EVOLUTION OF MESOZOIC MAGMATISM IN THE EASTERN CARPATHIANS: TENTATIVE CORRELATION WITH CONTEMPORANEOUS TECTONIC EVENTS

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Abstract: The metamorphic terranes of the Eastern Carpathians are cut by mafic dykes showing either tholeiitic or alkaline affinities. K/Ar age determinations showed that tholeiitic magmatism pre-dated the emplacement of the Ditrau alkaline massif and was partly coeval with its early stages, while the alkaline dykes are restricted to Middle Jurassic-Lower Cretaceous times. Possible correlations with the Vardar-Transylvanian and Civcin-Severin riftings are inferred.

Key words: Mafic dykes, K/Ar ages, Eastern Carpathians, Mesozoic, rifting.

The Alpine orogen of the Eastern Carpathians comprises pre-Alpine metamorphic terranes with younger sedimentary cover, known as the Crystalline-Mesozoic Zone (Uhlig, 1907). The Crystalline-Mesozoic Zone (CMZ) was amalgamated in Paleozoic times and sheared by Alpine thrust faults during the Middle Cretaceous (Sandulescu, 1984). The metamorphic rocks of the CMZ are pierced by many mafic dykes, generally referred to as lamprophyres, and by the Ditrau alkaline massif. The mafic dykes show two distinct geochemical affinities closely related to their petrography: tholeiitic (dolerite) and alkaline (camptonite-spessartite with subordinate kersantite).

Dolerites show a primary mineralogy consisting of plagioclase + pyroxene ± olivine phenocrysts in a groundmass of plagioclase and pyroxene. Subsequently, amphibole has grown on pyroxene, sometimes completely replacing it. In the coarser varieties, rare biotite crystals have grown on amphibole. Such transformations are presumed to have resulted from magma contamination with aqueous fluids (Dragusanu et al., 2000). Most alkaline rocks are composed of plagioclase+amphibole (pargasite and/or kaersutite±hornblende), sometimes with pyroxene and/or olivine. Because many mafic dykes cut the Ditrau massif (232-110 Ma - Dallmeyer et al., 1997),

they were considered more recent or partly contemporaneous. A few previous K/Ar investigations on the mafic dykes (Krautner et al., 1976) indicated ages younger than 150 Ma which sustained the precedence of Ditrau magmatism. Although the tholeiitic and alkaline mafic dykes occur locally very close to one another, their spatial relationships could not be observed because of their poor exposure, so their emplacement sequence could not be established. This was a main reason for performing new age investigations. Samples from both tholeiitic and alkaline dykes were cropped from locations remote from the Ditrau alkaline massif (Fig. 1), so that they could not bear its influence. The K/Ar ages determined on amphibole separates of each sample are shown in Table 1. The results allow the correlation between the petrographic type and the timing of emplacement. The alkaline dykes gave Middle Jurassic-Early Cretaceous ages (140-180 Ma). Unlike them, most tholeiitic rocks show ages older than 200 Ma and some of them are even older than the ages yielded by the Ditrău alkaline massif.

These ages are significant relative to the Alpine geotectonic evolution of the Carpathian area. The main tectonic events recorded in the Eastern Carpathians prior to the Middle Cretaceous thrusting were the Middle Triassic opening of the Alpine Tethys (Vardar-Transylvanian rift), and the Jurassic Civcin-Severin rifting (Sandulescu, 1984; 1990). A possible relation between the emplacement of the Ditrau alkaline massif and both rifting events was envisaged by Sandulescu (1984), but the implication of other magmatism located in the continental crust has not been yet approached. Our geochronological investigation suggests a possible genesis of the alkaline dykes in conjunction with the Civcin-Severin rift. The tholeiite dykes seem to have been generated by the first magmatic processes induced by the Vardar-Transylvanian rifting. According to their ages, the mantle updoming that determined the Vardar-Transylvanian rifting produced the first effects during the Upper Permian. Tholeiitic dykes preceded the Ditrau magmatism and accompanied its inception. Further investigation is needed to determine the significance of the younger age of a few tholeiite samples.

