The new geological 1:150000-scale map of the Bavarian Forest

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The Bavarian Forest is located in the south-eastern part of Germany, adjacent to the frontier with the Czech Republic and Austria. Geologically, it belongs to one of the largest outcrops of Variscan basement in Central Europe – the Bohemian Massif. The rocks in this area are predominantly high-grade gneisses and migmatites, orthogneisses, metabasites, granulites, and Variscan to late-Variscan intrusives.

Up to now, the most recent compilation of the geology of the Bavarian Forest was the one of Troll (1964). This author integrated the geological information available in two map sheets at 1:100000 scale. The map was based on information from a few already published 1:25000-scale geological sheets, on individual observations, and on historical maps dating from the 19th and early 20th century (e.g. Gümbel 1868).

In the framework of a major geoscientific project financed by the Bavarian Ministry of the Environment and the EU a geological mapping campaign focusing on east and northeast Bavaria took place in 2001-2007. The Geological Survey at the Bavarian Environment Agency as well as researchers of different German and Austrian Universities mapped the area at the 1:25000 scale.

Publication of the 1:25000 geological sheets is still in progress and many of these maps are already available. Beside the maps, an array of specific research was carried out, including geochronological, geothermobarometric, and structural studies. The cooperation between Agency and Universities was remarkably fructiferous, leading to the publication of several articles in scientific journals. All of the above has significantly improved the state of knowledge about the geology of the Bavarian Forest.

In spite of the excellent compilation work of Troll (1964), the amount of geological information available in the 1960s was limited. The above-mentioned, recent mapping campaign has produced a huge amount of information which is worth being offered to the public in a compiled form. Hence, the Bavarian Environment Agency has integrated new and pre-existing maps, all of them originally performed at the 1:25000 scale, in order to produce a new 1:150000-scale map of the Bavarian Forest (Teipel et al. 2008). The map allows a global visualization of the geology of the Bavarian Forest based on the present state of knowledge. As an advantage in comparison with former compilations, its legend is structured attending to the chronological, petrographic and genetic features of the cartographic units, including detailed descriptions. In order to allow a better comprehension of the map in an international scope, especially among geologists working in the Central European Variscides, the legend is available in three languages (German, English, and Czech), and the nomenclature used regards the recommendations of the IUGS. The map includes a short geological overview and additional information, such as locations of former mines, outcrops, geotopes, and points of interest. This makes the map interesting not only for geologists looking for basic information for their research work, but also for non-specialists who are interested in geology in a rather touristy way.

Troll, G. (1967): Führer zu geologisch-petrographischen Exkursionen im Bayerischen Wald - Teil I. - Geologica Bavarica, **58**: 1-188, München.

Teipel, U., Galadí-Enríquez, E., Glaser, S., Kroemer, E., Rohrmüller, J. (2008): Erdgeschichte des Bayerischen Waldes - Geologische Karte 1:150 000. - LfU, Augsburg.

Deformation phases in the southern Bavarian Forest: constraints from sheared granitoids

