

MESOZOIC PLATE TECTONIC RECONSTRUCTION OF THE CARPATHO-PANNONIAN AREA

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Paleomagnetic, paleobiogeographic and structural comparisons of different parts of the Alpine-Carpathian region suggest that three terranes build up this area. These are named here Alcapa, Tisza-Dacia and Adria (Fig. 1). All of them are composed of different Mesozoic nappes (Fig. 2) assembled during a complex Late Jurassic-Cretaceous-Paleogene history. Paleomagnetic data combined with tectonic transport directions delineate five different vergency units: the Alps (NW), the West Carpathians (E), the Dinarides (WSW) the Tisza (W) and East Carpathians (N) in Late Cretaceous coordinates (Fig. 3).

The Carpathians are built up by two major buckles. The Alcapa buckle has the Meliata oceanic unit, correlated with the Dinaric ophiolite belt, in its core (Fig. 4). It is composed of the West Carpathians, East Alps and South Alcapa units (Transdanubian Central Range, Bükk). This row finds its continuation in the Dinaric shelf of the Dinarides. Further elements of the Alcapa terrane are thought to be derived from "ribbon" microcontinents: Czorsztyń in the N and Drina Ivanjica in the SE. The Tisza-Dacia buckle has the Vardar-Mureş belt in its core (Fig. 4). It is composed of the Tisza, the East Carpathians and South Carpathians. This row finds its continuation in the Serbo-Macedonian Massif and Rhodopes. This terrane is completed by some geodynamic units derived from the Drina-Ivanjica microcontinent.

By analysis of structural position of nappes, stratigraphic columns, and typical Early Jurassic fauna belonging to two major faunal provinces, the Mesozoic shelves and oceans are individualized. Numerous branches of the Tethys ocean cut up the area in smaller microcontinents. The Vardar and

Ophiolite belt-Meliata oceans of the Dinarides, the Penninic-Váh ocean of the Alps-Carpathians, the Magura ocean of the West Carpathians and the Ceahlău -Severin ocean of the East and South Carpathians are the key elements in the Mesozoic plate-tectonic history (Fig. 5).

The presented plate tectonic reconstruction differs from others by giving emphasis on the Tisza-Getic microcontinent. This ribbon continent has an original position east of the West Carpathians and fills the present Carpathian embayment in Late Paleozoic-Early Mesozoic. Another continental ribbon, Drina-Ivanjica, hosting Juvavic, Szilice and Upper Codru nappes, occupies an intermediate position between the West Carpathian-East Alpine-Transdanubian-Dinaric margin on one hand and the Tisza-Getic-Serbo-Macedonian, on the other. An internal major ocean fills the remaining space. Drina-Ivanjica rifts off the Mediterranean-Apulian microcontinent in the Middle Triassic. Short-lived oceans subduct by the end of Jurassic, colliding Drina-Ivanjica with both the Dinaric-West Carpathian and the Tisza-Getic internal margins (Fig. 5).

An external Penninic-Váhic ocean tract begins to rift in Early Jurassic, separating the East Alpine-West Carpathian microcontinents (and their fauna) from the European shelf. Also in this line, the Severin-Ceahlau-Magura ocean begins its rifting in the south in Early Jurassic, but final separation of the Tisza-Getic ribbon (and their fauna) from the European shelf does not take place before the Middle-Late Jurassic.

Two buckle closures: the West Carpathians on the Dinaric margin and the Tisza on the South Carpathian Getic margin are essential elements of this reconstruction. These motions, Aptian in the first, Albian-Maastrichtian in the second case are partly suggested by paleomagnetism (Fig. 6). The two buckles are finally opposed and pushed along the Moesian gate into the Carpathian embayment by Paleogene.

