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PALAEONTOLOGY GROUP
WWU Münster

Ralph Thomas BECKER and the Münster Group

Since the pandemic made field work very difficult, especially abroad, the last year was successfully used to finish a large number of manuscripts. In our case, the autumn/winter lockdown phase was rather productive.

In the focus of first half year was the completion of the second volume on the Devonian and basal Carboniferous of the Moroccan Meseta. It resulted in seven chapters that are outlined in the Devonian publications section (therefore, not repeated in our following publications list). The second part grew gradually more and more, because we had to incorporate results from more than ten years of research. We like to re-emphasize the close cooperation with our good friend (Moroccan CM and co-editor) Ahmed EL HASSANI (Rabat). Apart from members of our team, the volume benefitted considerably from the expertise concerning sedimentology and various fossil groups of Pedro CÓZAR (Madrid), Hans-Georg HERBIG (Cologne), Sven HARTENFELS (Cologne), Andreas MAY (Unna), Uli JANSEN (Frankfurt a.M.), Andrej ERNST (Hamburg), Heiko HÜNEKE and Oliver MAYER (Greifswald), and Dieter WEYER (Berlin). Among the Moroccan colleagues, L. BAIDDER (Casablanca), Ali BOUARI (Marrakech), Mustafa BENFRIKA, and Fouad EL KAMEL (Casablanca) contributed, either in the field and/or by own data. The second volume is not yet the end. A third volume is planned, but after a pause, since first we must be able to return to the field for the completion of sampling of some of the localities (Fig. 1).

Fig. 1. Huge allochthonous glide block of Givetian reef limestone (with O. MAYER for scale) at Awajgal (Dechra-Aït-Abdallah region, W of Mrirt), eastern part of Western Meseta.

In parallel with the Academy Volume, we cooperated with Amine TALIH, Ph.D. student at the Mohammed V University, Rabat (supervisors: M. SAADI and A. BENMLIH). His work concentrates on the Devonian of the Tisdafine Basin in the Tinejdad region (SE Morocco), at the critical boundary between the stable Gondwana shelf (Tafiilalt-Maïder) and Meseta that was later subject to more intensive Variscan deformation. Results have been submitted for publication in the Journal of African Earth Sciences.

Another Moroccan project that went on for several years, is the close cooperation with Heiko HÜNEKE and his students at Greifswald. The project concentrates on the so far poorly understood contourite sedimentation both in the Tafilalt and at the foot of the High Atlas (Skoura Devonian). For the Tafilalt, two manuscripts are currently subject to corrections after their reviews. Another Moroccan paper in review describes rich ostracod faunas from around the Emsian-Eifelian boundary of the western Dra Valley (GROOS-UFFENORDE et al.).

The long-term cooperation with our Chinese friends MA Xueping and ZONG Pu resulted in the description of new upper Famennian *Gonioclymenia* faunas (ZONG et al. 2021) that were discovered since the first monographic treatment (ZONG et al. 2015) in the Junggar Basin of Xinjiang. As noted before, another

planned ammonoid contribution will deal with upper Frasnian *Manticoceras* faunas of Hunan. Based on a stay of Xueping a long time ago in Münster, a manuscript on the spiriferids of the Refrath Formation of the Rhenish Massif (Bergisch Gladbach-Paffrath Syncline) is close to completion.

Fig. 2. Part of the jaw of a bony fish, *Ad. pramosica* Zone, lower Frasnian, Beringhauser Tunnel section (photo K. DUDA).

Devonian ammonoid work continues with Till and will involve new M.Sc. projects (see below). The many topics listed last year are still relevant but other manuscripts were given preference. One of the local private collectors, Hartmut KAUFMANN, gave us free insights into his wonderful collection and he is willing to donate critical specimens for ongoing revisions and faunal descriptions. For example, he has valuable and partly rare specimens from the Odershausen Limestone of the Kellerwald, the Adorf Limestone of Martenberg (Fig. 3), Effenberg, and Nehden, including a nice *Archoceras* topotype.

Fig. 3. A rare *Trimanticoceras* from Martenberg (collection and photo of H. KAUFMANN).

After a long delay (the editors at Senckenberg are not to blame), the extensive revision of Rhenish D-C boundary sections was eventually published (BECKER et al. 2021). On purpose, it did not include much information concerning our best section at Borkewehr near Balve, the type-section of the Wocklum Limestone and *Protognathodus kockeli*. A multidisciplinary approach resulted in a long manuscript (HARTENFELS et al.) submitted to Palaeobiodiversity and Palaeonenvironments. In addition, we returned to the old Oberrödinghausen Railway Cut in order to re-sample the Hangenberg Limestone. Unfortunately, it turned out that its upper part is currently not exposed any more. As previously announced, Sven and I will resume work on the Lalla Mimouna section in southern Morocco. It will include an attempt to deal with the unsolved "siphonodelloid" taxonomy.

