plain environments (Fig. 2d). Paleotransport indicators in lower part of the Huty Fm. suggest to east northward to west northward oriented paleocurrents, reprendicular to basin axis. Sediments of Zuberec Fm., developed during Mid-Oligocene see level fall, they were deposited in elongate, more sand-rich fan (Fig. 2e). The study area is on distal part of this fan, however, shallow channels flanked by levees often reached into smooth, outer fan area. Youngest preserved part of the CCPB fill represents deposit of Biely Potok Fm., which is typical sand-rich fan (Fig. 2f). Proximal part of this fan with well developed suprafan lobes is in western part of basin (Orava region), in study area is preserved its distal part (Brzegi Mb.). Paleotransport direction in both, Zuberec Fm. and Brzegi Mb. is oriented toward east; submarine fans were redirected to axial position in basin.

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Gosau Deposits of the Apuseni Mts. as a Support to Understanding the Geodynamic Evolution of the Alpine/Carpathian Orogen

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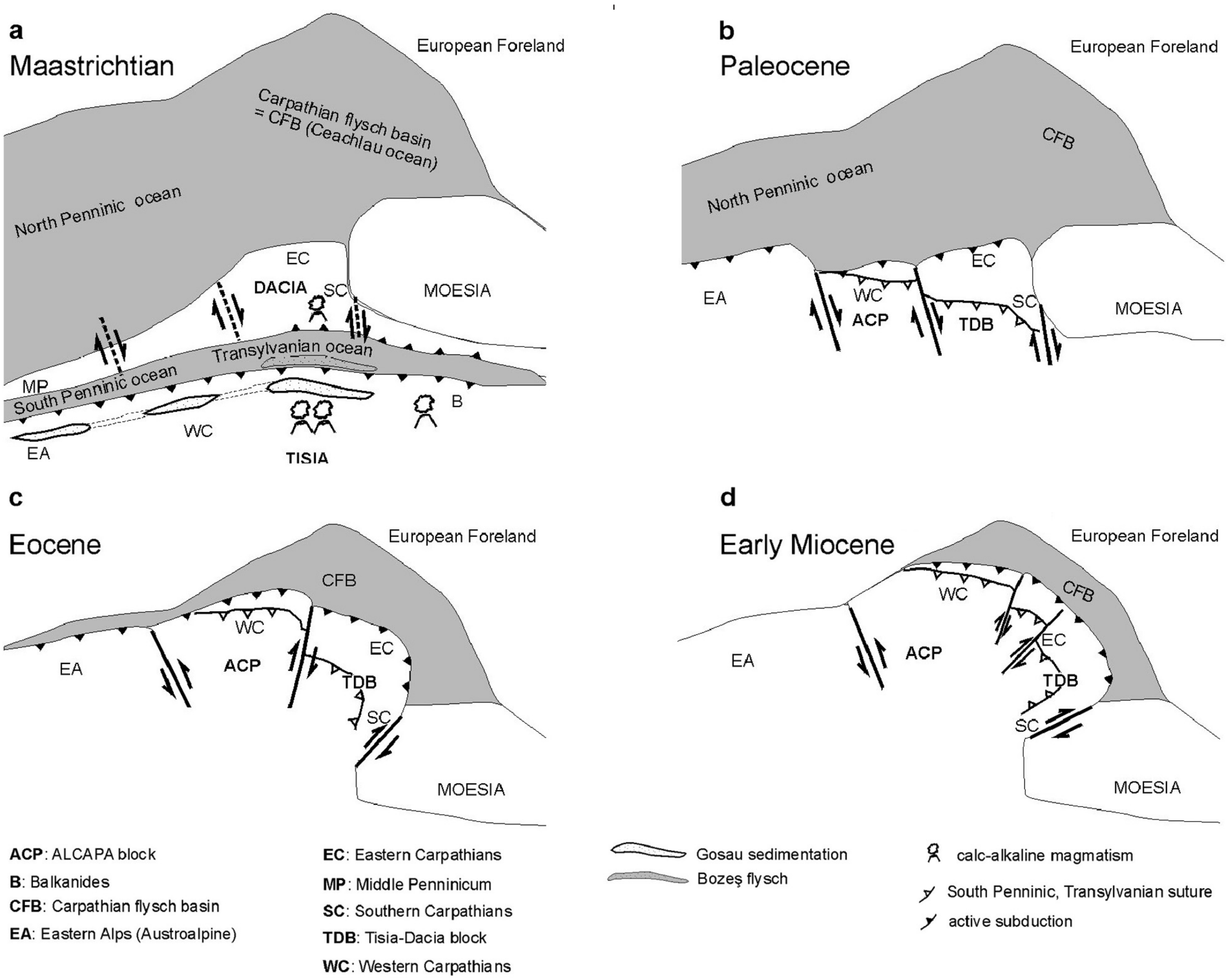
The present-day shape of the Alpine chain is a consequence of Mesozoic to Tertiary plate movements within the Tethys region. As part of this orogen, the Apuseni Mts. in Romania were formed during the Upper Cretaceous convergence between the Tisia and Dacia microplates. In both orogens (the Apuseni Mts. and the Eastern Alps) an Upper Cretaceous basin evolved, which commonly is known as Gosau basin. This work focuses on the sedimentologic and geodynamic evolution of the Gosau basins of the Apuseni Mts.

