Vorträge und Poster, Institut für Geologie. Institut für Paläontologie Univ. Wien, p. 74.
KERCSMÁR Zs., 2001. Ichnofossil record (rock-borers) and taphonomical reconstruction (nummulite accumulations) of initial Eocene sequences in the eastern margin of the Eocene Tatabanya Basin, Hungary. Abstracts of the 21st IAS Meeting of Sedimentology, Davos, p.113.
TARI G., BÁLDI T. and BÁLDI-BEKE M., 1993. Paleogene retroarc flexural basin beneath the Neogene Pannonian Basin: a geodynamical model. *Tectonophysics*, 226: 433–455.

Karst Phenomena as Indicators of Tectonic Styles

Eva KILENYI

Narcisz u. 26. 1126 Budapest, Hungary

The three main tectonic styles: normal faults, reverse faults and strike-slip faults can be recognized in up-to-date seismic time- or depth sections. Main criteria of each one are well described by several authors. Seismic examples of the different styles will be presented. The question is, when no seismic section is available, and the geologist in the field can only observe small sections of a fault plane how can he apply the seismic criteria in identifying the tectonic style. I had the opportunity of walking inside a flower structure, which is the main indicator of strike-slip movements. It happened in the Massif Centrale of France, where the brook Bonheur, having its source in the granite massif of Mont Aigoual, reaching its contact with the Devonian limestone, disappears. Its underground passage is 800 m long and when it reaches the surface again in a 100 to 120 m deep gully, it is called the Bramabiau – meaning the sound of belling stags – as water rushes out from the cave. Several photos will be presented to prove that the features of this cave fulfil the criteria of strike-slip movement. As the route of water penetrating limestone surfaces and causing karst phenomena is controlled by tectonics, we can use the inverse route: deduce the style of tectonic movements from the characteristics of karst phenomena.

Cretaceous Structural Evolution of the Bakony Mts., Hungary

Ada KISS[1] and László FODOR[2]

[1] Eötvös University, Department of Applied and Environmental Geology, Pázmány 1/C, H-1117 Budapest, Hungary
[2] Geological Institute of Hungary, Stefánia 14, H-1143 Budapest, Hungary

The Bakony Mts. is the SW part of the Transdanubian Range, situating SE from the Danube Basin. According to its Cretaceous structural setting, the Bakony Mts. is part of the Alpine nappe system (Tari 1995, Fodor et al. 2003). In our poster we present new paleostress data and other observation focused for the Cretaceous deformational phases of the Bakony Mts. In addition to the systematic compilation of the measured paleostress phases of the Cretaceous outcrops, and the tectonic settings, our data sets can have implications for the Cretaceous structural evolution of the Bakony area.

