Palaeo-Danube delta paradise: The vertebrate fauna of Atzelsdorf (Lower Austria, Late Miocene)

Göhlich, U.B., Daxner-Höck, G. & Harzhauser, M.

Natural History Museum Vienna, Geological-Paleontological Department, Burgring 7, A-1010 Vienna, Austria; ursula.goehlich@nhm-wien.ac.at, gudrun.hoeck@nhm-wien.ac.at, mathias.harzhauser@nhm-wien.ac.at

The site of Atzelsdorf – an abandoned gravel pit about 30km north of Vienna – is situated at the western margin of the Vienna Basin at the borderland to the North Alpine Foreland Basin. The section represents Upper Miocene deposits of the paleo-Danube and its delta, pouring and discharging south-eastwards into the Lake Pannon. The sediments of this braided-delta system are united into the so-called Hollabrunn-Mistelbach Formation. However, the top of the Atzelsdorf section is formed by a bed, reflecting a transgression of Lake Pannon westwards into the delta wetlands (Harzhauser et al. 2004). Even if no absolute dating exists for the Atzelsdorf section, this flooding event is a well known marker, which falls within the Vienna Basin Pannonian Zone C and corresponds to an absolute age of c. 11.0-11.1 ma (Harzhauser et al. 2004). The underlying vertebrate fossil bearing layers at Atzelsdorf yielded the following vertebrate fauna: Quantitatively dominating are ruminants (*Miotragocerus, Dorcatherium, Micromeryx, Euprox, Palaeomeryx*). Somewhat rarer faunal elements are carnivors (*Sansanosmilus, Plesiogulo, Martes, Thalassictis, Semigenetta*), equids (*Anchitherium, Hippotherium*), rhinos (*Aceratherium, Brachypotherium*), chalicotheres (*Chalicotherium*), suoids (*Taucanamo, Parachleuastochoerus, Listriodon*), proboscideans (*Deinotherium, Tetralophodon*), beavers (*Trogontherium, Chalicomys*), lagomorphs („*Amphilagus*"), but also reptiles (*Pseudopus*, testudines indet.), birds (Anseriformes), and fishes. Due to sedimentary aspects of the Atzelsdorf section, to the position of the locality within the reconstructed delta system, and to the preservation of the vertebrate fossils it can be concluded that the fauna represents a relatively short-termed accumulation event of perhaps a few thousand years, that might range within about 11.2 -11.1 ma. Thus, the fauna represents a well dated snapshot assemblage of the early Lower Miocene which may serve as marker for comparisons and correlations of other Vallesian faunas in central Europe.

Harzhauser, M., Daxner-Höck, G. & Piller, W.E. (2004): An integrated stratigraphy of the Pannonian (Late Miocene) in the Vienna Basin. - Austrian Journal of Earth Science, **95/96**: 6-19.

Huge seismic experiments in Central Europe - lithospheric structure between Eastern Alps, Dinarides and Bohemian Massif

Grad, M.[1,2], Brückl, E.[3], Guterch, A.[2], Behm, M.[3], Šumanovac, F.[4] & POLONAISE'97, CELEBRATION 2000, ALP 2002 & SUDETES 2003 Working Groups

[1]Institute of Geophysics, University of Warsaw, Poland; [2]Institute of Geophysics, Polish Academy of Sciences, Poland; [3]Institute of Geodesy and Geophysics, Vienna University of Technology, Austria; [4]Faculty of Mining, Geology and Petroleum Eng., University of Zagreb, Croatia; mgrad@mimuw.edu.pl, aguterch@igf.edu.pl, ebrueckl@mail.tuwien.ac.at, mbehm@mail.tuwien.ac.at, franjo.sumanovac@rgn.hr