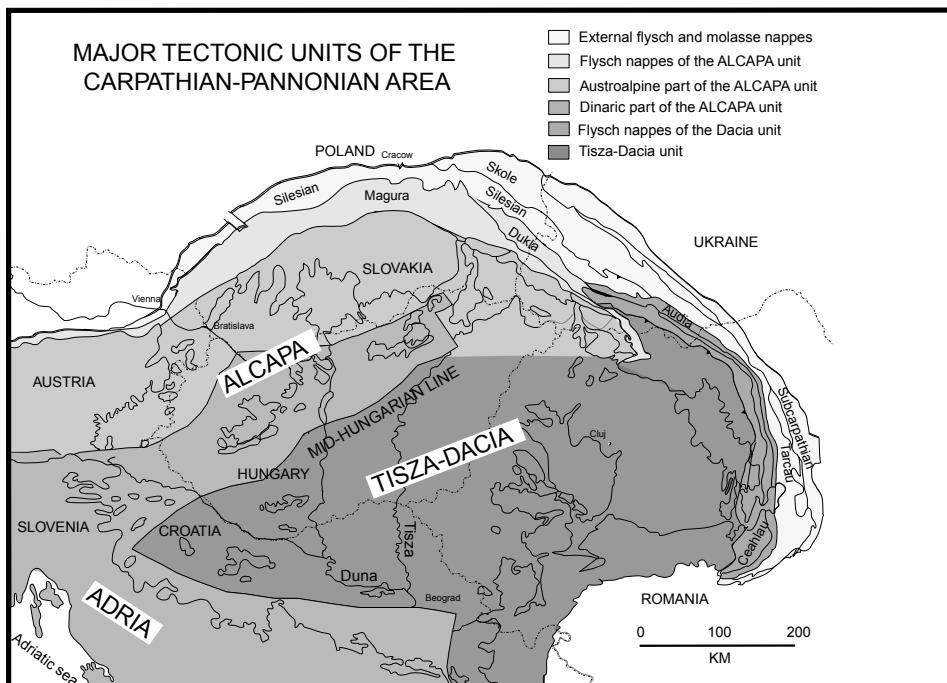


Figure 1. Main terranes of the Carpathian area. After Csontos 1995, modified.

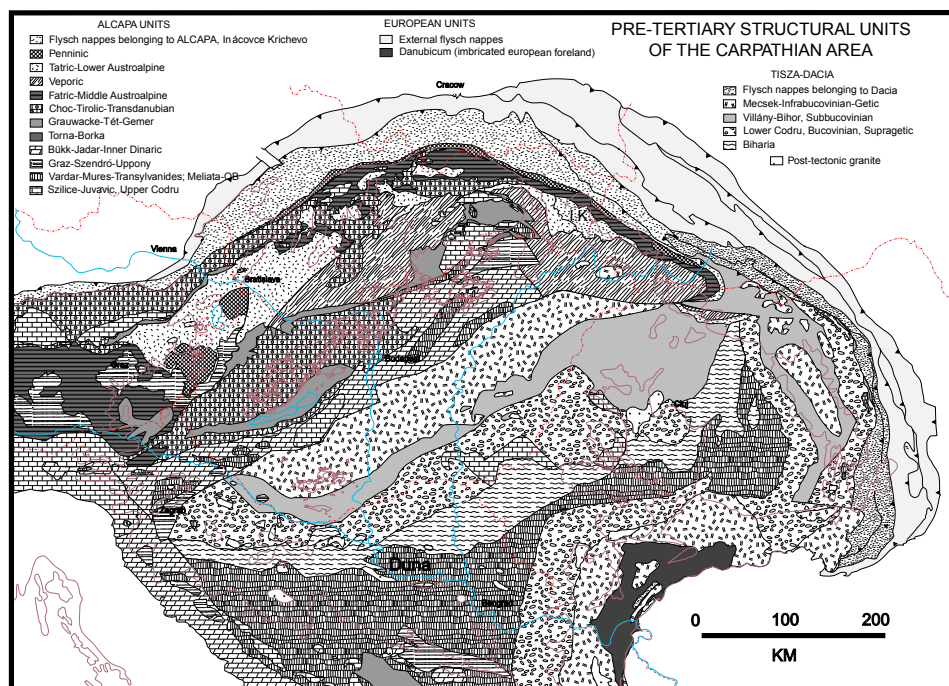


Figure 2. Mesozoic tectonic units of the Carpathian area without Tertiary formations (outcrop and subcrop). Modified from Csontos et al., (1992) after Árkai (1990), Árkai and Balogh (1989), Beck-Managetta and Matura (1980), Canovic and Kemenci (1988), Flügel (1988), Fülöp and Dank (1987), Fusán et al. (1987), Gnojek et al., (1991), Haas et al. (1988, 2000), Mahel' (1973), Nastaseanu (1975), Pamic (1998a), Pap (1990), Protic et al. (2000), Sandulescu (1975a, 1976, 1980, 1988) Sandulescu and Visarion (1978), Simunic et al. (1979), Soták et al. (1993) Tari 1994, Wessely (1988), and personal work.