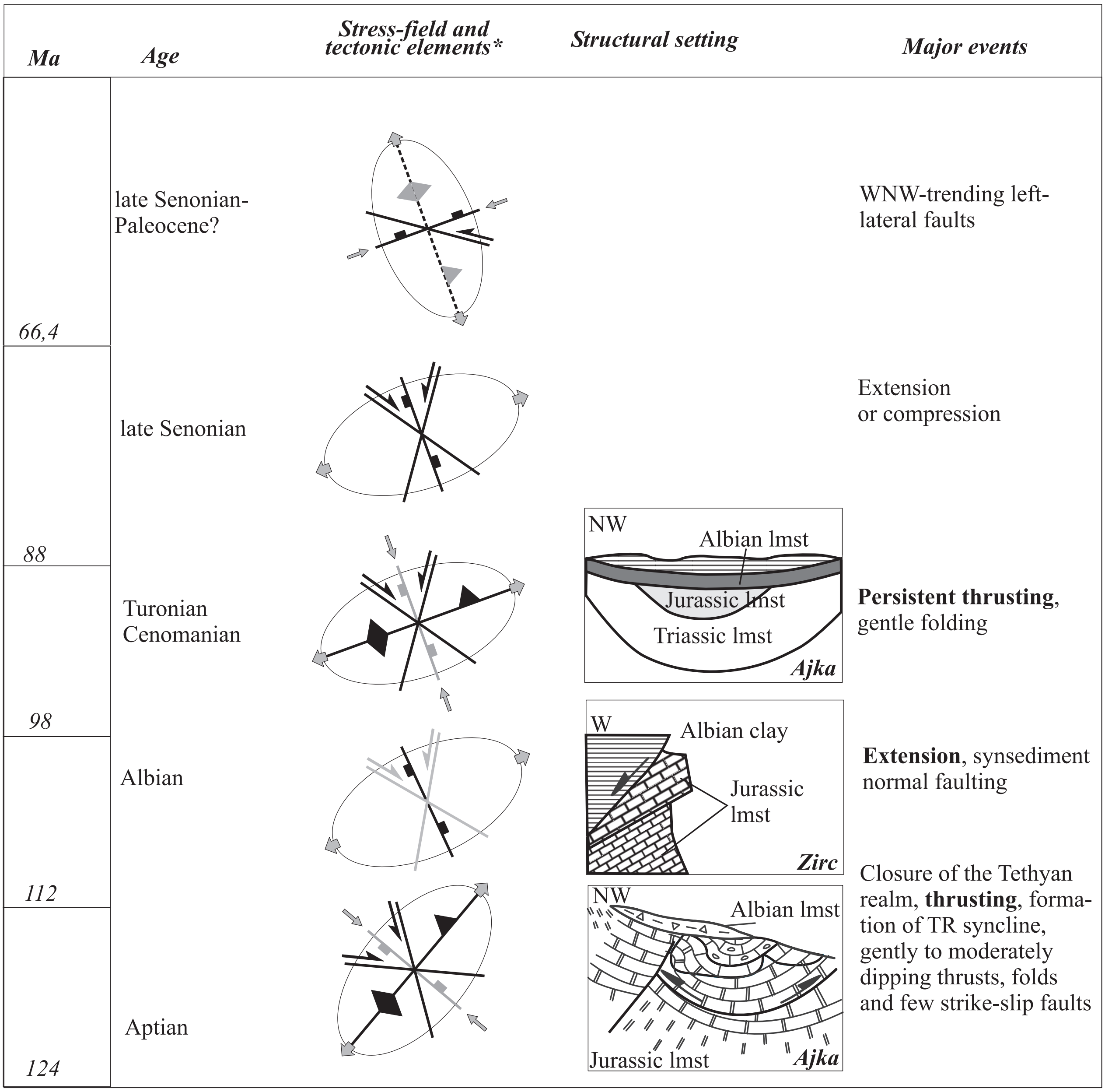
The most important structural element within this upper nappe of the Alpine nappe system is a pre-Tertiary double-syncline with Jurassic-Cretaceous formations in its core. The axes of the synclines are NE-SW. It is covered by almost-horizontal Senonian formation on the NE wing of the structure, but folds and thrust are covered by gently dipping Albian formation at the southern part of the Bakony. It indicates at least two tectonic phases within the nappe-formation.

There was an important tilting event during the late Early Cretaceous, when the synformal structure of the Transdanubian Range formed (Tari 1995). We detected at several outcrop gently dipping reverse faults and associated folds belonging to this (W)NW-(E)SE compressional phase (Kiss et al. 2001, Albert 2000). We have indications for the upper age limit of this deformation from a cross section near Ajka (Fig. 1.), where the NE-SW striking folds and thrust in the Triassic and Liassic carbonates are covered by flat-lying Albian cherty limestone (Fig. 1) (Fodor 1998). We have a looser time constraint at the SW part of the TR, Sümeg, the steeply dipping Aptian limestone is covered by flat lying Senonian formation (Haas et al. 1984). The steeply dipping Aptian layers show small-scale duplexes, formed at sub-horizontal bed position, by NW-SE compression.