Zhor Sarah ABOUSSALAM

Sarah contributed a wealth of conodont (Fig. 4) and microfacies data to the second Meseta volume, where she acted as co-editor and co-author of most chapters. Unfortunately, the pandemic prevented its presentation at the annual (2021) meeting of the Hassan II Academy of Science and Technology of Morocco, which had to be cancelled. She compiled already many new data for the third volume, due in 2023, which will mostly concern northern and eastern parts of the western Meseta

(e.g., the Tiflet, Tiddas, Azrou, and Khenifra regions). In parallel, many new Givetian and Frasnian conodont samples from the Tafilalt were identified for the collaboration project with Heiko HÜNEKE (Greifswald).

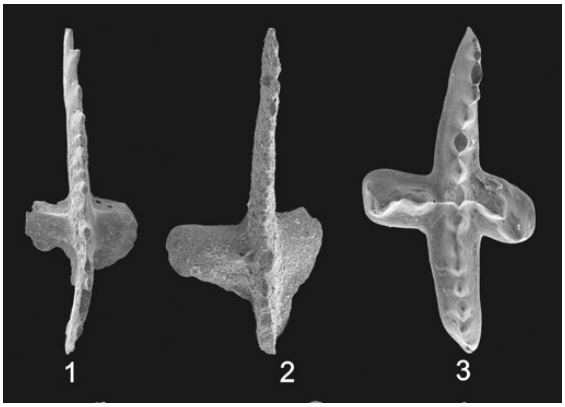

Fig. 4: Examples for Lower Devonian conodonts from Asserhmo, eastern Skoura region, southern Morocco. 1. *Criteriognathus miae*, **2.** *Cr. steinhornensis*, **3.** *Ancyrodelloides transitans*.

In the Rhenish Massif, new conodont faunas from the lower Frasnian of Beringhauser Tunnel, the lower Givetian of Binolen (LÖW et al. in prep.), and the Frasnian of Hofermühle and the Hahnenfurt Railway Station (Wuppertal region) were studied. Markus ARETZ and Elise NARDINE (both Toulouse) sent twenty samples from the Montagne Noire region for age determinations, which was partly successful. Apart from the conodont work, the bactritid M.Sc. Thesis of Lars OTTO was co-supervised.

Research assistants/Ph.D. students

Till SÖTE is in the third year of his PhD project on the upper Frasnian tornoceratids (Goniatitida). He published his first joint manuscript with Thomas, Carlo HERD and Jürgen BOCKWINKEL in the Paläontologische Zeitschrift (PalZ). Furthermore, he published a paper on the ammonoids, bactritids, and gastropods from Boudouda in the second Moroccan Meseta volume (SÖTE & BECKER 2021). Two more manuscripts on the so far neglected but rich tornoceratid fauna of Büdesheim, Eifel Mts. (presented at the annual PalGes conference in Vienna) and on Frasnian ammonoid faunas from Ouidane Chebbi and Oued Mzerreb (Fig. 5) in southern Morocco are nearly finished and should be submitted within the next months. The current results support previous ideas that the Lower Kellwasser Event did not have such a devastating impact on ammonoids as the Upper Kellwasser Event. Another manuscript, on the tornoceratid ammonoids of the Martenberg, will be done jointly with Thomas and with the help of Hartmut KAUFMANN and Felix SAUPE.

Fig. 5: Representative of a new aulatornoceratid genus from the Frasnian of Oued Mzerreb, eastern Dra Valley, southern Morocco.

Apart from his work on ammonoids, Till is working closely together with Mieke LÖW and other authors on the Binolen initial reef fauna.

Felix SAUPE continued his study on Frasnian conodont stratigraphy and diversity in the Rhenish Massif. He finished his joint manuscript with Thomas on the famous Martenberg, which has been restudied in order to document the microfacies development and to refine the conodont stratigraphy around the global *semichatovae* Event/Transgression. On a global scale, the Martenberg section is currently the best bed-by-bed documented section for facies changes, conodont and goniatite biostratigraphy at the middle/upper Frasnian transition. Therefore, it is regarded as a candidate for a future GSSP selection. The manuscript is currently under revision and will be published in the mentioned Rhenish Massif issue in Palaeobiodiversity and Palaeoenvironment.

A second manuscript on high precision conodont stratigraphy and alpha diversity

around the Kellwasser Crisis at Beringhauser Tunnel (eastern Sauerland) is in good progress. Faunas are partly exceedingly rich but the manuscript hopefully will be finished by the beginning of the next year. Furthermore, Felix will continue to work on samples of the former Schlupkothen Quarry (southeastern end of the Velbert Anticline), which was investigated before by Alexander KLEMENT in the frame of his B.Sc. project.

