seemed to be the most revealed and suitable locations. We correlated the collected samples (dumortierite bearing gneiss and clinohumite bearing marble) with those collected in Dunavarsány by the means of the upper mentioned methods and confirmed strong similarity between them.

With the knowledge of the place of the most possible origin, the fairly angular shape and the bigger size (gneiss: average 30 cm in diameter, marble: 80 cm in diameter) we suggest, that the most probable mean of transportation was the fluvio-glacial process. In this progress, the rocks fall, roll and/or solifluctate from the cliffs onto the river ice and raft even hundreds of kilometres along to the lower reach of the river. There the climate is appropriate for the ice floe to melt, so the rocks can fall down onto the river bed. These phenomena made possible for us to find unique rock types from the Austrian part of the Bohemian Massif in the middle of Hungary.