Historical seismicity - A review of the 1590 earthquake

HAMMERL, C. & LENHARDT, W.A.

Department of Geophysics, Central Institute for Meteorology and Geodynamics, Hohe Warte 38, A-1190 Vienna, Austria; christa.hammerl@zamg.ac.at, wolfgang.lenhardt@zamg.ac.at

The project „Historical Earthquakes in Lower Austria" serves to complete the Austrian Earthquake Catalogue to gain a better image in terms of seismic hazard (see also HAMMERL 2007, LENHARDT et al. 2007).
The project aimes at the investigation of
- so far unknown earthquakes,
- fake quakes, and
- the correction of false catalogue entries.

To improve the seismic hazard assessment in Lower Austria the project focuses mainly on the research of gaps and the restudy of the most important historical earthquakes in the area like the damaging Neulengbach earthquake of 1590 09 16 with the epicentral intensity I_0=9° EMS.
The results of the project among others – the translation, the interpretation and the documentation of the original sources, the intensity estimation for each place (IDP´s - intensity data points) is shown for the example of Neulengbach.
The question where the actual earthquake occurred can only be tentatively answered. However, when comparing historical reports of local damage with the gravity field in Lower Austria in the vicinity of Neulengbach points towards a flat dipping and N-S-striking thrust fault. Such a mechanism would explain the reconstructed historical pattern damage.

HAMMERL, Ch. (2007): „Die khirchen dermassen zerschmetert und zerlittert, das man nit darein darf…" - Historische Erdbebenforschung in Niederösterreich. - Studien und Forschungen aus dem Niederösterreichischen Institut für Landeskunde, **46**: 21-44, St.Pölten.

LENHARDT, W.A., SVANCERA, J., MELICHAR, P., PAZDIRKOVA, J., HAVIR, J. & SYKOROVA, Z. (2007): Seismic activity of the Alpine-Carpathian-Bohemian Massif region with regard to geological and potential field data. - Geologica Carpathica, **58**: 397-412, Bratislava.

The Neogene-Quaternary magmatism of the Carpathian-Pannonian Region and its geodynamic relationships

HARANGI, S.

Department of Petrology and Geochemistry, Eötvös University, Budapest, Hungary; szabolcs.harangi@geology.elte.hu

Neogene to Quaternary volcanism of the Carpathian-Pannonian Region is part of the extensive volcanic activity in the Mediterranean and surrounding regions. The volcanic rocks can be divided into four main groups based on their geochemistry: (1) Miocene (21-13 Ma) silicic pyroclastic (mostly ignimbrite) suites; (2) Middle Miocene to Quaternary (16.5-2 Ma) calc-alkaline volcanic rocks; (3) Miocene to Quaternary (15-0.02 Ma) potassic and ultrapotassic rocks; and (4) Late Miocene to Quaternary (11-0.2 Ma) alkaline sodic volcanic rocks.
Using the spatial and temporal distribution of the magmatic rocks and their major and trace element and Sr-Nd-Pb isotope characteristics, lithospheric extension in the Pannonian Basin could have a major role in the generation of the magmas. Dehydration of the subducting slab resulted in thorough metasomatism in the mantle wedge during Cretaceous to Early Miocene, lowering the melting temperature, and therefore playing an indirect role in the generation of magmas later on. Mixing between mantle-derived magmas and lower crustal melts was an important process at the first stage of the silicic and calc-alkaline magmatism in the Northern Pannonian Basin. However, the crustal component gradually decreased with time consistent with a magmatic activity in a continuously thinning continental plate. Calc-alkaline volcanism along the Eastern Carpathians was mostly post-collisional and could be related to slab break-off process. However, the fairly young (<1.5 Ma) potassic magmatism at the southeasternmost segment of the Carpathian volcanic arc could have been related to lithospheric delamination under the Vrancea zone. Alkaline basaltic volcanism began at the end of rifting of the Pannonian Basin (11 Ma) and continued until recently. A mantle plume beneath the Pannonian Basin is highly unlikely as indicated by the distribution of the basaltic volcanic fields and the calculated mantle potential temperatures. Mafic magmas were formed by small degree partial melting in a heterogeneous asthenospheric mantle, which has been close to the solidus temperature due to the lithospheric extension in the Miocene. Significantly, the basaltic volcanic fields are located mostly on the western and northwestern margins of the CPR, where the lithosphere/asthenosphere boundary shows a steep gradient. Thus, the cause of CPR basaltic volcanism could be an eastward flow of sublithospheric mantle from beneath the thick Alpine lithosphere. The mantle flow could have been triggered either by the thin-spot suction beneath the Pannonian Basin or by slab roll-back beneath the East Carpathians. At the western margin of the CPR, this mantle flow could have had a significant vertical component due to the steep lithosphere/asthenosphere boundary, leading to decompression melting. In contrast, eruption of alkaline mafic magmas at the southeastern margin of the CPR can be explained by upwelling of hot asthenospheric mantle due to slab detachment.

Karstentwässerung im Kaisergebirge: Modellkonzept - hydrologisches Modell - Konzeptmodell

HARUM, T., RESZLER, C., BENISCHKE, R., SACCON, P., ORTNER, G. & RUCH, C.