The beginning of this compression could be post-Barremian based on the section of a quarry nearby Zirc, where the tilted Barremian limestone is discordantly covered by late Aptian crinoidal limestone (Fülöp 1964). The age of this deformation can be early Aptian. Pre-late Aptian deformation is also suggested by variable pebble composition of the late Aptian basal layers (Lelkes 1990).

We detected a well-dated middle Albian ENE-WSW extensional event at a Bakony Mts. At two outcrops nearby Zirc the formation of Albian clay is controlled by NNW-EES to N-S striking normal faults, sometimes with syn-sedimentary features (Fig. 1).

We observed a (N)NW-(S)SE compressional type stress field in Albian limestone at several sites. The phase is characterised



■ **Fig. 1.** Stress fields, simplified fault pattern, and structures in the Bakony Mts.

by gently dipping reverse faults perpendicular to the compression. At some places the Albian-Cenomanian formations occur in the core of map-scale synclines (Fig. 1).

Senonian stress field was not determined without doubt. Tari (1995) suggested compressional origin of the Senonian basins, with similar orientation that of the Albian and Cenomanian-Turonian phases. On the other hand, the formation of asymmetric ENE-WSW trending horst and graben-type structures was also related to extension (Haas 1999).

Several authors determined ENE-WSW compression (Bada et al. 1996, Fodor 1998, Albert 2000) from the Transdanubian Range. The detected W(SW)-E(NE) compression can be documented in a number of places in the Bakony Hills and further to the NE (Bada et al. 1996, Bíró 2003). The related faults are WNW trending left-lateral faults (parallel with the most important fault of the Bakony Mts, called Telegdi Roth line. They affected Triassic, Liassic and Albian site and few Senonian occurrences while no faults from Eocene has reported yet in the Transdanubian Range. The age of this post-Senonian tectonic phase is questionable, latest Cretaceous–Paleocene cannot be ruled out.

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References

ALBERT G., 2000. Folds in the northern Bakony Mts., Hungary. MSc. Thesis, Eötvös Univ. Dept. Gen. Hist. Geol., Budapest, Hungary.

BADA G., FODOR L., SZÉKELY B. and TIMÁR G., 1996. Tertiary brittle faulting and stress field evolution in the Gerecse Mts. N. Hungary. *Tectonophysics*, 255: 269–290.

BÍRÓ I., 2003. Structural investigation of the Vértessomló Line near the Mária gorge (in Hungarian, translated title). MSc. Thesis, Eötvös Univ. Dept. Regional Geol., Budapest, Hungary.

FODOR L., 1998. Late Mesozoic and early Paleogene tectonics of the Transdanubian Range. Abstracts of XIVth CBGA Congress, Vienna, Austria, p.165.

FODOR L., KOROKNAI B., BALOGH K., DUNKL I. and HORVÁTH P., 2003. Nappe position of the Transdanubian Range Unit ('Bakony') based on new structural and geochronological data from NE Slovenia. *Földtani Közlöny*, 133: 535-546.

FÜLÖP J.. 1964. Unterkreide-Bildungen (Berrias-Apt) des Bakony Gebirges. *Geol. Hung. Ser. Geol.*, 13.

HAAS J., JOCHA-EDELÉNYI E., GIDAI L., KAISER M., KRETZOI M. and ORAVECZ J., 1984. Geology of the surroundings of Sümeg. Geologica Hungarica, ser. Geol. 20.

HAAS J., 1999. Genesis of Late Cretaceous toe-of-slope breccies in the Bakony Mts. Hungary. *Sed. Geology*, 128: 51-66.

KISS A., GELLÉRT B. and FODOR L., 2001. Structural history of the Porva Basin in the Northern Bakony Mts. (Western Hungary): Implications for the Mesozoic and Tertiary tectonic evolution of the Transdanubian Range and Pannonian Basin. *Geologica Carpathica*, 52: 183-190.

LELKES Gy., 1990. Microfacies study of Tata Limestone Formation (Aptian) in the northern Bakony Mountains, Hungary. *Cret. Res.*, 11: 273-287.

