rotation of host strata. The orientation of the thrust fault strike of the (1) group is changing along the map-scale fold axis. On the contrary, the thrust fault strike of the (2) group is nearly stable and oriented about WNW-ESE. Therefore, the most probably during the tectonic shortening of the studied part of the Silesian nappe the horizontal compression was stable and oriented NNE-SSW. In such stress field the map-scale folds were formed and initially their fold axes were oriented WNW-ESE. During this time were formed also the in-sequence thrust faults striking WNW-ESE. Increasing of the tectonic shortening of this area caused increasing of the thrusting amplitude, which cut these folds. This thrusting caused the couterclockwise rotation of the western parts of the map-scale anticlines and clockwise rotation of the eastern parts of these folds. At the same time the existing mesoscopic thrust faults underwent also counterclockwise or clockwise rotation, together with the host strata. However, newly forming thrust faults were still characterized by WNW-ESE oriented strike.

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Calcite Twinning Stress Inversion Using OIM (EBSD) Data

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Deformation origin of calcite twin lamellae (e-twins) and their crystallographic laws have been recognized in the end of the 19th century (e.g., Mügge 1883). During the last 60 years it has been found that twinning is an important intracrystalline deformation mechanism with low critical resolved shear stress (e.g. Turner 1963, DeBresser and Spiers 1996) and therefore it is the main deformation feature for low temperatures, low confining pressures and low finite strains (up to 15 %). Since the fifties of the 20th century, when Turner (1953) developed a method for determination of stress axes from a set of e-twins (TDA), it became a useful tool for paleostress analysis in deformed calcitic rocks (or rocks containing calcite veins). Several methods of differential stresses estimations (Jamison and Spang 1976, Rowe and Rutter 1990) and stress tensor calculations (e.g. Lacombe and Laurent 1996) have been developed during last 60 years based on experimental and field data.

Orientation of calcite twin lamellae as well as the c-axis orientation can be measured directly on an universal stage. This cheap method does not require any special samples but it is subjective and inaccurate, especially if c-axis orientation is measured and very thin lamellae may cause problems as well (difficulty of differentiation between cleavage planes and e-twins). However, Orientation Imaging Microscopy (OIM) using Electron Backscatter Diffraction (EBSD) provides precise data without subjective factors. A chosen area within a thin section is investigated using a hexagonal grid of lattice orientation measurements. Such data set can be presented as a bitmap, where each pixel represents one measurement coded by color. One can then directly observe misorientation of grains, subgrains and e-twins. The greatest disadvantage of OIM is that it is a time-consuming method. One orientation map covers a tiny area (0.03 mm^2, 82,000 measurements), so investigating a sample of 1×2 cm would take weeks. We propose a grid of linescans to compensate this disadvantage. These linescans with measurement step 0.6 microns arranged in an orthogonal grid with 1 mm interval would cover a much larger area (1.3×0.7 cm) using the same number of measurements. This method is able to provide appropriate data from a relative large area in an acceptable time.

A new computer program has been developed for stress analysis of calcite twin lamellae, including most of the methods mentioned above, and processing EBSD data files as well. In our view, the optimal method of paleostress orientation and magnitude determination in calcitic carbonate complexes is the total search method of Lacombe and Laurent (1996). A modification of this method has been used in the Moravian Karst (Bohemian Massif) model area. Instead of using a set of random reduced stress tensors and then penalisation function to choose the most probable stress tensor, a systematical searching in all possible stress tensors generated from input limits was preferred.

Combination of precise calcite lattice orientation measurements (EBSD) and numerical methods of paleostress analysis makes calcite a very useful tool for evaluating deformation pathways in sedimentary complexes.

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The Alps-Dianrides-Carpathians Connection: a Compilation of Tectonic Units as a First Step for Retrodeforming the Pre-Miocene Configuration

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In an attempt to understand the evolution of the Alps-Dinarides-Carpathian connection in time and space we attempted to design a tectonic map of the entire system. This map was arrived at by compiling existing geological maps and by using subsurface information taken from the literature for those parts of the system that are covered by very thick Mio-Pliocene (in case of the Pannonian basin) or Mid-Cretaceous to Pliocene deposits (in case of the Transylvanian basin). This map will serve as a base map for a series of retrodeformations we plan to perform in the future. The first obvious step in such retro-deformations consists in establishing the pre-Mid-Miocene (pre 20 Ma) geometry of the various tectonic units of the system. The retro-deformation of Mio-Pliocene rotations and translations was sketched for the first time by the pioneering work of Balla (1987). Many attempts were made later on, including attempts to retrodeform the situation during Tertiary and/or Cretaceous orogeny (i.e. Csontos and Vörös 2004). There is also a large amount of very differing reconstructions regarding the opening of the various oceanic domains of Neo-Tethys, including the Alpine Tethys (e.g. Haas and Pero 2004, Stampfli and Borel 2004). However, all attempts to retrodeform configurations valid for Early Tertiary and/or Mesozoic configurations have to rely on a careful retrodeformation of the rather spectacular rotations and translations that led to the the invasion of various "blocks" into the Carpathian embayment during the Miocene to Pliocene, and such a retro-deformation is not available in sufficient detail yet. The reasons for this are manyfold, but one important reason is that we do not have a clear picture yet as to what the link was between the different orogens of the system (Alps, Carpathians, Dinarides). Establishing these links will serve as an important input for restoring Miocene extension, shortening, strike slip faulting and rotations, all of them unfortunately overlapping in space and time. Hence this complex partitioning of strains, translations and rotations is therefore extremely difficult to retro-deform without having a clear concept as to how exactly these orogens were linked in pre-Miocene times.

Our map individualised the following most important tectonic elements, grouped into the following series of first-order tectonic units:

1. Miocene thrust belt: This thrust belt is the only feature that is common to Alps and Carpathians and which can be followed from the Alps all the way around the East Carpathians into the bending zone NW of Bucharest. The South Carpathians were juxtaposed with the Moesian platform by strike-slip movements along curved faults rather than by thrusting (Schmid et al. 1998). This belt consists of, from external to internal, (a) the thrusted internal fore-deep, (b) the Tarcau-Skola nappe system, and (c) the Audia-Macla-Convolute flysch-Silesian-Ducla-Subsilesian nappe system.
2. Europe-derived allochthons: These comprise, from external to internal, (a) the Helvetic and Subpenninic unists of the Alps and the Danubain nappes of the South Carpathians, (b) the Briançonnais terrane of the Alps that terminates west of the Tauern window (Schmid et al. 2004a), (c) the Rhodope unit of still uncertain position, (d) the Bukovinian-Getic-Sredna Gora nappe system, and (d) the Serbo-Macedonian unit.
3. The Tisza "block" with mixed European and Apulian affinities: This block broke off Europe during the middle Jurassic, i.e. at the same time as the Piemont-Liguria ocean of the Alps opened. Hence it had European affinities before this opening, being positioned well north of Neotethys (Meliata). As a function of the opening of an ocean between Tisza and Europe, this block moved into a paleogeographic position that is comparable to that of the Austroalpine nappes, hence the post-rift sediments such as late Jurassic Maiolica and/or radiolarites exhibit "Apulian" affinities. We distinguished, from external to internal, (a) the Bihor-Mescek nappe system that is closest to the