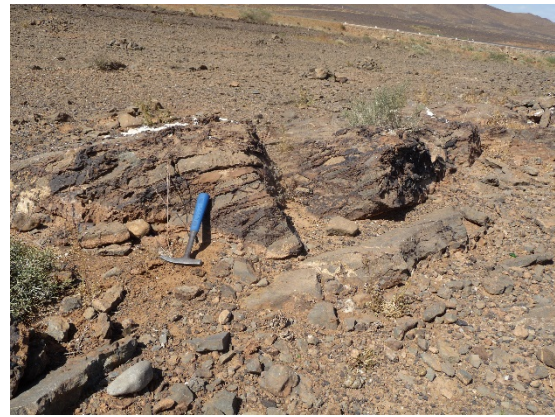


**TM R. Thomas BECKER, CM Z. Sarah ABOUSSALAM, CM S. HELLING and the Münster Group**

As in the past years, work on the Devonian of Morocco played a major role since the last report. Field work in spring 2019, jointly with Till SÖTE and Philip HERBERS, concentrated on neglected sections in the Tafilalt and Maider, on the filling of knowledge gaps, and on the exploration of so far unstudied regions, such as the region S of Tazzarine, where the Lower Devonian rests on a large mountain (Jebel Saredrar) formed entirely by Silurian black orthoceratid limestone. For anybody interested in the area, we can recommend the “Camp Saredrar”, a small, privately owned paradise at the foot of the Palaeozoic. In the Tafilalt/Maider, there was some focus on the Frasnian-Famennian boundary, as a base for the Ph.D. studies of Till and Felix LÜDDECKE. One of the finest, so far poorly studied F-F succession is situated at Rich Gaouz in the western Tafilalt. We also re-collected the Rich Bou Kourazia in the SW Maider, one of the best sections for the correlation of post-Kellwasser goniatite-conodont radiations. At the eastern Aguelmous, a lateral section to Lambidia exposes the so far most ammonoid-rich succession through the global Dasberg Event and overlying strata in basinal shale facies. An attempt to re-collect Upper Devonian sections in the eastern Tafilalt failed because the military zone around the Moroccan-Algerian border has been largely expanded. For example, this made our Ouidane Chebbi-West sections inaccessible. Now one can just drive until Tisserdimine, not beyond. But the unexpectedly forced diversion resulted in the discovery of a new fossiliferous lower/middle Famennian section at the eastern end of the Tisserdimine ridge. On the way to the eastern Anti-Atlas we continued our detailed survey of the previously unknown Middle Devonian at the foot of the High Atlas N of Ouarzazate (Talioune section). We collected several new upper Givetian ammonoids but their source in a mostly covered steep slope formed by Eovariscan conglomerates is still unclear. Afterwards, we met up with Amine TALIH from Rabat (Université Mohamed V), who is currently working on a Ph.D. on the sedimentology and structural geology of the autochthonous Devonian of the Tinejdad region. This led to further sampling at Oued Ferkla and SE of the Bou Tisdafine (Fig. 1).



**Fig. 1:** Eovariscan (Givetian), hematite impregnated breccia bed at Bou Tisdafine SE, area of Southern Variscan Front.

Jointly with Christian KLUG, Dirk FUCHS, Ahmed EL HASSANI, Kathleen RITTERBUSH, and Daniel MARTY, the editing of the proceedings volume of the 10<sup>th</sup> International Cephalopod Symposium, which the Münster Group organized jointly with Ahmed and others in spring 2018 in Fes, Morocco, was completed (KLUG et al. 2019). The issue was dedicated to the late Jürgen KULLMANN (see his obituary in SDS Newsletter 33). It includes our discovery of the oldest Devonian goniatites of Morocco (*Praechebbites* n. gen., Fig. 2), which are correlated with the global record of oldest ammonoids (BECKER et al. 2019). The advanced morphology of the new genus led to the conclusion that there must be even older faunas that are still to be discovered. Other goniatite work progresses more slowly, e.g. descriptions of further upper Givetian, lower/middle Frasnian and upper Famennian (Dasberg Event Interval) faunas.