Joanneum Research, Institut für WasserRessourcenManagement, Elisabethstrasse 16/II, 8010 Graz; till.harum@joanneum.at, christian.reszler@joanneum.at, ralf.benischke@joanneum.at, pierpaolo.saccon@joanneum.at, gerlinde.ortner@joanneum.at, christophe.ruch@joanneum.at

Die Erkundung von Wasserressourcen aus verkarsteten Festgesteinsaquiferen zur Trinkwasserversorgung erfordert gerade bei der Quantifizierung des nutzbaren Dargebots den Einsatz adäquater Erkundungs- und Auswertemethoden. Die Komplexität von Karstaquiferen drückt sich vor allem darin aus, dass in derartigen Gebieten kaum jemals orographische Einzugsgebiete mit hydrographisch wirksamen übereinstimmen. Im Rahmen des Kompetenznetzwerkes „Wasserressourcen" war die Hauptzielrichtung eines Arbeitspakets die Erarbeitung von neuen methodischen Grundlagen zur Erkundung von Karstaquiferen in Gebirgsräumen und damit verbunden die Abgrenzung hydrographisch wirksamer Einzugsgebiete unter Einsatz physikalisch basierter hydrologischer Modelle (BENISCHKE et al. 2008). Die Erarbeitung der Grundlagen und konkrete Tests zur Quantifizierung hydrologisch relevanter Kenndaten erfolgten im intensiv verkarsteten Massiv des Kaisergebirges.
Für die Simulation aller Teilkomponenten des Wasserhaushalts wurde das flächendetaillierte integrierte hydrologische Modell MIKE SHE herangezogen. Der Schwerpunkt bei diesem Modell ist die Koppelung aller hydrologischen Prozesse, es werden Schneefall, Schneeschmelze, Evapotranspiration, Infiltration und die Wasserbewegung in der ungesättigten Zone sowie der Grundwasserabfluss für jede Zelle nachgebildet. Die Abflüsse aus den Pixeln werden sodann den orographischen Einzugsgebieten entsprechend zusammengefasst, an denen teils kontinuierliche, teils

episodische Kontrollmessungen durchgeführt wurden. Die zeitliche Auflösung der Berechnun-gen erfolgte auf Tagesbasis für den Zeitraum 1994 bis 2007.
Stationäre räumliche Inputdaten für das Modell sind der digitalen 10x10 m-Höhenraster des BEV, Landnutzungsverteilung und Blattflächenindex (Ermittlung mittels Fernerkundungsmethoden) und Pedohydrotope (ähnliche bodenphysikalischen Eigenschaften). Zeitlich und räumlich variierende Inputdaten sind mittels der Gradientenmethode regionalisierte Niederschläge, vegetationsbezogene Referenzverdunstung und Lufttemperaturen.
Zur Beschreibung der Wasserbewegung in der ungesättigten Zone wird das physikalisch basierte Modell um konzeptionelle Ansätze erweitert. Daraus ergeben sich zusätzlich zu bestimmende Parameter. Dies erfolgt durch Kalibrierung aus den gemessenen Abflüssen, den Zusatzinformationen aus den karsthydrologischen und isotopenhydrologischen Untersuchungen und einer Überprüfung der daraus abgeleiteten Modellvorstellung.
Der überwiegend intensiv verkarstete Felsuntergrund ist geprägt von Röhren- und Kluftsystemen, in denen ein Teil des Niederschlagswassers sehr rasch durch den Untergrund zum Abfluss gelangt. Um diesen Prozess im Modell zu beschreiben, wird ein Bypass-Fluss eingeführt, der die Bodenmatrix überbrückt und einen Teil des Niederschlages unmittelbar in die gesättigte Zone leitet. Die beobachteten Quellschüttungen bestätigen diesen signifikanten Prozess. Zur Kalibrierung des Modells wurden gemessene Abflussganglinien herangezogen.
Durch Vergleich der gemessenen Abflüsse mit den simulierten Werten konnten in Anlehnung an ein früheres Modellkonzept Defizite und Überschüsse ermittelt werden und unter Einbeziehung des Höheneffektes des stabilen Isotops Sauerstoff-18, früherer Markierungsversuche und der geologisch-tektonischen Situation ein Konzeptmodell der Karstentwässerung mit Abschätzung unterirdischer Entwässerungsrichtungen entwickelt werden, das eine wichtige Basis für Ressourcenbewertung und -schutz darstellt.

Benischke, R., Ebenbichler, R., Ederer, W., Fleischhacker, E., Harum, T., Kodré, B., Moser, G., Ortner, G., Pevny, G., Pliessnig, H., Ruch, Ch., Saccon, P., Skritek, P., Stadler, H. & Woletz, K. (2008): WP 2.1.1: Ressourcenerkundung. - In: Kompetenznetzwerk Wasserressourcen GmbH (Hrsg., 2008): Tagungsband zur Internationalen Fachtagung „Wasserressourcen und deren Bewirtschaftung - Die Bedeutung von Netzwerken“, 22. bis 23. April 2008, 59–67, Graz.

