

TM R. Thomas BECKER, CMs Sven HARTENFELS, Zhor Sarah ABOUSSALAM, Stephan HELLING, and the Münster Group

Field work in Morocco was conducted jointly with Heiko HÜNEKE, Oliver MAYER and his student group from Greifswald and with Moroccan counterparts Ahmed EL HASSANI and Lahssen BAIDDER, in the frame of their current DFG project on Devonian contourites. In spring 2017 we concentrated on the poorly studied Palaeozoic outcrop belt at the foot of the High Atlas and to the N/NE of Ouarzazate (Skoura region). There, the variably thick Lower Devonian is in Anti-Atlas type pelagic facies, followed by more neritic Middle/Upper Devonian preserved only in massive Eovariscan breccia beds. Especially interesting was the discovery of a *Mimagoniatites* marker unit (Fig. 1) at the top of the lower Emsian. We failed to reach the Devonian succession east of the high Tizin Tichka Pass (on the way to Marrakech) because we climbed up the wrong steep mountain, where the widely visible Silurian black shales are unexpectedly capped by a thrust fault and post-Devonian limestones. Subsequently, we re-sampled sections in the Jebilet and Rehamna, with a focus on the Silurian-Devonian transition and Eovariscan reworking.



Fig. 1. *Mimagoniatites* in a marker unit at the top of the lower Emsian at Taliouine, N of Ouarzazate (March 2017).

In other Moroccan matters, joint work with Jürgen BOCKWINKEL (Leverkusen) on upper Givetian pharciceratid faunas from the Anti-Atlas continued. As a result, a detailed study on the *Taouzites* Bed of Ouidane Chebbi, including conodont data, has been published (BOCKWINKEL et al. 2017). We have started another manuscript that will concentrate on the oldest pharciceratid faunas of the Tafilalt, from around the proposed middle/upper

Givetian boundary level. At a slow pace, other Moroccan ammonoid faunas are studied. These will play an important role in the forthcoming field trip to the Devonian/Lower Carboniferous of the Tafilalt/Maider in conjunction with the 10th **International Cephalopod Symposium**, which Ahmed and I (with many others) will organize in spring 2018 in Fes.

In March 2017, the Münster Group, jointly with the Palaeobotany Group (Hans KERP and students), organized the **Annual Meeting of the Paläontologische Gesellschaft**, more than 50 years after the society last visited the city. A meeting report can be found in the newsletter GMit (BECKER & KERP 2017). Before and after the scientific sessions there were one-day field trips to the Hönne Valley and to the eastern Rhenish Massif, with a focus on the Frasnian-Famennian (Beringhauser Tunnel, Winsenberg Road Section) and Devonian-Carboniferous boundaries (Drewer). The distributed field guides were identical to the chapters in the Rhenish Massif Guidebook published last year in our institute journal (see SDS Newsletter 31).

Ongoing/continuing research in the Rhenish Massif concentrates on the Velbert Anticline, where large active quarries and motorway constructions open new outcrops. But it is also surprising how many old quarries have never been properly studied. We concentrate on reef faunas, extinctions, the post-reefal facies, ammonoid and conodont faunas. There is a close cooperation with the Krefeld Survey (Geologischer Dienst) and Rheinkalk/Lhoist Group. A range of experienced and highly motivated amateur collectors are very cooperative and frequently show their findings. Excavations for buildings open also some interesting outcrops in the northern Rhenish Massif (Hagen to Iserlohn areas). In the eastern Rhenish Massif, the joint work with Greg RACKI and co-authors on the lower/middle Frasnian boundary (Padberg section) has not yet been completed; a joint publication is in progress. We also agreed to work in future together with David DE VLEESCHOUWER (Bremen) and Peter KÖNIGSHOF (Frankfurt a.M.) on Famennian cyclostratigraphy, in the frame of the current IGCP 652 on “Reading geological time in Paleozoic sedimentary rocks”.

After the D-C Boundary Workshop in Montpellier in autumn 2016 we increased our efforts to revise and refine the stratigraphy of various important sections, from Lalla Mimouna in the Anti-Atlas, the La Serre Trench C in the Montagne Noire (CIFER et al. 2017a, 2017b), the Royseux section in the Ardennes with the globally youngest rich

phacopids (new conodont and microfacies work, BECKER & HARTENFELS 2017) and neritic succession of Klein-Steinkothen (western Velbert Anticline, with Hans-Georg HERBIG, Cologne), to the palynomorph-rich shales of Riescheid (Sven and Christoph HARTKOPF-FRÖDER, Krefeld), the classical sections of Oese, Oberrödinghausen, and Drewer, the mostly neglected Reigern Quarry near Hachen (SÖTE et al. 2017), and the type-locality of the Wocklum Limestone and of *Protognathodus kockeli* near Wocklum (BECKER & HARTENFELS 2017; HARTENFELS et al. 2017). Close cooperation with Agnes PISARZOWSKA and her group from Poland led to a revised understanding of clastic sedimentation during the peak of the global Hangenberg Regression in the Rhenish Massif (KOLTONIK et al. submitted). An attempt is planned to combine the dispersed many data from at least four different research groups concerning the Kule section near the Uzbekistan-Tadzhikistan boundary in one joint publication but this will certainly need some time. More imminent is the publication of the first ammonoids from the Hangenberg Black Shale of a section in South China, jointly with MA Xueping and his co-authors (ZHANG et al. 2017 in prep.).

