NEOGENE-QUATERNARY VOLCANISM OF THE CARPATHIAN-PANNONIAN REGION. A VOLCANOLOGICAL PERSPECTIVE

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The Carpathian-Pannonian Region (CPR) records a ca. 20 Ma old volcanic activity closely related to the geodynamic evolution of the area. Eruption styles are different for the three main compositional groups of the feeding magmas – felsic calc-alkaline, intermediate calc-alkaline and alkali-basaltic. The time-space evolution of volcanism, inferred using K-Ar geochronology, shows that volcanism started with felsic magmas and ended with alkali-basaltic magmas in most of CPR.

Felsic calc-alkaline magmas, sometimes with alkaline affinity, mostly produced large-volume explosive eruptions generating welded and non-welded ash-flow deposits as well as their reworked counterparts deposited both on land and under water. Since most of their occurrences are buried beneath younger sediments, their respective eruptive centers are difficult to identify. However, a few centers have tentatively been localized – e.g. as buried calderas in the central part of the Pannonian Basin. Felsic and intermediate calc-alkaline volcanics are closely related in both space and time in various areas of CPR.

Andesite-dominated intermediate calc-alkaline magmas – traditionally thought as being subduction-related – generated volcanics with an obvious geochemical signature, however, coeval subduction is very unlikely for most of the areas in CPR, since most of the volcanism is postcollisional. This volcanism first developed in the western part of CPR with an areal-type spatial distribution. An obvious magmatic arc with a definable volcanic front has been active after ca. 14 Ma from Eastern Moravia to the Calimani and Gurghiu Mts. in the East Carpathians, until ca. 8 Ma ago. Arc segmentation – and related specific evolution patterns – are due to features of the overriding plates, unlike most modern analogues worldwide. Eruptions occurred at a large number of centers, most of them being composite volcanoes with variable size and complexity, located in various paleogeographic environments. Some of them evolved until large caldera systems including post-caldera resurgence stages or even multiple caldera-forming events. Edifice instability led to sector collapse and generation of large-volume debris avalanche deposits at a few volcanoes. Spatial distribution of volcanic centers shows close spacing of edifices in most areas, leading to complicated patterns of merging, interfingering and overlapping of various volcanic facies at neighboring volcanoes. Interaction between large volcanic edifices and their basement including low yield-strength rocks have been observed at some volcanoes in the East Carpathians.

Alkali-basaltic volcanism is clustered in a number of rather well-localized areas, corresponding to narrow-section mantle plumes. They form fields of small-sized monogenetic volcanoes, including maar structures, Strombolian cinder cones and lava fields. The size of the fields, number of centers included and duration of volcanism are variable.

The most recent volcanic activity in CPR occurred ca. 35–42 Ka ago in the Ciomadul Massif at the southeastern end of the East Carpathian volcanic arc, and ca. 0.1 Ma ago in the Central Slovakian Volcanic Field. Further eruptions cannot be ruled out in these areas and volcanic hazard should be considered for the unforeseeable future.