In the Rhenish Massif, the fruitful co-operation with Agnes PISARZOWSKA, Greg RACKI and others resulted in a detailed manuscript (PISARZOWSKA et al. 2019) on the Middlesex/“*punctata*” Event at the long-known Padberg Section in the eastern Sauerland (turbiditic volcanic seamount facies). A review of global conodont and carbon isotope data led to a refined correlation. It showed that the main isotope spike does not start in the *punctata* (= MN 5) Zone, but everywhere in the level of the first *Ancyrodella nodosa* (= *gigas* Morphotype 1), at the top of MN Zone 4 (*transitans* Zone). SDS should re-consider the definition of the base of the proposed Middle Frasnian substage. It seems that an *Ad. nodosa* Zone is much easier to recognize in most regions than the base of the *punctata* Zone. Also, it would correlate strictly with the anoxic, transgressive Middlesex Event and the initiation of one of the most significant positive carbon isotope

excursion in the Palaeozoic. The new data also require a re-evaluation of the question whether there was a causal connection between the isotope spike and the contemporaneous, famous Alamo Impact in Nevada.



**Fig. 2:** A paratype of the oldest Tafalalt goniatite, *Praechebbites debaetsi*, from the top *Deiroceras* Limestone (top *Eol. excavatus* M114 Zone, basal Emsian).

We continue to study Rhenish Devonian reefs. These may develop a new economic importance, as reservoirs for deep geothermal energy projects. In the Wülfrath Reef Complex, colleagues from the Geological Survey at Krefeld discovered a new goniatite bed that indicates a phase reef drowning. It may represent the Upper Kellwasser level but its conodonts are exceedingly distorted and very difficult to identify. There are also some new biostratigraphic ages for black shale intercalations and the final drowning of the Hofermühle, Neanderthal, and Hagen-Balve reefs (e.g. STICHLING et al., in prep.).

Jointly with Sven HARTENFELS and Sandra KAISER, investigations at the D/C boundary continued. We still have to secure the important conodont collections from Franconia of Harald TRAGELEHN. In the Rhenish Massif, our regional GSSP favorite at Borkewehr (Wocklum) was demonstrated to excursion members in conjunction with the International Congress on the Carboniferous and Permian (HARTENFELS & BECKER 2019, HERBIG et al. 2019). Some re-sampling at the famous Drewer section showed a major problem of that section: a common very poor conodont yield. The most critical question to solve is the precise taxonomy, with strict definitions of

new subspecies and morphotypes, in the *Protognathodus collinsoni-kockeli* lineage. A requested (by the D/C Boundary Task Group) review of Rhenish D/C boundary sections (BECKER, HARTENFELS & KAISER, in prep.) is close to completion. In parallel, work on Moroccan D/C boundary section continued. Important goniatite results for the Mkarig and Lalla Mimouna sections were presented at Cologne (BECKER 2019). At the Task Group Meeting, a general overview of Moroccan sections was given (without abstract). Unfortunately, the joint international and interdisciplinary efforts concerning the Kule section of Uzbekistan have not progressed much.

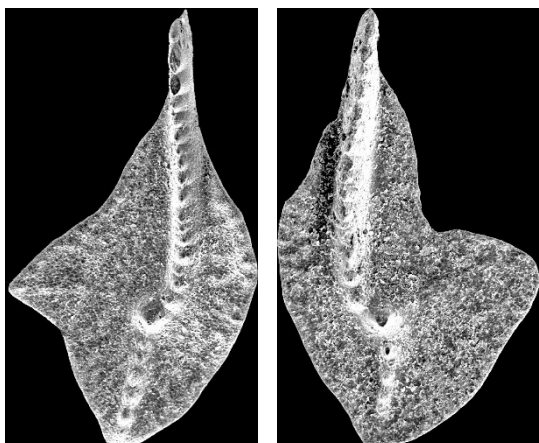
Another major task was the completion of the Devonian chapter, jointly with Anna-Christine DA SILVA, John MARSHALL, Gabi and Jim OGG, for the GTS 2020 volume, which will come out in summer 2020. Felix GRADSTEIN is the main project editor and without his pushes, things would have lasted much longer. There will be a new absolute time-scale (beyond our responsibility), but it is clear that we need many more biostratigraphically well-tuned zircon age tie points before stability of the time scale will become in sight.