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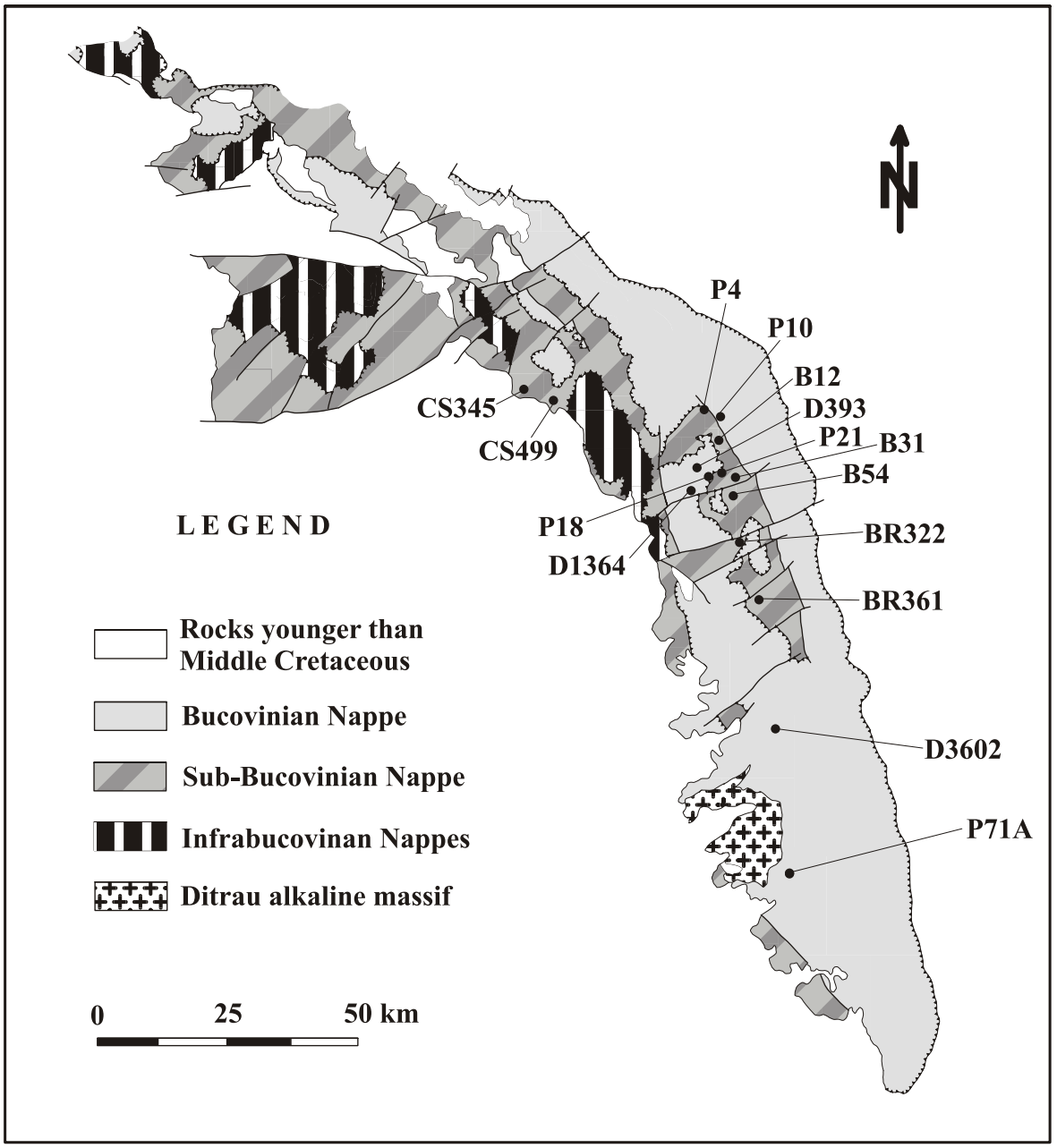
Table 1. Results of the K/Ar geochronological investigation of the mafic dykes from the East-Carpathian Crystalline-Mesozoic Zone

Fig. 1. Structural map of the East-Carpathian Crystalline-Mesozoic Zone and sample locations.

Sample	Rock type	K %	40Ar(rad) 10-6cm3/g	40Ar(rad) %	Age Ma±s
B31	Spessartite	0.366	2.051	29.6	138.7±7.5
BR-361	Kersantite	0.328	1.968	35.5	148.1±7.3
CS499	Camptonite	0.899	5.646	85.7	154.7±6.0
B54	Spessartite	0.746	4.797	68.7	158.2±6.2
CS345	Camptonite	0.865	5.873	80.8	166.7±6.4
BR-322	Camptonite	0.981	6.923	77.5	173.0±6.7
D1364	Camptonite	0.272	1.967	48.2	177.0±7.6
P71A	Kersantite	0.838	8.065	61.7	232.0±11.5
P18	Dolerite	0.346	1.77	37.7	127.0±6.0
P4	Dolerite	0.321	2.111	57.6	161.7±6.6
P21	Dolerite	0.314	2.773	42.1	214.0±9.7
D3602	Dolerite	0.359	3.501	41.9	234.9±10.6
D393	Dolerite	0.17	2.014	32.4	281.6±14.0
B12	Dolerite	0.178	1.807	37.3	243.9±11.5
P10	Dolerite	0.336	3.891	25.5	275.7±16.8


P4
P10
B12
D393
P21
B31
B54
CS345
CS499
P18
D1364
BR322
BR361
D3602
P71A
LEGEND
Rocks younger than Middle Cretaceous
Bucovinian Nappe
Sub-Bucovinian Nappe
Infrabucovinan Nappes
Ditrau alkaline massif
0
25
50 km