In case you were wondering about the new family name (previously LÜDDECKE), it remains to say that Felix and Anna SAUPE got married in August.

Anna SAUPE is currently working on living benthic foraminifera in contourite drift systems to evaluate their potentials as proxies for (palaeo-) oceanic current pattern reconstructions, in the frame of her Ph.D. project at the University of Cologne. But the results of her M.Sc. thesis on biofacies analysis of agglutinated foraminifera along a middle/upper Fammenian transect from Central Europe to North Africa are planned to be published in a joint manuscript.

Sören STICHLING is now responsible at the Krefeld Geological Service for the region of the Remscheid-Altena Anticline. Accordingly, work on a multi-authored manuscript on the drowning and extinction of the Hönne Valley Reef Complex was resumed and will be submitted to the Rhenish Massif Devonian volume of Palaeobiodiversity and Palaeoenvironments.

Stephan EICHHOLT has a full-time position in an environmental geology company near Münster, but managed to submit his microfacies data on the Devonian Rehamna reefs to the second Meseta volume (EICHHOLT et al. 2021). As a co-author, Andreas MAY was so kind to identify the coral and stromatoporid taxa. Work has begun on a third paper dealing with the Givetian reef limestones of the Oulmes and Azrou-Mrirt regions.

Master students

Mieke LÖW finished her B.Sc. project on the microfaunas of the initial reef phase of the Hönne Valley Reef complex at Binolen in the northern Rhenish Massif. Results will be part of a multi-authored manuscript for the Rhenish Devonian volume of Palaeobiodiversity and Palaeonenvironments. This will involve microfacies analyses (Till, Thomas & Sören), conodont stratigraphy (Sarah), and identifications of macrofauna (Andreas MAY, Unna, and Simon Felix ZOPPE, Frankfurt a.M.). For her M.Sc., Mieke was asked to change to Frasnian ammonoids (gephuroceratids), beginning this fall.

After completion of his M.Sc., **Lukas AFHÜPPE** agreed to run for some time the micropalaeontology lab at Münster. Therefore, he is mostly occupied by our conodont samples. He contributed to the second Meseta volume (two new Emsian discosorids, AFHÜPPE & BECKER in BECKER et al. 2021) and started to translate his M.Sc. into English, as a preparation for publication. Apart from this, he wrote a short joint manuscript with Thomas on a new Givetian discosorid from Binolen. So far, no discosorid has been described from German reef facies.

Lara HOLDERIED is working full time with a publishing company. Therefore, her M.Sc. Thesis on middle Frasnian goniatites from the Canning Basin is progressing slowly. But she will get there.

Konrad SEYFFERT worked after the completion of his M.Sc. on Emsian phacopids from Morocco for the study organization of our faculty administration. This slowed manuscript preparations.

Lars OTTO finished his M.Sc. project on lower/middle Frasnian bactritids from the Canning Basin, using a modern morphometric approach. His analyses confirmed that there are several new endemic species (Fig. 6) and even a new endemic genus. Since he now works full-time in environmental geology, the publication of the important results will take some time.

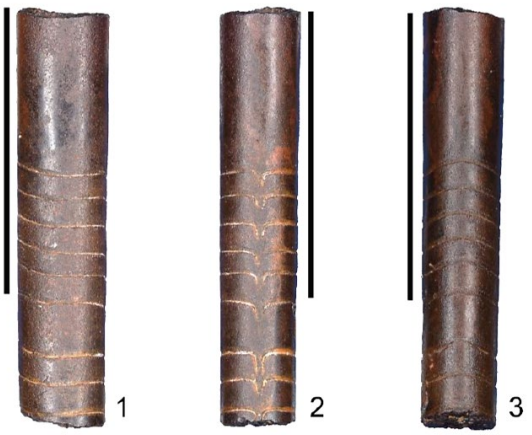

Fig. 6. New species of *Lobobactrites* from the Canning Basin (middle Frasnian of McIntyre Knolls), showing an unusual episodic interruption of normal septal spacing (scale bar = 1 cm).

Max KERN is near the completion of his M.Sc. Thesis on a core of the northern Hofermühle Reef complex (Velbert Anticline, NW Rhenish Massif). Apart from detailed microfacies analyses, carbonate diagenesis and secondary porosities formed by dolomitizations are key elements of the study, which is part of a larger project to explore the geothermal energy prospects of surface reefs and carbonate platforms in our state. Stephan BECKER from the Krefeld Geological Survey co-supervises the master work.

