Magma-mixing and -mingling as key magmatic processes controlling the development of the volcanic events in the Gutâi Neogene Volcanic Zone, Eastern Carpathians, Romania

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The Gutâi Volcanic Zone (GVZ) belongs to the Neogene-Quaternary volcanic chain of the Carpathians developed on the north-western part of the Romanian territory. A calc-alkaline intermediate volcanism represented by a series of rocks ranging from basalts to rhyolites (andesites are the prevalent ones) took place during Miocene (13.4-7.0 Ma). The mineralogical, textural and geochemical features of many of the igneous rocks from GVZ suggest that magma-mixing and -mingling processes were involved during their genesis (e.g. the large-sized embayed sanidine crystals coexisting with high Mg# (85-90) chromian-diopside and high amount of gabbroic-type MME in the same biotite dacite and the large-sized sieve-textured or strong reverse zoned plagioclases together with large-sized embayed quartz crystals in the same andesite rock). Most of the rock types are dacites and subordinately andesites mainly related to extrusive domes (13.2-8.0 Ma). In some cases, two different but co-genetic rock types appear spatially and temporally associated as a result of magma-mixing and -mingling (e.g. biotite dacite and biotite andesite). Sometimes, one of the rocks is a hybrid rock such as a MME-hosting dacite and the other one is compositionally close to the potential basic end-member such as a basaltic andesite with 51.5-54.3 SiO_2. Some of the magma-mixing and -mingling products show compositions matching with the acidic end-members (e.g. the biotite dacites/rhyolites with glassy, perlitic groundmass texture). The mineralogical and geochemical similarities between the MME of the dacite rocks and some of the basaltic rocks from GVZ suggest the involvement of such basaltic magmas as basic end-members. These features enable the reconstruction of the magmatic processes developed in the crustal magma chambers or in the volcanic conduit, processes which controlled the emplacement of these rocks. Many volcanic events controlled by repeated magma-mixing and -mingling processes took place during the volcanic activity of GVZ and conducted to the emplacement of important volcanic structures by triggering the eruption events timewise in different locations of the area. The different PT parameters of the mineral phases contained in the hybrid rocks, suggest different conditions of evolution of the magma-mixing and -mingling processes involving different magmatic sources. The small-volume acidic MME-hosting volcanic rocks (e.g. the Dănesti dacite/rhyolite -11.6 Ma, Valea Morii dacite -10.1 Ma and Laleaua Albă dacite -8.0 Ma) resulted from magma-mixing and -mingling processes developed in small-sized, shallow level evolved/silicic reservoirs. Opposite to these, some hybrid rocks which represent one of the dominant volcanic phases in GVZ (e.g. the large-spread quartz andesite complexes – 11.3-10.5 Ma) resulted from magma-mixing and -mingling processes developed in large-sized differentiated magma chambers with near-continuous replenishment by new basaltic magmas.