Sedimentologic records yield facies differences within the Apuseni Mts: the southern and eastern parts of the Apuseni Mts. record both, deep marine and shallow marine sediments, which, according to the Austroalpine definition, are grouped into the Lower Gosau Subgroup (shallow marine facies) and Upper Gosau Subgroup (deep marine facies). In the northern Apuseni Mts. only shallow marine sediments were deposited. Paleontological data constrain the stratigraphic range: sedimentation started in Upper Turonian time and ended in the uppermost Cretaceous. The sedimentation onset of the Lower Gosau Subgroup occurred diachronously with a lateral shift from southwest to northeast (Schuller 2004). The sedimentation onset of the Upper Gosau Subgroup does not show a diachronous pattern. Heavy mineral assemblages prove the erosion of areas lying on both sides of the elongated basin. Basin modeling based on vitrinite reflectance confirms maximum sediment thickness of approximately 3000 m, similar to what is know from the Eastern Alps. Fission-track age populations of detrital zircons from the Gosau sediments reflect three Mesozoic tectonothermal events in the hinterland: at 90–110 Ma, 130–150 Ma and 170–200 Ma (Schuller 2004). Two additional age populations record Paleozoic ages (250–300 Ma and ~400 Ma). The convergence of the Tisia and Dacia microplates resulted in a “soft” collision, which is indicated by non-resetting of detrital apatite fission-track ages from the Gosau sediments. However, there was increased exhumation in the crystalline hinterland, which is shown by thermal modeling of apatite fission-track lengths (Schuller 2004).

The achieved data lead to a reinterpretation of the plate tectonic evolution of the studied area and the proposal of a geodynamic model for the generation of such type of basins. Initial basin subsidence is a consequence of high-strain forced subduc-



■ **Fig. 1.** Position of continental blocks within the Eastern Alpine – Carpathian region from Late Cretaceous to Early Miocene.
(**a**) The South Penninic ocean subducted beneath the Austroalpine Unit At least in the Tisia-Dacia region subduction happend on both sides of the oceanic crust, since calc-alkaline magmatism is known on both plates. The Gosau sediments were deposited on the entire non-fragmented block, in elongated basins, which probably were connected to each other. The collision with the northern continetal slice happened in the Upper Cretaceous in the Eastern Alps and at the K/T boundary in the Apuseni Mts.
(**b**) The Paleocene collision on the western margin of Moesia resulted in dissection of the continuous continental block during the Paleocene (Zweigel 1997).
(**c**) The closure of the North Penninic ocean happened in the Eocene in the Eastern Alps. Its eastward prolongation (Cehlau ocean, after Zweigel 1997) was subducted until the Upper Miocene (figures b, c, d: modified after Zweigel 1997).

tion with high frictional shear at the contact between the overriding and subducting plate (Stern et al. 1992, Stern and Holt 1994), accompanied by flexure of the overriding plate and low basin subsidence rates during the deposition of the Lower Gosau Subgroup. Change to retreating subduction due to dehydrating and thus increasing slab density, accompanied by downward pull from the downbending plate, is responsible for the rapid basin subsidence and sedimentation of the Upper Gosau Subgroup. The installation of a cornerflow after the beginning of retreating subduction is inferred to be responsible for the Late Cretaceous banatite magmatism. The "soft" continental collision around the Cretaceous/Tertiary boundary was a consequence of the retreating subduction, as proposed for this type of subduction (Royden 1993).

The similarities to the Gosau occurrences of the Eastern Alps lead to direct correlation with the Alpine paleogeographic evolution and the assumption that a continuous ocean basin (South Penninic and Transylvanian ocean basin) has been consumed during Upper Cretaceous times (Fig. 1).

Depositioning of Upper Cretaceous flysch sediments (e.g. Bozeş flysch, South Apuseni Mts.) occurred into a second basin, which is interpreted as a deep sea subduction-trench basin. The difference to the Gosau basin is supported by basin modeling based on vitrinite reflectance (Schuller 2004).

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Crustal Structure of the Western Carpathians from CELEBRATION 2000 Data

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CELEBRATION 2000 was a large international cooperative experiment that focused on lithospheric structure in Central Europe. It consisted of a series of profiles along which wide-angle reflection and refraction seismic data were recorded. Profiles CEL01 and CEL04 are located in the transition from the old Precambrian and Palaeozoic Platforms to the young Alpine orogen (Carpathians). The data were modelled using 2D tomographic and forward modelling techniques. The profile CEL01 (about 900 km long) crosses the southwest margin of the East European Craton, the Trans-European Suture Zone, the Carpathians and reaches the Pannonian basin system. The depth of Moho boundary varies along the profile from 27–33 km under the Pannonian basin system area, 30–35 under the Carpathians and within the TESZ to 40–45 km under the East European Craton. The CEL04 profile (630 km long) starts in the Polish trough and crosses the Małopolska unit, the Carpathians and the Pannonian basin system. Along the CEL04 profile, the Moho interface shallows from 40 km beneath the Polish trough to about 35 km in the Małopolska unit. The crustal thickness is 43 km beneath the Carpathians, while in the Pannonian basin system the Moho interface shallows to 25 km. In the Pannonian basin system low upper mantle velocities of 7.8 km/s are observed. The structure of the West Carpathians was formed due to interplay between Palaeogene to middle Miocene subduction of the oceanic or suboceanic crust and subsequent collision. The architecture of the collision-related crustal suture was altered by subsequent mantle upwelling collapse and continuing convergence of plates. The subduction-related orogenic root is at least partially preserved in both profiles. Crustal thickness reaches there 35 km (CEL01) and 43 km (CEL04). The boundary between the Małopolska unit and the Bruno-Silesian unit is discernible north of the Carpathian frontal thrust along the CEL01 profile, but is not observed farther to the SE (CEL04) beneath the Carpathians. No substantial differences in the crustal structure between the Tisza unit and the ALCAPA unit were observed. Therefore, the Mid-Hungarian Line separating these units is not discernible. Upper mantle reflections observed along both profiles originate from a north-dipping mantle discontinuity, probably representing a shear zone related to collision and possibly ongoing convergence between European plate and ALCAPA unit.