Beginning in 1997, Central Europe has been covered by an unprecedented network of seismic refraction experiments POLONAISE'97, CELEBRATION 2000, ALP 2002, SUDETES 2003 which extend from the East European Craton, trough the Trans-European Suture Zone, Bohemian Massif and Carpathians, to Pannonian basin, Eastern Alps and Dinarides. The total length of all profiles is about 19,000 km with over 300 explosive sources. Thickness of the crust in the area of investigations changes from 40-50 km in EEC, 35-55 km in the TESZ, 22-25 km in the Pannonian basin, to 35-45 in Eastern Alps and about 40 km beneath Dinarides. We show lithospheric structure and tectonic interpretation for profiles Alp01, Alp02, Alp07 and CEL10/Alp04. In the Alpine area the European Moho dips generally to the south and reaches a maximum depth of 47 km below the transition from the Eastern to the Southern Alps. The Adriatic Moho continues further south at a significantly shallower depth. Moho topography and a prominent south-dipping mantle reflector in the Alpine area support the idea of southward subduction of the European lithosphere below the Adriatic microplate. The most prominent tectonic feature on the Alp02 profile is a vertical step of the Moho at the transition between the Alpine and Pannonian domains, suggesting the existence of a separate Pannonian plate fragment. The development of the Pannonian fragment is interpreted to be a consequence of crustal thinning due to tectonic escape from the Alpine collision area to the Pannonian basin.

Öl - Öl und Öl -Muttergesteinskorrelation im Alpinen Molassebecken Österreichs

Gratzer, R.[1], Sachsenhofer, R.[1], Bechtel, A.[1], Schulz, H.M.[2] & Smuck, A.[3]

[1]Montanuniversität Leoben, Department Angewandte Geowissenschaften und Geophysik, 8700 Leoben; [2]GFZ Potsdam, Telegrafenberg D-14473 Potsdam; [3]Rohöl-Aufsuchung AG, Schwarzenbergplatz 16, A-1015 Wien; reinhard.gratzer@mu-leoben.at, reinhard.sachsenhofer@mu-leoben.at, achim.bechtel@eawag.ch, schulzhm@gfz-potsdam.de, a.smuck@rohoel.at

Das Alpine Molassebecken bildet mit 193 kleinen Feldern, 53 noch produktiv, eine kleine Öl- und Gasprovinz in Mitteleuropa. Im österreichischen Anteil sind zwei KW-Systeme ausgebildet; Mesozoikum - Unteres Oligozän Öl und thermisches Gas, im Oligo - Miozän biogenes Gas.

Ziel dieser Arbeit ist die geochemische Charakterisierung der Öle in den einzelnen Feldern mittels Biomarker, ein Vergleich dieser untereinander sowie mit Extrakten potentieller Muttergesteine.

Die Felder werden geographisch in eine westliche (K, Ktg, R), zentrale (Mdf, Eb, Ob, Ra, Sat, Sths, Sths-N) und östliche Gruppe (BH, BH-N, Ke, En) zusammengefasst. Die Felder Trattnach (Trat) und Voitsdorf (V) werden getrennt diskutiert.

Die meisten Öle sind durch Pristan/Phytan Verhältnisse zwischen 1,2 und 1,8 und Dibenzothio-phene/Phenanthren (DBT/Ph) Verhältnisse ~0,25 charakterisiert. Eine Ausnahme bilden die Öle der westlichen Gruppe mit geringfügig höheren DBT/Ph Verhältnissen. Eine Differenzierung zeigen auch die als Fazies- und Reifeindikatoren zu wertenden 18α(H)Tris-norneo-hopan/17α(H)Tris-norhopan (Ts/Tm) und Hopan/Moretan Verhältnisse. Hier zeigen die östlichen Öle die geringsten und die Voitsdorfer Öle die höchsten Ts/Tm Verhältnisse. Die nahe am Gleichgewicht liegende Steran-Isonerisierung und der Methylphenanthrene Index (MPI) ergeben eine Mutter-gesteinsreife zwischen 0,75%Rr (westliche Gruppe; Voitsdorf) und 0,90%Rr (Trattnach). Das C_{28}/C_{29}-Steran Verhältnis vs. C_{27}-Diasteran/C_{27}-Steran Verhältnis differenziert, trotz breiter Streuung innerhalb der Gruppen, die einzelnen Ölgruppen deutlich und weist, im Gegensatz zu den übrigen Ölen, für die Öle der westlichen Gruppe auf Muttergesteine mit geringen terrestrischen pflanzlichen Anteilen hin. Öl/Muttergesteinskorrelationen, basierend auf Biomarkerdaten, weisen die Schön-