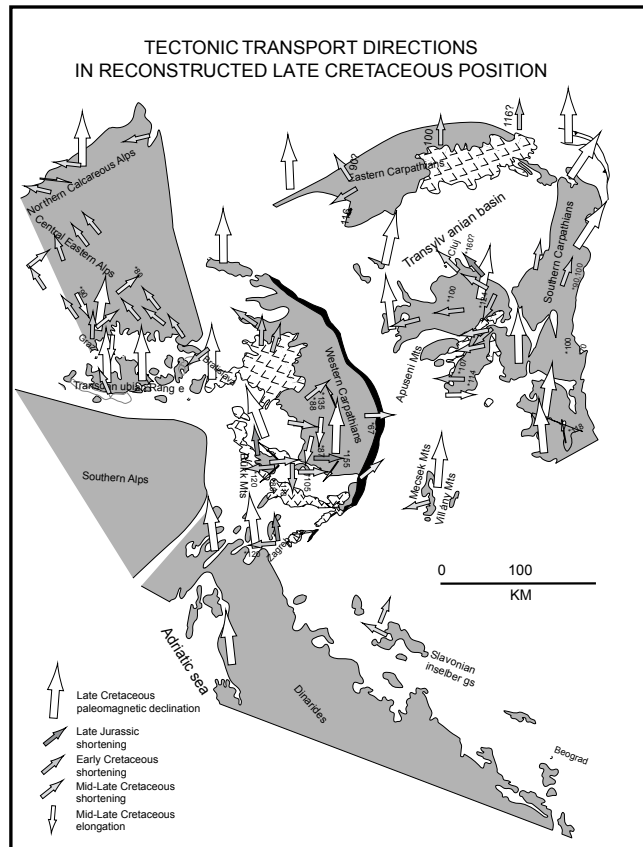


Figure 3. Tectonic transport directions and terrane positions reconstructed for rotations younger than Late Cretaceous. Pieces were reoriented so that arrows (measured declinations point northwards). Paleomagnetic declination data from Márton, tectonic transport data from various authors.

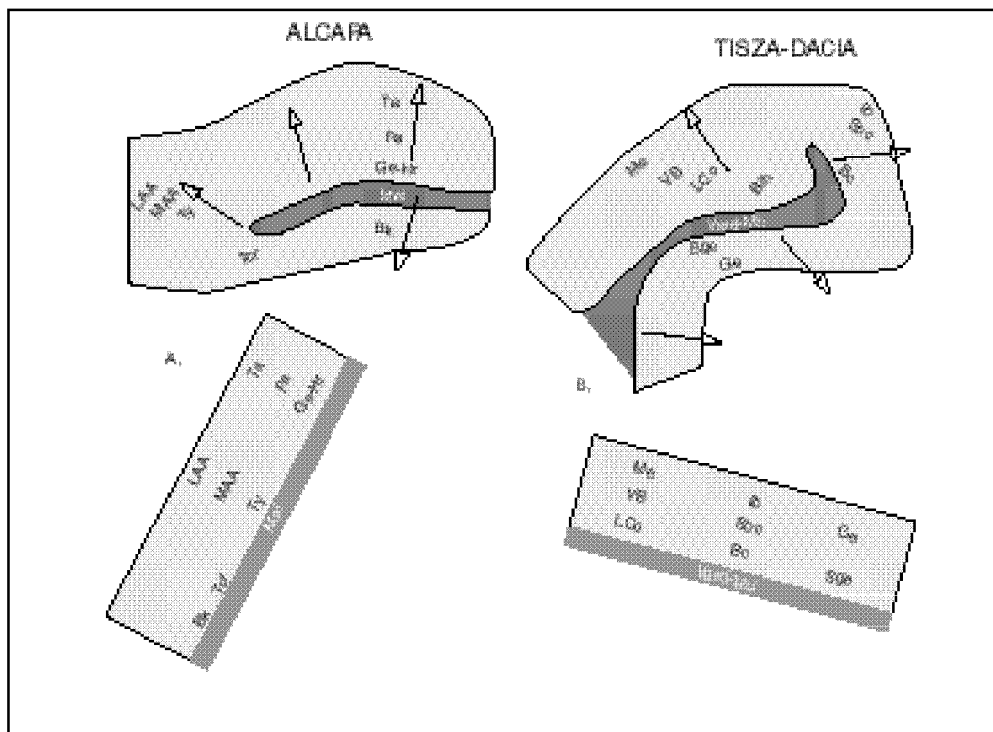


Figure 4. Schematic disposal of facies belts in Alcapa and Tisza-Dacia terranes, respectively. Arrows show main nappe vergencies. A, present situation and simplified reconstructed situation for Alcapa; B, present situation and simplified reconstructed situation for Tisza-Dacia.

