on the pattern of seismicity, surface geology, and more recently geodesy. It appears that much of the deformation associated with the eastward extrusion is accommodated within the asthenosphere. This suggests that the entire lithosphere is escaping to the east, not only the crust.

The origin and age of the metamorphic sole from the Rogozna Mts., Western Vardar Belt: New support for the one-ocean model for the Balkan ophiolites

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This study reports new geochronological and petrochemical data from the metamorphic sole beneath the Rogozna Mts., Western Vardar ophiolite belt. The Rogozna metamorphic sole is located at the base of an Ibar serpentinite nappe and consists of (i) high-grade andalusite–garnet–sillimanite gneisses and cordierite-bearing hornfels (mostly listwanitized), (ii) medium-grade pyroxene amphibolites and hornfels, amphibolites, amphibolite schists and metagabbros and (iii) low-grade micaschists and talc-chlorite schists. Selected samples of the Rogozna amphibolites and talc-chlorite schists were subjected to the electron microprobe, SEM-EDS, $^{40}Ar/^{39}Ar$ analysis and whole-rock geochemistry. The Rogozna amphibolites are medium- to fine-grained rocks with nematoblastic texture and pronounced foliation. They consist of green amphibole (~70 vol.%) with variable silica contents (6.4 to 7.8 Si a.p.f.u.), as well as Mg# (molMg/[Mg+Fe_{tot}]; 0.53 to 0.77) and variably albitized plagioclase (~30 vol.%; Ab_{24}–Ab_{98}). Amphibolites are overprinted by a retrograde assemblage containing actinolite, epidote, clinochlore, sericite, chlorite and magnetite. The amphibolites formed due to metamorphism of two basaltic suites: subalkaline/tholeiitic and alkaline. Subalkaline/tholeiitic amphibolites possess low Zr, Nb, Y, Th, Hf, TiO_2 and P_2O_5 values and a LREE-depleted patterns typical for the N-MORB to BAB (back-arc basalt) origin. Alkaline amphibolites show elevated concentrations of Zr, Nb, Y, Th, Hf, TiO_2 and P_2O_5 with a LREE-enriched patterns typically displayed by ocean island basalt (OIB). Amphibolites crystallized during intra-oceanic thrusting at temperatures between 685 ºC–765 ºC and at a depth of 12–17 km. $^{40}Ar/^{39}Ar$ cooling ages of amphibole range from 165–170 Ma and slightly postdate the sole formation. The Rogozna talc-chlorite schists are related to retrograde greenschist-facies metamorphism after amphibolite facies conditions. They consist of talc (Mg-rich minnesotaite), chlorite (diabantite), serpentine and white mica pseudomorphs after amphibole and MORB-type Cr-Al spinel, surrounded by Al- and Mg- poor ferrit-chromite. The occurrence of ferrit-chromite is related to earlier, amphibolite facies metamorphism. Chlorite pseudomorphs after amphibole were formed at ~415 °C, whereas low-K white mica from the assemblage cooled below the argon retention temperature in a time period of ~95–105±25 Ma. The studied metamorphic rocks of the Rogozna Mts. underlying the Ibar serpentinite massive represent, therefore, typical products of metamorphic sole. The amphibolites are of igneous origin, displaying subakaline/tholeiitic and alkaline geochemical affinities. The protoliths of subakaline/tholeiitic amphibolites originated in a N-MORB or BAB setting. The alkaline group of amphibolites are analogous to E-MORB or OIB and their protolith derived from fragments of seamounts or islands from the lower oceanic plate. Maximum P-T conditions of the formation of the Rogozna Mts. metamorphic sole were 685–765 ºC and 4–6 kbar (corresponding to a 12–17 km thick overburden). The Rogozna Mts. metamorphic sole experienced rapid cooling below the closure temperature of hornblende and actinolite between 164.9±1.3 and 170.0±1.4 Ma. Intra-oceanic thrusting must have started maximum 5 m.y. earlier, between 170 Ma and 175 Ma. The greenschist-type retrograde assemblage was

formed after medium-grade metamorphic conditions at ~415 °C. A weakly constrained Cretaceous age (95 and 105±25 Ma) obtained from white mica within talc-chlorite schists is related to the westward obduction of the Vardar ophiolites over the Adria continental margin.
Data reported in this study clearly suggest that there is no essential difference in the emplacement age of the Dinaric and West Vardar ophiolite belts, supporting the interpretation involving a single Mesozoic ocean in the Balkan sector.

Tectonometamorphic record in the cover sequences of the western Tauern Window, Eastern Alps

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The Tauern Window in the Eastern Alps represent a tectonic window within Austroalpine crystalline nappes. The window is formed by the Venediger (Zentralgneiss) nappe system forming large scale antiformal dome structure with preserved Mesozoic cover sequences. This system is overlain by the Subpenninic nappes (namely Modereck and Wolfendorn nappe and Eclogite zone) distinguished from the rest of the nappes by discrete deformation record. The Subpenninic nappes are overlain by the Penninic nappes represented by the Glockner nappe, Reckner Ophiolitic Complex and Matrei zone.

In the studied area, the Venediger duplex is composed of nappes of late Variscan/Permian Tux Gneiss and Zillertal Gneiss with its post-Variscan (Permo-Carboniferous and Mesozoic) cover sequences (VESELÁ et al., 2011). The Subpenninic nappes in the hanging wall are represented by the Modereck and Wolfendorn nappes which are overlain by the Glockner nappe being part of the Penninic units (SCHMID et al., 2013). The nappes alltogether were previously named as Lower Schieferhülle, Upper Schieferhülle and their P-T conditions of up to blueschist facies were described by SELVERSTONE (1988, 1993).

Our detailed structural and petrological study focused mainly on the cover sequences represented by the post-Variscan cover and Subpenninic nappes and their tectono-metamorphic evolution with respect to the Central gneiss complexes.

The cover sequences consist mainly of schists, amphibolites and quartzites and they show dominant NW-dipping fabric in the northern and central parts of studied area and S-dipping fabric in the western part. The observed stretching lineation plunge to the W-SW. This dominant fabric is subsequently folded by open to tight folds with steep E-W trending axial planes and axes gently plunging to the W. The rocks were later affected by cleavage showing dip-slip kinematics with lineations perpendicular to fold axes.

The overlying Glockner nappe (former Upper Schieferhülle) is composed of deformed greenschists and marbles, which are together folded by large-scale open folds with NW trending fold axes and lineations and steep NW dipping cleavage in fold planes.

The metamorphic overprint observed in the cover sequences is characterized by occurence of garnet. These garnets show decrease in spessartine and sometimes also grossular component, while almandine and pyrope increase towards the rim. The core to rim increase in XMg documents the overall prograde growth of these garnets. An attempt is made to characterize this prograde evolution of a garnet by means of thermodynamic modelling.

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