Despite excellent ratings by all external reviewers, our research proposal concerning the role of the Afro-Appalachian Seaway for global palaeobiogeography, palaeoceanography and palaeobiodiversity was not successful. We will try to study relevant sections, for example in the Tan-Tan region, in the frame of other projects. Jointly with Ahmed EL HASSANI we started to write chapters for a volume to be published by the Geological Survey of Morocco on the Devonian stratigraphy, facies development, palaeogeography and syndimentary tectonics of the Moroccan Meseta. It gives us the opportunity to publish at least some of the wealth of new data, including many ammonoids, conodonts, and thin sections that we assembled in the last ten years. We hope to finish ten chapters until early next year. Of course, we intend to produce a volume that becomes a MUST for all Devonian stratigraphers.

## CM Z. Sarah ABOUSSALAM

The year 2019 started with a most pleasant event. Sarah's scientific research was rewarded by a nomination to become a Corresponding Member of the Royal Academy of Sciences and Technics of Morocco. The inauguration took place in February in Rabat, during the annual meeting of the academy.

She is part of an only small group of geoscientists and the only external member from Germany.



**Fig. 3:** Two unusual palmatolepids from intra-Kellwasser beds (MN Zone 13a) of Anajdam, S of Mrirt, Moroccan Meseta.

Her conodont work focused on additional samples from the Moroccan Meseta, for example from the Skoura region (Taliouine, Tizi-n-Ourthi, Asserhmo), and from the Tafilalt. The new samples from Seheb-el-Rhassal confirmed the results of her Ph.D. Thesis. The section is currently the best in the Anti-Atlas for the middle/upper Givetian boundary, especially since the Ouidane Chebbi region is now very difficult to access. A major task is the final identification of all Meseta conodont samples (Fig. 3), corresponding microfacies analysis, and section log drawings for the planned Meseta volume (see above).

In the Rhenish Massif, the conodont stratigraphy for the joint paper on the Padberg section and the Middlesex Event was the prime work. In addition, there were some new samples from reef complexes (Oberrödinghausen, Neanderthal). The second Wulankeshun paper (Famennian of Xinjiang) with WANG Zhihong and Sven is still waiting for Thomas...

### CM Stephan Helling

Stephan has spent much of the last year with various excavations campaigns, ranging from archaeology to Devonian palaeontology. A focus of his trilobite work were upper Famennian faunas from pelagic shales of Wuppertal-Üllendahl. These include ontogenetic stages of proetids (*Drevermannia*) and phacopids (*Dianops* and *Phacops* ex gr. *granulatus*), which will be published in at least two papers. This led to a further delay of manuscripts on Pragian trilobites from the Moroccan Meseta (Ain-al-Aliliga) and the Southern Variscan Front (Taourirt Khellil, SE of Tinerhir). A

new interest are rare new odontopleurid specimens from the upper Givetian/lower Frasnian of the Rhenish Massif (Hofermühle, Beul).

### Research assistants/Ph.D. students

**FELIX LÜDDECKE** finished his M.Sc. on the Famennian conodont biostratigraphy and biofacies of the Minervois Nappe of the Montagne Noire, southern France, late in 2018. Final results were presented at the 3<sup>rd</sup> ISC - STRATI in Milano (LÜDDECKE & HARTENFELS 2019). Prior to the 19<sup>th</sup> ICCP in Cologne, he accompanied Wenkun QIE and Sven HARTENFELS during field work in the Rhenish Massif, which focused on the Famennian of the Effenberg and Frasnian/Famennian transition at Beringhauser Tunnel. Felix is now continuing his research as a research assistant. His Ph.D. studies focus on the ontogeny, taxonomy, palaeodiversity and extinction patterns of conodonts across the F-F boundary, with special respect to climatic and facies gradients, conodont biofacies, and palaeobiogeography. Relevant conodont samples from Morocco, southern France, the Saxothuringian Zone and the Rhenish Massif assembled in the last decade. As a first topic, he is currently reinvestigating the famous Martenberg section in search for the *jamieae* Zone around the middle/upper Frasnian boundary.