A giant early Miocene sunfish from the North Alpine Foreland Basin and its implication for molid phylogeny

Harzhauser, M.[1], Gregorova, R.[2], Schultz, O.[1], Kroh, A.[1] & Coric, S.[3]

[1]Natural History Museum Vienna, Burgring 7, A-1010 Vienna, Austria; [2]Moravian Museum, Zelný trh, CZ-601 00 Brno, Czech Republic; [3]Geological Survey of Austria, Neulinggasse 38, A-1030 Vienna, Austria; mathias.harzhauser@nhm-wien.ac.at

The Molidae Ranzani, 1839 comprise a family of ocean sunfishes and represent the largest extant bony fishes, reaching lengths of over 3 m. All known Molidae are characterized by a stout, truncated shape, with a body that ends rather abruptly just behind the dorsal and anal fins. They are epipelagic and are distributed worldwide in tropical to temperate seas. Due to their largely cartilaginous, weakly ossified and spongy skeleton, the fossil record of the Molidae is very poor. Representatives of the family Molidae are mostly represented by isolated jaws and dermal scale plates. Complete skeletons even of modern sunfishes are rare in museum collections and, unsurprisingly, no complete Molidae skeletons have been reported so far in the fossil record. Consequently, the record of three fossil Molidae skeletons, found by private collectors during construction work for a hydroelectric power plant near Pucking in spring 1980, is extremely outstanding. The specimens were associated with a complete dolphin skeleton, numerous small teleost fishes and scattered lucinid bivalves along with a diverse algal- and leaf flora. The pelitic deposits are part of the Ebelsberg Formation and are dated as Aquitanian (lower part of nannoplankton Zone NN2) based on the presence of *Helicosphaera scissura* and *Helicosphaera sellii* and the absence of *Helicosphaera ampliaperta*. In terms of regional stages, the deposits are part of the upper Egerian stage and are ca. 22 Ma old. During that time, the area was part of the Central Paratethys Sea, and the North Alpine Foreland Basin was covered by a deep sea. The section was situated on the northern shelf of that sea within the outer neritic zone.
The skeletons represent the the oldest known modern-type sunfish, which will be described as the new genus *Austromola*. A giant size of more than 320 cm body length and 400 cm maximum diameter can be calculated based on linear extrapolation of morphometric parameters of recent *Mola mola*. Thus, this early Miocene Molidae was the largest sunfish known so far. Phylogenetic analysis shows that it forms a sister-clade of *Ranzania* together with *Mola* and *Masturus*. Therefore, its Aquitanian age suggests an Oligocene age for the origin of *Ranzania* and an at least early Oligocene age for the last common ancestor of the extant Molidae. The radiation of the (*Austromola* (*Mola*+ *Masturus*)) clade occurred soon thereafter during the Early Miocene and, consequently, oldest *Mola* fossils turn up in Middle Miocene deposits. The huge gap of c. 20 Ma between the basal molid *Eomala* and the giant *Austromola* and the lack of *Masturus*-fossils in Miocene to Pleistocene deposits emphasise the extremely spotty fossil record of the sunfishes, which usually are docu-mented solely by isolated jaw elements or scale plates. Thus, the three more or less complete skeletons from the deep water deposits of Upper Austria are an outstanding and unparalleled finding.

Faunal diversity, gradients and interrelations in Neogene Lake Systems of Central and South-Eastern Europe

Harzhauser, M. & Mandic, O.

Naturhistorisches Museum Wien, Geologisch-Paläontologische Abteilung, Burgring 7, A-1010 Wien, Austria;
mathias.harzhauser@nhm-wien.ac.at,
oleg.mandic@nhm-wien.ac.at

The gastropod γ-diversity of 12 Neogene lake systems is evaluated. In total, 1184 gastropod taxa from 119 localities are recorded deriving from the Early Miocene *Rzehakia* Lake System, the Early to Middle Miocene Dinarid Lake System, Lake Skopje, the Paratethyan Sarmatian lakes and the South German lakes, the Late Miocene Lake Pannon, the Pliocene lakes Dacia, Transylvania, Slavonia, Kosovo and Šoštanj as well as the Holocene Lake Petea. Each lake system is characterised according to its faunistic inventory and endemism. Many papers dealing with extant mollusc faunas of Eurasian aquatic systems refer to Lake Pannon when explaining extant biogeographic distributions and phylogenetic relations. Our dataset, however, points to a much more complex history of the faunas reaching back at least to the Early Miocene. High endemisms and low inter-lake relations of the Early and early Middle Miocene lake systems suggest that these experienced the first autochthonous evolutionary pulses. Many genera display their FADs in these systems (e.g. *Marticia, Kosovia, Orygoceras, Pyrgula, Dianella, Emmericia*). This pattern changed at the Middle/Late Miocene boundary when Lake Pannon inherited numerous species which evolved prior in the Sarmatian Paratethyan lakes. On the generic level, parts of the Lake Pannon fauna can be traced back even to the Early Miocene faunas of the Dinarid Lake System. The combined effect of heritage and new radiations in a geochemically unique aquatic system