60°. This orientation of s1 (NE-SW) coincides with that in the eastern segment of the Polish Outer Carpathians, both in the Palaeogene strata of Dukla and Silesian nappes and in the unconfortably overlying Middle Miocene molasses, as well as with the orientation of the present-day maximum horizontal stress axis, detected by breakout analysis.

Summing up, the stress field associated with jointing in the Magura nappe in the medial sector of the Polish Outer Carpathians has undergone clockwise rotation since the Late Cretaceous. The bulk of this rotation (130°) occurred during Palaeogene times, whereas Neogene rotation amounted to some 60°. No traces of this rotation have been found within other nappes.

The Miocene strata of the Carpathian Foredeep near Kraków display another picture. These strata are cut by four sets of joints and one set of gypsum veins. These structures appear to result from four successive deformation stages, including N-S extension of Langhian age, and three stages of subsequent compression (N-S, NE-SW and NW-SE). The last compressional episode appears to have been active during Pliocene-Quaternary times.

Jointing in the Skiba (Skole) Unit, Ukrainian Carpathians: preliminary results

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The Skiba (Skole) nappe is one of the outermost flysch nappes in the Outer Ukrainian Carpathians fold-and-thrust belt. The nappe is composed of a number of imbricated slices thrust one upon another in the middle-late Miocene times. In a SW-NE oriented profile, these are Slavsko, Rozhanka, Zelemianka, Parashka, Skole, Orovska and marginal slices, whose lithostratigraphic inventory includes: Upper Cretaceous thin- to medium-bedded Stryi beds, Palaeocene thick-bedded Jamna sandstones, Palaeocene-Eocene variegated shales and thin- to medium-bedded turbidites of Maniava, Pasiechna, Vyhoda and Bystritsa beds, Oligocene Menilitic beds and calcareous Holovets beds, as well as Oligocene-Miocene thin- to medium-bedded sandstone-shale complexes of Verkhovina beds. Joints and shear/hybrid shear fractures have been measured at some 40 localities equally spaced throughout all but the marginal slices of the Skiba nappe along the Opir river section.

The fractures are mostly kathetal and cluster into two to three cross-fold sets. The axes of maximum compression associated with jointing usually trend NE-SW to W-E, as far as Paleogene and Miocene strata are concerned, being subperpendicular to the overall strike of thrusts and fold axes. In the Upper Cretaceous strata, however, the axes in question strike N-S to NNE-SSW. These results are fairly coincident with those obtained by microtectonic studies of Kopyst'iansky and Kryzhevich (1985) on orientation of optical axes of deformed quartz crystals, and suggest that jointing must have been coeval with folding and thrusting of the rocks studied.

Kopyst'iansky R. S. and Kryzhevich V. L. 1985. Microstructural analysis of flysch deposits of the Carpathians and its significance for oil geology (in Russian). AN USSR, Inst. Geol. Geoch. of Fossil Fuels, 28 pp., Lvov.

The Outer Eastern Carpathians record continuous convergence since the late Cretaceous.

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Convergence and resulting folding and nappe stacking of the Eastern Carpathian Moldavides nappe complex have traditionally (e.g. Sandulescu 1984) been interpreted to have occurred in two main phases: in late Cretaceous and in Miocene times. This separation was enforced by the previous view of the internally conformable Maastrichtian to Eggenburgian Gura Beliei unit as the sedimentary cover of the folded, but not yet stacked area of the future Teleajen and Macla nappes in the front of the Ceahlau nappe complex. Strong deformation of the base of the Gura Beliei unit (Maastrichtian Gura Beliei Marls) suggests that large parts of this unit represent an out-of-sequence nappe. Its emplacement age is constrained to be Eggenburgian to Ottnangian, because lower Eggenburgian strata are a conformable member of the pile (Sandulescu et al. 1981) and the Ottnangian-Karpatian Doftana Molasse (Stefanescu & Marunteanu 1980) covers the folded pile sedimentary. This re-interpretation allows foreland propagating, in-sequence emplacement of the Teleajen, Macla, and Audia nappes between the Senonian (youngest sediments in Teleajen nappe) and the Lower Miocene (sedimentary onlap of the later folded Doftana Molasse on an already deformed nappe edifice). The progressive eastward shift of sedimentary facies and depocenter especially in the structurally lower Tarcau nappe (Sandulescu 1984) reflects the propagating deformation front in this interval. Prograding upper age limits of conformable sedimentation and successively younger ages of sediments covering the folded pile of the outer part of the Moldavides nappe complex demon-strate continued advancing of the deformation front from Lower Miocene in the Tarcau Nappe to at least Sarmatian in the deformed foreland. Re-interpretation of the top of the frontal wedge of the Subcarpathian nappe as roof backthrust of a triangle zone (as indicated by folded overlying Sarmatian to Pleistocene strata) indicates con-tinuing deformation to sub-Recent times. Recent earthquakes (Oncescu 1984) below the bend region and results of geodetic surveys (Schmitt et al 1990) document ongoing tectonic activity.

Therefore, the structural evolution of the outer Eastern Carpathians took place between late Cretaceous and Recent times and reflects continuous, but punctuated convergence during this timespan. Deformation rates peaked during Early and Middle Miocene which is a result of possibly accelerated convergence rates in the Early Miocene, and Middle Miocene continental collision following preceding subduction of oceanic or thinned continental crust.

Dating the rotation of the Tisza-Dacia block by paleomagnetic analysis of Tertiary sedimen-tary rocks.

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Clockwise rotation of the Tisza-Dacia block (TDB) by ca. 90° has been demonstrated by a number of studies, but the precise dating of this rotation is still lacking. Published analyses of rotated Late Cretaceous magmatites ('Banatites') from the Apuseni Mts. and the Southern Carpathians constrain the rotation to be post-Cretaceous, and non-rotated Late Miocene magmatites from the Eastern Carpathians yield a lower age bracket. In contrast to previous paleomagnetic determinations of the rotation of the romanian parts of the Tisza-Dacia block which were based on usually poorly dated magmatic rocks, our study will be based mainly on paleomagnetic analyses of well-dated sedimentary rocks.

The Transylvanian Basin is situated in the stable center of the Tisza-Dacia block and paleomagnetic vectors documented in its sedimentary filling will therefore be a good representation for the time-evolution of the block's rotational movement. This study will concentrate on sediments of the western part of the Transylvanian Basin which document almost all the time-span from Late Cretaceous to Late Miocene times and did not undergo any significant deformation since they were deposited. In addition, we will analyse magmatic and sedi-mentary samples from the Southern Carpathians to constrain the areal extent of the TDB in pre- and syn-rotation times. This part of the project is designed as a test for the hypothesis that the eastern and central parts of the Southern Carpa-thians are integral parts of the rotated TDB, whereas the western Southern Carpathians consist of partly rotated slices of the TDB which were accreted to the Moesian plate during the block's rotation.

Our project, funded by NATO through its Linkage Grant scheme, is a cooperation between research groups from Tübingen, Cluj-Napoca, and Bucuresti and its participants bring together regional, sedimentologic, biostratigraphic, paleomagnetic, and tectonic expertise. A pilot study has been started this year and we will present preliminary results of it.

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