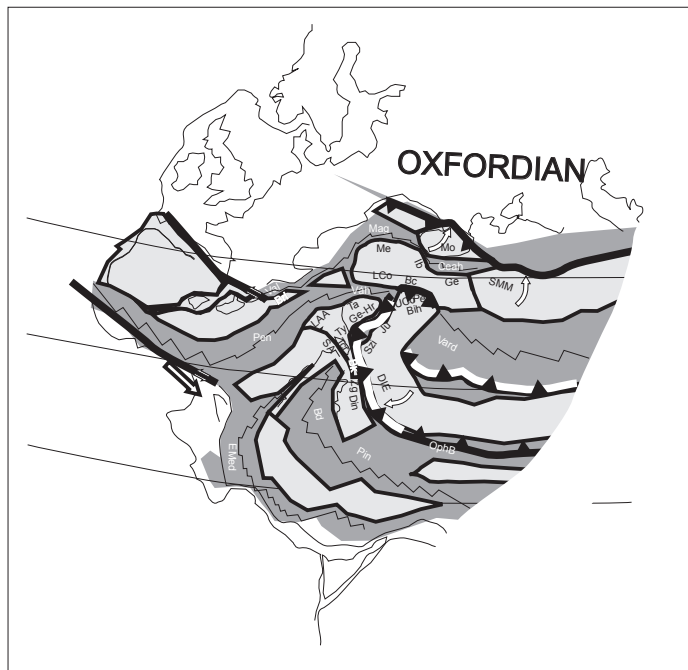


Figure 5. Proposed position of units in Oxfordian. Thin broken lines indicate rift axes and transfers. Thick lines indicate active tectonic zones. Open barbs: subduction, with barbs on the upper plate. Full barbs: collision-thrusting. Abbreviations TTZ: Tornquist-Teisseyre Zone; ?: Thinned crust of the External NE Carpathians (Silesian unit?); Mo: Moesia; Sl: Slavonian inselbergs; Me: Mecsek; VB: Villány-Bihar; LCo: Lower Codru; Ib: Infrabucovinian; Sbc: Subbucovinian; Bc: Bucovinian; Ge: Getic; Sge: Supragetic; SMM: Serbo-Macedonian Mass; Rho: Rhodopes; Cz: Czortosztyn; Ta: Tatric; Fa: Fatric-Veporic-Krizna; Ge-Hr: Gemer Paleozoic (Torna-Bórka included) and Hronic; Bri: Briançonnais; LAA: Lower Austroalpine; MAA: Middle Austroalpine; Ty: Tyrolic; Tcr: Transdanubian Central Range. Bk: Bükk; Zg: Zagrebacka Gora; Din: Dinaric plateau; SA: South Alpine; Ap: Apulia; Mel: Meliata; OphB: Ophiolite belt; Mal: Maliak; Parn: Parnassos plateau; Pin: Pindos; Ion-Trip: Ionian-Tripolitza; EMed: East Mediterranean; DIE: Drina-Ivanjica Element-Pelagonian; Szi: Szilice; Ju: Juvavic; Uco: Upper Codru; Bih: Bihária-Baia de Aries; Pe: Persani; Vard: Vardar;

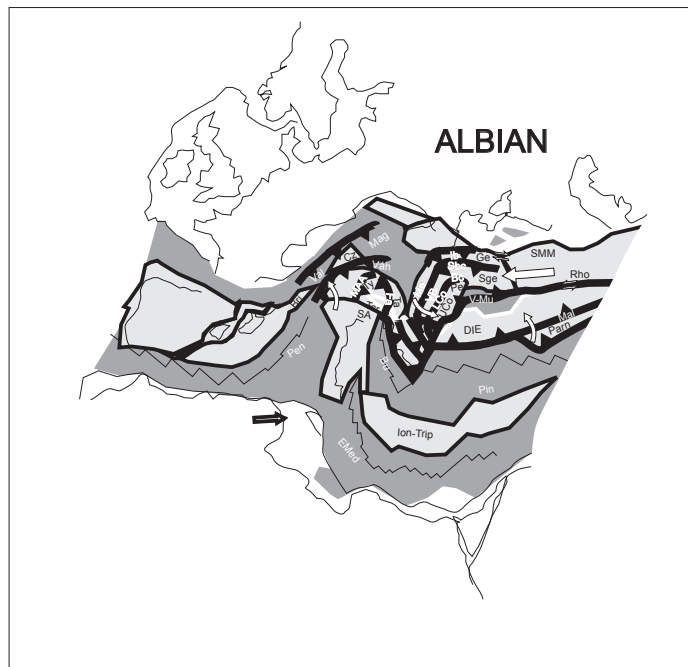


Figure 6. Proposed position of units in Albian. Contours and main latitudes inferred from Stampfli et al. (1998a, b)