eck-Formation als Hauptquelle für die akkumulierten Molasseöle aus, wobei eine Verzerrung des Gesamtöl-Datenclusters als Beitrag der Dynow-Formation interpretiert wird.
Generell sind die Unterschiede in den Ölzu-sammensetzungen gering, dies weist auf ein gemeinsames Muttergestein (Schöneck-Formation) sowie eine Homogenisierung während der lateralen Migration hin. Dennoch ermöglichen Biomarkerdaten eine regionale Unterteilung in verschiedene Ölgruppen.

- Die westliche Gruppe (K, Ktg, R) ist charakterisiert durch eine relativ geringe Reife (geringe MPI und Ts/Tm Werte), hohe Hopan/Moretan Verhältnisse sowie hohe C_{29}-Steran und Schwefelgehalte. Die Einheit „b" der Schöneck Formation bildet hier wahr-scheinlich das Muttergestein.
- Die Trattnach Öle sind schwerer (>30° API) und entstammen einem Muttergestein hoher Reife (~0,9%Rr).
- Die Öle aus dem Feld Voitsdorf und der zentralen Gruppe zeigen eine Zunahme der Reife gegen Norden (MPI Werte). Unterschiede im Ts/Tm- sowie im Diasteran/Steran-Verhältnis deuten Faziesänderungen (Tongehalt) im Muttergestein an.
- Die Öle der östlichen Gruppe zeigen ebenfalls einen Anstieg der Reife gegen Norden.

Die Autoren danken der Rohöl-Aufsuchungs AG für die Erlaubnis die Daten zu veröffentlichen.

Integrated Facies-Analysis in the Oligo-Miocene of the North Alpine Foreland Basin

Grunert, P.[1], Harzhauser, M.[2], Piller, W.E.[1] & Sperl, H.[3]

[1]Institute for Earth Sciences (Geology and Paleontology), Graz University, Heinrichstraße 26, A-8010 Graz, Austria; [2]Natural History Museum Vienna, Geological-Paleontological Department, Burgring 7, A-1014 Vienna, Austria; [3]Rohöl-Aufsuchungs AG, Schwarzenbergplatz 16, A-1015 Vienna, Austria; patrick.grunert@uni-graz.at, werner.piller@uni-graz.at, mathias.harzhauser@nhm-wien.ac.at, hanns.sperl@rohoel.at

Micropaleontology has always been a highly effective tool in hydrocarbon exploration. It provides information on biostratigraphy and thus helps interpreting seismic images by correlating sediments from different wells. Additionally, micropaleontology offers information about facies distribution, depositional environment, paleogeography and paleoceanography. Thus, having this source of information available is crucial for detecting potential source and reservoir rocks.
Currently, the Rohöl-Aufsuchungs AG (RAG) is facing new ventures of exploration in the southern North Alpine Foreland Basin (NAFB) comprising the Foreland, the Imbricated and the Overthrusted Molasse. This area adjacent and below the Alps is heavily tectonised and imbricated. To assure efficient drilling, exploration will have to rely on the means of micropaleontology to unravel the relations between these highly deformed and dislocated deposits and their connection to the undisturbed northern part of the basin.
Micropaleontology offers various reliable tools to face these problems. By faunal, floral and geochemical analyses it helps to reveal information on biostratigraphic and isotopic correlation between wells, facies distribution and change, paleogeographical conditions and paleoceanographic parameters like productivity, water column stratification, salinity and water temperature. Thus, it seems useful to apply these tools to the NAFB.
A project co-funded by the RAG and the Comission for the Paleontological and Stratigraphical Research of Austria intends to provide a high-resolution biostratigraphy for the Late Oligocene - Early Miocene of three selected wells in the NAFB. These wells will be analysed in terms of geochemistry based on stable isotopes ($\delta^{18}O$, $\delta^{13}C$), trace elements (Mg/Ca) and total organic carbon (TOC) measurements. Several reference wells along a N-S-oriented transect in the Upper Austrian NAFB will be integrated and compared with the high-resolution patterns. Additionally, analyses of foraminiferal and dinoflagellate assemblages will provide information on facies distribution and past productivity. The expected results will lead to the establishment of standard curves for the Upper Oligocene and Lower Miocene deposits which in turn will allow a new reconstruction of the paleoceanographic and paleogeographic setting in the NAFB.