Alexander KLEMENT will begin this autumn a Ph.D. project on the morphometry-based taxonomy and palaeobiogeography of middle Famennian ammonoids of the Canning Basin.

References

Regular Publications

BECKER, R. T. (2020 submitted). Devonian and Lower Carboniferous global events in the Central Variscan orogen. – In: LINNEMANN, U. (Ed.), Geology of the Central European Variscides and its Avalonian-Cadomian precursers.

BECKER, R. T., HARTENFELS, S. & KAISER, S. I. (2021). Review of Devonian-Carboniferous Boundary sections in the Rhenish Slate Mountains (Germany). – Palaeobiodiversity and Palaeoenvironments, **101** (2): 357-420.

BECKER, R. T., EL HASSANI, A. & ABOUSSALAM, Z. S. (Eds., 2021). Devonian to Lower Carboniferous stratigraphy and facies of the South-Western Moroccan Meseta: Implications for palaeogeography and structural interpretation. – Frontiers in Science and Engineering, Earth, Water and Oceans, Environmental Sciences, **10** (2): 1-311. [open access; for the individual chapters see Devonian Publications]

GROOS-UFFENORDE, H., SCHINDLER, E., BECKER, R. T., DOJEN, C., BROCKE, R. & JANSEN, U. (2021 submitted). Late Early Devonian ostracods from the Torkoz area (SW Morocco) and the Emsian/Eifelian bioundary. – Paläontologische Zeitschrift.

HARTENFELS, S., BECKER, R. T., HERBIG, H.-G., QIE, W.-K., KUMPAN, T., DE VLEESCHOUWER, D., WEYER, D. & KALVODA, J. (2021 submitted). The Devonian-Carboniferous transition at Borkewehr near Wocklum (northern Rhenish Massif, Germany) – a potential GSSP section. – Palaeobiodiversity and Palaeenvironments.

SAUPE, F. & BECKER, R. T. (2021 submitted). Refined conodont stratigraphy at Martenberg (Germany) as base for a formal middle/upper Frasnian substage boundary. – Palaeobiodiversity and Palaeoenvironments.

SÖTE, T., BECKER, R. T., HERD, K. J. & BOCKWINKEL, J. (2021). Upper Frasnian Tornoceratidae (Ammonoidea) from the Sand Formation (Bergisch-Gladbach-Paffrath Syncline, Rhenish Massif). – Paläontologische Zeitschrift, **95** (2): 237-273.

STICHLING, S., BECKER, R. T., HARTENFELS, S., ABOUSSALAM, Z. S. & MAY, A. (2021 in prep.). Drowning, extinction and subsequent facies development of the Devonian Hönne Valley Reef Complex (northern Rhenish Massif, Germany). – Palaeibiodiversity and Palaeoenvironments.

TALIH, A., ABOUSSALAM, Z. S., BECKER, R. T., SAADI, M. & BENMLIH, A. (2021 submitted). Stratigraphy and tectono-sedimentary processes of allochthonous Devonian deposits of the Tisdafine Basin, Eastern Anti-Atlas, Morocco. – Journal of African Earth Sciences.

ZONG, P., BECKER, R. T. & MA X.-P. (2021 online). The ammonoid *Gonioclymenia* fauna from the Upper Devonian (upper Famennian) of western Junggar, northwestern China. – Geological Journal, **2021**: 1-20, doi: 10.1002/gj.4182.

Abstracts

LÖW, M., SÖTE, T., BECKER, R. T., MAY, A., STICHLING, S., ABOUSSALAM, Z. S. & ZOPPE, S. F. (2021). Microfauna and Microfacies from the initial reef stadium of Binolen in the Hönne Valley (Sauerland, Middle Devonian). – 92nd Annual Meeting of the Paläontologische Gesellschafts, Vienna, 26 Sept. – 01 Oct., 20021, Abstract Volume.

SÖTE, T. & BECKER, R. T. (2021). Exceptionally high diversity in the Frasnian (Upper Devonian) Tornoceratidae (Ammonoidea) from Büdesheim (Rhenish Massif, Germany). – 92nd Annual Meeting of the Paläontologische Gesellschafts, Vienna, 26 Sept. – 01 Oct., 20021, Abstract Volume.

Devonian B.Sc./M.Sc. Thesis

LÖW, M. (2020). Mikrofaunen aus dem initialen Riffstadium von Binolen im Hönnetal (Sauerland, Givetium). – B.Sc. Thesis, WWU Münster, 59 pp.

OTTO, L. (2021). Lower and Middle Frasnian Bactritida (Cephalopoda) from the Canning Basin (NW Australia) – morphometry, systematics, and palaeobiogeographical comparisons. – M.Sc. Thesis, WWU Münster, 141 pp.