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A deformation sequence is established from an array of small granitic bodies situated in the area between the Bayerischer Pfahl and the Danube shear zones, in the neighbourhood of the Fürstenstein Pluton (Bavarian Forest, south-eastern Germany). The major tectonic features of the study area are related to the so-called Bayerischer Pfahl shear-zone system (sensu Galadí-Enríquez 2007, including the Bayerischer Pfahl, Danube, Buchberger Leite, Rodl, and Karlstift shear zones among others). It consists of subvertical NW-SE dextral shears, subsidiary NNW-SSE dextral shears and conjugate NE-SW sinistral shears. The latter have been active over a wide time and temperature span, ranging from amphibolite facies to near-surface conditions (e.g. Brandmayr et al. 1995). The Bayerischer Pfahl shear-zone system formed under N-S to NNW-SSE compression, as proposed by Brandmayr et al. (1995). Such a compression direction is also responsible for the subvertical NW-SE striking foliation developed under dextral simple shear in migmatites of the study area (S_2 after Galadí-Enríquez 2007). However, the granitic bodies presented here were affected by sinistral shears along subvertical planes trending ENE to ESE. Since this deformation took place under NE-SW compression and is not compatible with the previous N-S to NNW-SSE compression trend, it is proposed that these sinistral shear zones found in granites do not belong to the Bayerischer Pfahl shear-zone system and constitute themselves a separated one, which is called „D_3 shear-zone system". The deformation D_3 took place under upper greenschist to lower amphibolite facies conditions (~480-550°C), as supported by the observed microfabrics and quartz lattice-preferred orientation patterns. The silicon content of magmatic and syn-kinematic white mica suggests that both the intrusion and the deformation of the granites affected by D_3 occurred at deep to intermediate levels of the crust (27-17 and 19-14 km, respect.). Datings on two of the deformed granites yielded 324.4 ± 0.8 Ma (Galadí-Enríquez et al. 2005) and 315.0 ± 1.0 Ma (Siebel unpubl. data). Thus, the age of D_3 is most probably ~315 Ma, although an episodic D_3 is also conceivable involving some additional older pulses. After D_3 the N—S to NNW—SSE compression which governed D_2 was restored, giving way to the next deformation phase D_4, which was linked to further deformation at and next to the principal shears of the Bayerischer Pfahl shear-zone system under greenschist facies conditions. The causes for the change of the stress field leading to a NE—SW compression during D_3 might be related to (1) changes in the dynamics of the tectonic plates in late-Variscan times, (2) orogenic collapse leading to the sinking of the Teplá-Barrandian and lateral extrusion of the surrounding Moldanubian rocks, (3) distortion of the regional stress field by local intrusion of large stocks, such as the Saldenburg granite of the Fürstenstein Massif, or (4) distortion of the regional stress field due to the existence of ephemeral releasing bends in the Bayerischer Pfahl shear zone.

Brandmayr, M., Dallmeyer, R.D., Handler, R. & Wallbrecher, E. (1995): Conjugate shear zones in the Southern Bohemian Massif (Austria): implications for Variscan and Alpine tectonothermal activity. - Tectonophysics, **248**: 97-116.

Galadí-Enríquez, E. (2007): Granitoids from the European Variscides: an approach to their emplacement and tectonometamorphic history. - Unpubl. Diss. Univ. Frankfurt: 1-240.

Galadí-Enríquez, E., Zulauf, G., Heidelbach, F., Dörr, W. & Rohrmüller, J. (2005): Variscan dyke emplacement and sinistral strike slip in the Bavarian Forest (SE Germany): constraints on the evolution of the Bavarian Pfahl shear zone. - Schriften. Dt. Ges. Geowiss., **39**: 111-112.

Auslösung von Bergstürzen durch Erdbeben: Anwendung der Skala für makroseismische Umwelt- und Landschaftsauswirkungen (EEE der INQUA)

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Zur Bestimmung der makroseismischen Intensität verwenden moderne Skalen die Fühlbarkeit der Erschütterung (für niedere Intensitätsgrade), Schäden an Gebäuden (für mittlere und hohe Intensität ab Grad 5) und Auswirkungen auf Landschaft und Umwelt (für höhere Intensität). Das Poster weist auf die jüngsten Fortschritte bei der makroseismischen Beurteilung von Felsstürzen, die im Gebirge in der Nähe des Epizentrums eines Starkbebens aufzutreten. Für Gebirgsareale mit geringer Vevölkerungsdichte stellt die Berücksichtigung von Massenbewegungen einen beachtenswerten Versuch der Intensitätsbestimmung dar, die jecoch in der EMS98 nur sehr kursorisch beschrieben sind. Die Phänomene werden in der Skala für makroseismische Umwelt- und Landschaftsauswirkungen, deren Endfassung 2007 von INQUA publiziert wurde, berücksichtigt. Als Beispiele ihrer Anwendung werden mehrere alpine Beben des letzten Jahrhunderts sowie die historischer Beben von Villach mit dem Bergsturz der Dobratsch-Südflanke (Villacher Alpe) besprochen.