Integrated biostratigraphy and geochemistry of the Ottnangian stratotype section

Grunert, P.[1], Soliman, A.[1], Coric, S.[2], Piller, W.E.[1] & Harzhauser, M.[3]

[1]Institute for Earth Sciences, Graz University, Heinrichstraße 26, A-8010 Graz, Austria; [2]Geological Survey of Austria, Neulinggasse 38, A-1030 Vienna, Austria; [3]Natural History Museum Vienna, Geological-Paleontological Department, Burgring 7, A-1014 Vienna, Austria; patrick.grunert@uni-graz.at, ali.soliman@uni-graz.at, werner.piller@uni-graz.at, stjepan.coric@geologie.ac.at, mathias.harzhauser@nhm-wien.ac.at

The stratotype section for the regional Central Paratethys stage of the Ottnangian (Early Miocene, mid-late Burdigalian) is located at Ottnang-Schanze in the North Alpine Foreland Basin of Upper Austria. About 10m of silty clays with layers of fine sand („Schlier") are exposed with two faults running through the succession. A new study on the section combines biostratigraphic information from dinoflagellates, foraminifers and calcareous nannoplankton as well as geochemical data ($\delta^{18}O$, $\delta^{13}C$, TOC, S, $CaCO_3$ content).
The studied samples revealed 70 species of dinoflagellate cysts including several biostratigraphic markers characterizing the Burdigalian (e.g. *Exochosphaeridium insignia*, *Nematosphaeropsis downiei*, *Sumatradinium soucouyantiae*, *Sumatradinium druggii*, *Hystrichokolpoma reductum* and *Cerebrocysta poulsenii*). The recorded assemblages are equivalent to the dinocyst zone Ein of Jiménez-Moreno et al. (2006) and range within dinoflagellate zones DN3 of de Verteuil and Norris (1996) and D17a of Lourens et al. (2005).
Investigations of foraminifers >125ìm revealed well preserved assemblages with a significant increase in total numbers of specimens up-section. Benthic foraminifers include high numbers of *Lenticulina inornata-melvilli* together with the lower Ottnangian index taxa *Amphicoryna ottnangiensis* and *Sigmoilopsis ottnangiensis*. Planktic foraminifers are dominated by globigerinids, e.g. *Globigerina praebulloides*.
The samples are rich in well preserved calcareous nannoplankton with high amounts of *Coccolithus pelagicus* (Wallich) Schiller. The frequent occurrence of *Helicosphaera ampliaperta* Bramlette & Wilcoxon and the absence of *Sphenolithus heteromorphus* Deflandre suggest a stratigraphic correlation with upper NN2-NN3 nannoplankton zones (Martini 1971).
Geochemical measurements on bulk samples revealed $\delta^{18}O$ values from -5.31‰ to -4.42‰, $\delta^{13}C$-values range from –0.25‰ to +0.69‰. Both isotopic signals show no clear trend. TOC values vary within a very narrow range between 0.31% and 0.45%, the carbonate content ranges from 26-35%. Sulfur data range from 0.06% to 0.49% showing a slight trend towards higher values up-section.
Further studies on the samples with respect to stratigraphy, geochemistry and palecology will lead to an integrated description of the Ottnangian stratotype section. The results will contribute