**Till SÖTE** became a research assistant in late 2018. He is currently working on a PhD thesis dealing with the morphometry, taxonomy, palaeobiogeography and phylogeny of tornoceratids (Goniatitida) around the global Kellwasser Crisis. The first project deals with a completely new Intra-Kellwasser (UD I-K) fauna from the Sand Formation of Bergisch-Gladbach, which was mostly provided by the amateur collector Carlo HERD. Jürgen BOCKWINKEL is also co-operating closely and supplied nice photographs (Fig. 4). The Sand Formation yielded a highly diverse tornoceratid fauna with 21 species, 6 genera, and 10 new taxa. First results were presented at the annual meeting of the Paläontologische Gesellschaft in Munich (SÖTE et al. 2019). A joint manuscript is close to completion. Subsequently he will work on a contemporaneous, new and rich goniatite fauna from Büdesheim in the Eifel Mountains, which is somewhat younger than the diverse fauna from the classical Büdesheim Goniatite Shale.



**Fig. 4:** *Serramanticoceras serratum* from the Sand Formation (“*Archoceras*” *varicosum* Zone, UD I-K) of Bergisch Gladbach, western Rhenish Massif (photo J. BOCKWINKEL)

**Stephan EICHHOLT** is mostly occupied by his full time job in an environmental geology company. On the side, he is slowly working on a second paper on the Devonian reef complexes of the Moroccan Meseta. This second contribution will deal with the Oulmes to Azrou region.

### M.Sc. Students

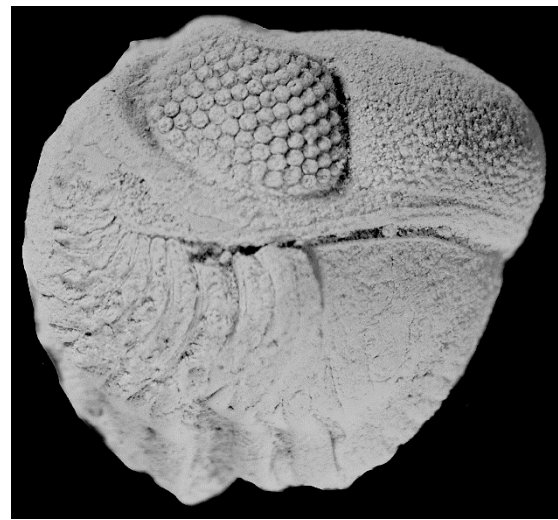
**Lucas AFHÜPPE** started to investigate the partly common Middle Devonian (mostly upper Givetian) oncoceratids and discosorids of the Tafilalt Platform. He is faced with an unexpected morphological variability; almost all specimens must have been adults, but partly at very different size.

**Lara HOLDERIED** studies middle Frasnian goniatites from two sections in the Canning Basin of Western Australia. Her task is to use ontogenetic morphometry to clearly define all present species (of *Manticoceras*, *Prochorites*, *Probeloceras*, *Gogoceras*, and *Acanthoclymenia*) and to compare them with contemporaneous, closely related forms of Europe and Eastern North America. This will give a base for an improved palaeobiogeographic understanding.

**Lars OTTO** started a M.Sc. project on so far undescribed Devonian bactritids from the Canning Basin and Southern Morocco. As a novelty in the group, he will apply simple morphometry and statistics to clarify species variability and ontogeny.

There is also unpublished material from the Rhenish Massif for comparisons.

**Konrad SEYFFERT** also applies detailed morphometry in his project, but on Emsian phacopids of southern Morocco (Fig. 5). So far, there are a very few population, ontogenetic and statistical approaches in that group. However, this is regarded as essential in order to reach a refined taxonomy. The description and revision of faunas will form a base for evaluations of biodiversity and regional phylogeny.