Um Felsstürze für die Intensitätsbestimmung heranzuziehen hat Vidrih et al. (2001) das Erdbeben im Oberen Isonzotal (Soèa 1998) "als einen Versuch für eine statistisch sinnvolle Beurteilung der makroseismischen Intensität zur Bewertung der seismogeologischen Auswirkungen" ausgewertet. In einer Tabelle werden Volumen und Art des Felsausbruches mit der makroseismischen Intensität des Bebens korreliert. Zuvor wurde bereits für das Friaul-Beben 1976 von Govi (1977) die Häufigkeit von Steinschlägen bzw. Felsstürzen im Epizentralgebiet aufgrund von Luftaufnahmen ausgewertet. Die makroseismische Intensität des Friaulbebens in Österreich lag im Gailtal bei I = 7. Für das Beben konnten die Orginaldaten der ZAMG eingesehen und in Hinblick auf die Felsstürze bearbeitet werden.

Das „Villacher Beben" von 1348 führte zu zahlreichen Felsstürze, zum Stau des Gail-Flusses durch einen Bergsturz und zur Bildung eines Sees im Gailtal, der mehrere Jahrhunderte bestand. Über das zweite Villacher Erdbeben im Jahre 1690 sind keine Berichte über größere Felsstürze bekannt, obwohl die makroseismische Intensität beinahe so hoch war, wie die des Bebens von 1348 (Gangl & Egger 2006). Wahrscheinlich lag das von Felsstürzen betroffene Gebiet nahe des Epizentrums nördlich der Stadt Villach. Die Südflanke des Dobratsch in Kärnten kann als eine Art Testgebiet für Felsstürze betrachtet werden, die durch historische Erdbeben ausgelöst wurden und die Bewertungen der lokalen makroseismischen Intensität erlauben. Die Bewertung von historischen Ereignissen kann im Gebirge durch die Berücksichtigung von Felsstürzen auf eine breitere Datenbasis gestellt werden.

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Govi, M. (1977): Photo-interpretation and mapping of Landslides triggered by the Friuli Earthquake 1976. - Bull. Int. Ass. Engineering Geology, **15**: 67-72.

INQUA (2007): Earthquake Environmental Effects (EEE) Scale.

Vidrih, R. A., Ribièiè, M. & Suhadolc, P. (2000): Seismogeological effects of rocks during the 12 April 1998 Upper Soèa Territory earthquake (NW Slovenia). - Tectonophysics, **330**: 153-175.

Geological profiles through the poly-phase deformed Paleozoic of Graz

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The Upper Austroalpine / Upper Central Austroalpine Paleozoic of Graz consists of a 30 x 50 km sized nappe complex built up mainly of low-grade carbonates and schist of Silurian to Carboniferous age. It lies on top of high-grade Middle Austroalpine / Lower Central Austroalpine crystalline basement, and it is discordantly overlain by a small Cretaceous Gosau Basin and by the Neogene Styrian Basin. As such, the Paleozoic of Graz records many of the sedimentological, tectonic and metamorphic events that formed the present Eastern Alps since the early Paleozoic.

Stratigraphy, palaeontology, internal structure and metamorphism of the Paleozoic of Graz were extensively studied over the past 180 years, and resulted in over 500 publications (e.g. Flügel & Hubmann 2000 and references therein). However, remarkably no geological profiles through the *entire* Paleozoic of Graz are published and the complex, poly-phase tectonic history is still not fully understood.

We present geological profiles through the entire Paleozoic of Graz in order to understand the actual 3D geometry of this complex. As a base, we use 1:50 000 geological maps, a 10 m digital elevation model, local detailed maps and profiles, drillhole data and descriptions of structure and stratigraphy from various publications listed in Flügel & Hubmann (2000).

The structure of the Paleozoic of Graz, as revealed by the profiles, is dominated by the following elements: (i) a probably Variscian (?) large-scale isoclinal fold with an ~E-W trending axis in the lower nappe complex bringing Silurian schist on top of Devonian limestone, (ii) early Cretaceous W to NW directed thrusts and open to tight folds separating the Paleozoic of Graz into an upper and a lower nappe system, and (iii) late Cretaceous to Tertiary ductile to brittle normal and strike-slip faults defining the borders against the surrounding crystalline basement. Which of these events could have led to the emplacement of the Paleozoic of Graz on top of the crystalline basement is discussed.

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Reconstruction of a lost Triassic-Jurassic ocean as evidenced by mélange analysis in the Mirdita ophiolite zone (Albania)

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