

## **THERMOCHRONOLOGICAL INVESTIGATIONS FROM THE PELAGONIAN AND SUBPELAGONIAN ZONE (REPUBLIC OF MACEDONIA AND NORTHERN GREECE). NEW K/AR, ZIRCON AND APATITE FISSION TRACK DATA**

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The northern Pelagonian crystalline zone (NPCZ) is part of the NNW-SSE trending Pelagonian zone (PZ) which extends from Skopje (Macedonia) to northern Evvia (Greece) covering a ca. 420 km long and 60 km wide area. Mesozoic cover rocks overlay the crystalline rocks, which crop out in tectonic windows (e.g. Olympus-Ossa, Pelion, Kranea).

For the southern part of the Pelagonian crystalline zone early Cretaceous nappe stacking and a Tertiary extensional phase is proven by numerous authors (e.g., SCHERMER et al., 1990; WALCOTT, 1998; LIPS et al., 1998, 1999). From the northern part of the Pelagonian zone practically no modern structural geological, petrological and thermochronological data are available. First petrogenetic characteristics of the rocks and some structural data have been presented by KOSSMAT, 1924; MEDWENTZSCH, 1956; JANCEV et al., 1977 and DUMURDZANOV, 1985. An unspecified K/Ar age of 800–1000 Ma for a Pelagonian granite had been presented by DELEON, 1966.

The Pelagonian crystalline zone can be separated into a lower unit (I) consisting of gneisses, micaschists, granitoides, migmatites and amphibolites and an upper unit (II) comprising a mixed series of micaschists, gneisses and marbles. The metamorphic gradient increases from greenschists facies conditions at the margin of the Pelagonian crystalline to amphibolite facies conditions in the central part. The high pressure / low temperature paragenesis of crossite + epidote + white mica + albite + quartz represents a meta-

morphic event under blueschist facies conditions at the northern margin of the Pelagonian crystalline zone (Mt. Vodno near Skopje).

Ongoing structural geological investigations document a polyphase deformation history of the Pelagonian zone and the adjacent tectonic units of the Vardar- and Subpelagonian zone.

Some 40 biotite and white mica mineral concentrates from more than 30 samples have been analysed by the K/Ar technique.

(I) The first group comprises ages from biotite and white mica derived from unfoliated granitoids and amphibolites of the Pelagonian zone. They range from  $447 \pm 17$  Ma to  $267 \pm 10$  Ma and show that relics of a Hercynian basement are present.

(IIa) Eohellenic ages between  $148 \pm 6$  Ma and  $111 \pm 4$  Ma of the second group representing Late Jurassic to Early Cretaceous nappe stacking associated with the development of the dominating fabrics and structures in the rocks of the Pelagonian crystalline zone. All micas of this group have been separated from strongly foliated paragneisses, orthogneisses (foliated granites), micaschists, cipollinos and blueschists.

(IIb) Three K/Ar ages between  $102 \pm 4$  Ma and  $86 \pm 3$  Ma were gained from micaschists and gneisses from the southern part (Kaimacszalan), overlain by Mesozoic cover rocks and micaschists of the Vardar zone.

(III) Tertiary white mica ages around 64 Ma were obtained from rocks of the Mesozoic sequence from the SE part of the study area.

Westward movement along a mylonitic shear zone in the western part of the studied area (near Brod) is documented by an Upper Eocene to Lower Oligocene K/Ar white mica fabric age ( $36\pm 1$  Ma).

Zircons from the central part of the Pelagonian crystalline zone yield fission track ages between  $84\pm 3$  Ma and  $68\pm 4$  Ma. These ages indicate cooling after the Eohellenic tectonometamorphic cycle and lack of Cenozoic resetting. In the Subpelagonian zone the zircons show slightly younger ages around 56 Ma.

The apatite fission track ages are systematically younger than the zircon fission track ages and range around 30 Ma in the central part of the crystalline zone. An apatite fission track age of 45 Ma was obtained near its eastern margin.

## References

- DELEON, G. (1966): translated title "Isotopic age of granitic rocks of Pelagonia and western Macedonia". – Ref. VI. Colloquium of Yugoslavian Geologists, Ohrid.
- DUMURDZANOV, N. (1985): Petrogenic characteristics of the high metamorphic and magmatic rocks of the central and western part of Selecka Mountain, SR Macedonia, Yugoslavia. – *Geologica Macedonica*, 2: 173–220, Stip.
- KOSSMAT, F. (1924): Die Kriegsschauplätze 1914–1918, geologisch dargestellt: Geologie der zentralen Balkanhalbinsel. – Brontraeger Verlag, 198 S., Berlin.
- LIPS, A.L.W.; WHITE, S.H. & WIJBRANS, J.R. (1998):  $^{40}\text{Ar}/^{39}\text{Ar}$  laserprobe direct dating of discrete deformational events: a continuous record of early Alpine tectonics in the Pelagonian Zone, NW Aegean area, Greece. – *Tectonophys.*, 298: 133–153, Amsterdam.
- LIPS, A.L.W.; WHITE, S.H. & WIJBRANS, J.R. (1999): New insights from  $^{49}\text{Ar}/^{39}\text{Ar}$  laserprobe dating of white mica fabrics from the Pelion Massif, Pelagonian Zone, Internal Hellenides, Greece: implications for the timing of metamorphic episodes and tectonic events in the Aegean region. – *GSA Spec. Pub.*, 156: 457–474, Tulsa.
- MEDWENITSCH, W. (1956): Zur Geologie Vardarisch-Makedoniens (Jugoslawien), zum Problem der Pelagoniden. – *Sitzber. Österr. Ak. Wsch, Math-Naturwsh. Kl, Abt. I*, 165/1-10: 397–473, Wien.
- SCHERMER, E.R., LUX, D.R. & BURCHFIELD, B.C. (1990): Temperature-Time History of Subducted Continental Crust, Mt. Olympus Region, Greece. – *Tectonics*, 9/5: 1165–1195, Washington, D.C.
- WALCOTT, C.R. (1998): The Alpine evolution of Thessaly (NW Greece) and late Tertiary Aegean kinematics. – *Geologica Ultraiectina*, 162, 176 S., Utrecht.

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