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