**Fig. 5:** Enrolled new specimen of the large-eyed phacopid *Austerops kermi* (MCKELLAR & CHATTERTON, 2009) from the upper Emsian of Rich Tamelougou, western Dra Valley.

**Philip HERBERS** identified the conodonts from Famennian foraminifer samples from Col de Tribes, Montagne Noire, left over from the M.Sc. study of Anna SAUPE (see 2018 report). These faunas will form a base for modern statistical analyses of conodont biofacies, using cluster analysis and other features of the R software package. The aim is to better recognize and define conodont subfacies types based on a species group approach, rather than on the simplified, outdated count of “mega-genera”, such as *Polygnathus* and *Palmatolepis*.

**Maro-Pascal ELLERKAMP** finished his M.Sc. thesis on Givetian gastropods from the western Dra Valley, which remained unstudied although they were collected almost 20 years ago by Thomas and Sarah from pelagic black shale facies. As expected, there are several new taxa, but there are also various forms that are long known from oxic peri-reefal facies of the Rhenish Massif. This led to comparisons, which also investigated the influence of the global Taghanic Crisis on gastropods from the deeper water realm.

## Publications

### Journal papers

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- KLUG, C., BECKER, R. T., EL HASSANI, A., RITTERBUSH, K., FUCHS, D. & MARTY, D. (2019): Special Issue: Cephalopods through time. – Swiss Journal of Palaeontology, **138**: 1-7.
- KOLTONIK, K., PISARZOWSKA, A., PAZKOWSKI, M., SLÁMA, J., BECKER, R.T. ZYCZERBA, M., KRAWCZYNSKI, W., HARTENFELS, S., MAZUR, S. & FRANKE, W. (2019). Reply to Comment by M.F. PEREIRA, J.B. SILVA and C. GAMA on “Baltic provenance of top-Famennian siliciclastic material of the northern Rhenish Massif, Rhenohercynian zone of the Variscan orogeny, by KOLTONIK et al., International Journal of Earth Sciences (2018) 107:2645-2669”. – International Journal of Earth Sciences, **108**: 1075-1078; doi.org/10.1007/s00531-019-01692-z.
- PISARZOWSKA, A., BECKER, R. T., ABOUSSALAM, Z. S., ZYCZERBA, M., SOBIEN, K., KREMER, B., OWOCKI, K. & RACKI, G. (2019 in press). Middlesex/*punctata* Event in the Rhenish Basin (Padberg section, Sauerland, Germany) – multidisciplinary clues to the early-middle Frasnian global biogeochemical perturbation. – Global and Planetary Change.

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- BECKER, R.T. (2019). Paläozoische Ammonoidea (inklusive Bactritida) 2014 bis 2018. Literaturbericht. – Zentralblatt für Geologie und Paläontologie, Teil II, **2018** (5/6): 373-437.

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- BECKER, R.T. & ABOUSSALAM, Z.S. (2018). The upper Givetian – strange mid-Palaeozoic interval with maximum biostratigraphic time resolution and rapid eustatic fluctuations. – Opening Meeting IGCP 652 “Reading Time in Paleozoic sedimentary Rock”, 12<sup>th</sup> – 13<sup>th</sup> September 2018, Bremen, Germany, Oral Presentations: 2 pp.
- BECKER, R. T. (2019a). Principles of Devonian ammonoid zonations. – In: Strati 2019, 3<sup>rd</sup> International Congress on Stratigraphy, 2-5 July 2019, Milano, Italy, Abstract Book: 86.
- LÜDDECKE, F. & HARTENFELS, S. (2019). Famennian conodont biostratigraphy and biofacies of the Minervois Nappe (Ravin de la Fontaine de Sante, Montagne Noire, Southern France) – a reinvestigation. - In: Strati 2019, 3<sup>rd</sup> International Congress on Stratigraphy, 2-5 July 2019, Milano, Italy, Abstract Book: 187.
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of the Paläontologische Gesellschaft, Munich  
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