TARI G., HORVÁTH F. and WEIR G., 1995. Palinspastic reconstruction of the Alpine/Carpathian/Pannonian system. In: F. HORVÁTH, G. TARI and Cs. BOKOR (Editors), Extensional collapse of the Alpine orogene and Hydrocarbon prospects in the Basement and Basin Fill of the Western Pannonian Basin. AAPG International Conference and Exhibition, Nice, France, Guidebook to fieldtrip No. 6., Hungary, pp.119–132.

Do We Know the Oldest Rock from the Western Carpathians at all?

Milan KOHÚT[1], Sarah C. SHERLOCK[2] and Ulrike POLLER[3]

[1] Dionýz Štúr Institute of Geology, 817 04 Bratislava, Mlynská dolina 1, Slovakia
[2] CEPSAR, Department of Earth Sciences, The Open University, Milton Keynes, UK
[3] Max-Planck-Institute for Chemistry, D-55020 Mainz, Germany

The oldest rocks on Earth found so far are the Acasta Gneisses in northwestern Canada near Great Slave Lake (4.03 Ga) and the Isua Supracrustal rocks in West Greenland (3.7–3.8 Ga), but well-studied rocks nearly as old are also found in the Minnesota River Valley and northern Michigan (3.5–3.7 Ga), in Swaziland (3.4 to 3.5 Ga), and in Western Australia (3.4–3.6 Ga). Indeed, these most ancient rocks are found exposed at the surface in parts comprising the Precambrian shield, a stable core of the continental landmass, very old rocks are found in the mobile – orogenic belts as well. Generally, the oldest rocks are known mainly from cratonic areas forming by greenstones and/or gneissic rocks, whereas in the young collisional belts are the older rocks present in the form of basement slivers. The basement areas in the modern collisional orogenic belts such as the Alps, Carpathians or Himalayas often comprise multistage metamorphic and magmatic events. It is common that within these young (Cretaceous–Cenozoic) orogenic belts locally survived relatively old rocks. The oldest orthogneissic rocks known from Himalayas are as old as 1850 Ma (Zeitler et al. 1989) although Late Proterozoic – Early Paleozoic (820–460 Ma) gneissic and granitic rocks are not so scarce there (Ahmad et al. 2003). However, the Proterozoic rocks are extremely rare within the basement of the Alps e.g. mantle related 1.72 Ga peridotite, 870 Ma gabbro from Central Alps (Gebauer 1993), and/or intermediate meta-igneous rocks 650–600 Ma from Eastern Alps (Thöni 1999). There are relatively more frequent only the products of the Cambrian and Ordovician magmatism (530–450 Ma) often sheared onto orthogneisses in the Alps (see review Schaltegger and Gebauer 1999). Due to missing of relevant isotopic dating the situation in the Carpathians is more or less obscured, indeed, scarce Late Proterozoic orthogneiss 770 Ma and granites 570 Ma in age were identified in the South Carpathians (Liégeois et al. 1996). As for almost all European basement territory, the Hercynian orogeny is dominant within the Western Carpathians basement (WCB) areas at the present erosion level. Available isotopic data (U/Pb, Rb/Sr, and Ar/Ar) support mainly the event between 360–340 Ma. The HT/MP metamorphism with concomitant widespread granitic magmatism has heavily overprinted basement precursors, and masked the polyorogenic history of the WCB. However, as observed in other European basement areas there exist some indication of older processes in the WCB. The oldest rocks identified so far in the Western Carpathians are metatrondhjemitic orthogneisses from layered amphibolites dated to be 514 ± 24 Ma (Putiš et al. 2001) and felsic Murán orthogneisses 470–450 Ma (Gaab et al. 2003) in age. Albeit, there exist some indications of older rocks on the basis of our reconnaissance study from the Patria crystalline complex – Branisko Mountains, suggesting for long multistage evolution. The northern part of the Branisko Mts. – Smrekovica massif is composed of a crystalline core – Patria complex consisting of magmatic rocks - including a biotite granodiorite to tonalite and felsic two-mica granite to granodiorite, from metamorphic rocks there are present