Other joint work concerning Chinese Devonian successions is continuing but progress has been slow. This applies to the second taxonomic part on Famennian conodonts from Xinjiang, jointly with WANG Zhihong, or to Frasnian goniatites from Hunan (with MA Xueping). The rich Devonian ammonoid collections from the Canning Basin have become the subject of student projects (see below). Some new lower Emsian ammonoids from Victoria hopefully will eventually be published in 2018. This, and a begun revision of *Teicherticeras*, will form the base for the first chapter (on the Mimosphinctacea) of the revised Devonian ammonoid Treatise.

A summer highlight of 2017 was the ICOS 4 symposium and the well-organized and “stimulating” (in various ways) field trips to the Devonian of the Pyrenees and Celtiberia, Well done, Nacho, Teresa, Carlo, Peter etc. Especially delighting was the recovery of many new *Falcitornoceras* specimens from the basal Famennian. A few conodont samples are hopefully useful to check the suitability of Theresa’s Pyrenees sections in the search of a future upper Givetian GSSP.

CM Sven HARTENFELS

As a part of the congress committee, I was deeply involved with the organization of the 88th Annual

Conference of the Paläontologische Gesellschaft and, as a part of the editorial board, strongly occupied with the editing of the congress abstract volume (*Münstersche Forschungen zur Geologie und Paläontologie*, vol. **109**). The annual conference took place in Münster, March 26th to 30th, and two Devonian excursions were successfully guided. Together with Sören STICHLING, we introduced the evolution of the Hönne Valley Reef Complex and the subsequent Upper Devonian strata of the northern Sauerland and, together with Thomas, mass extinction events in the Upper Devonian of the eastern Sauerland.

Research concentrated in the last year on Famennian to Lower Carboniferous successions of the Rhenish Massif, Thuringia, Montagne Noire, and SE Morocco. I continued to collaborate with Christoph HARTKOPF-FRÖDER (Krefeld), Hans-Georg HERBIG, and Sarah ESTEBAN LOPEZ (both Cologne) on the revision of the Famennian to Lower Carboniferous Riescheid section of the Velbert Anticline. Together with Thomas and Tomáš KUMPAN (Brno), I re-sampled the so far insufficiently studied type section of the Wocklum Limestone and of important uppermost Famennian index clymenids, the Borkwehr near Wocklum (northern Rhenish Massif; BECKER & HARTENFELS 2017; HARTENFELS et al. 2017). The conodont samples provide sparse to moderately rich faunas, which enable the location of zonal boundaries and, most importantly, the evolutionary succession of species within the genus *Protognathodus*. Current data suggest that the phylogenetic change from advanced *Pr. collinsoni* to *Pr. kockeli* is recognizable in the first few transgressive limestones immediately after the siliciclastics of the glacio-eustatic Hangenberg Regression. Therefore, it conforms to the recently decided criteria for the future Devonian/Carboniferous GSSP level. Thin-sections of each conodont-bearing layer were investigated for microfacies analyses and give no hints for reworking processes. These new results were presented at the 4th International Conodont Symposium (ICOS IV) held at the end of June in Valencia, Spain.



Fig. 2. Top of the Wocklum Limestone and sharp base of Hangenberg Black Shale in the classical D/C section of the Oberrödinghausen Railway Cut.

In co-operation with Peter KÖNIGSHOF (Frankfurt am Main), David De VLEESCHOUWER (Bremen), and Thomas, I started to re-investigate the Effenberg Quarry (see HARTENFELS 2011, *Münstersche Forschungen zur Geologie und Paläontologie*, vol. **105**) in the frame of the new IGCP 652 project. Based on the completed M.Sc. thesis of Marius SACHER in 2016, I also continued work on the cyclic Oberrödinghausen Railway Cut (including both *Annulata* Black Shales as well as the Dasberg and Hangenberg Black Shales; Fig. 2).

During the last year, my Moroccan conodont work was mainly devoted to the biostratigraphy of El Khraouia (eastern end of Amessoui Syncline, southern Tafilalt) and the ongoing study of Devonian/Carboniferous successions of the northern Maider (Lalla Mimouna and Jebel Rheris West). There is also a wide range of Famennian samples from the Moroccan Meseta (provided by Sarah and Thomas). This includes a special focus on the Ziyar section in the Khenifra region, which includes the *Annulata* Events.

Jointly with Thomas, many B.Sc. and M.Sc. students have been supervised, some of which (see below) presented their research results at national and international meetings (e.g. HERBERS et al. 2017). During a trip to southern France with Felix LÜDDECKE, we spent two days in the field with Raimund FEIST and Jean-Jacques CORNÉE (both Montpellier), in order to advance work on the La Serre trench C, which is situated 200 m east of the present GSSP trench E'. In contrast to the stratotype section, the Hangenberg Black Shale is well-developed below the regressive oolitic sequence; nevertheless, sedimentological evidence and conodont faunas allow a fine-scaled lateral correlation. There is a co-operation with Tim CIFER (Ljubljana), Carlo CORRADINI (Cagliari), Catherine

GIRARD, Raimund FEIST, Jean-Jacques CORNÉE (all Montpellier), and Sandra I. KAISER (Stuttgart). First results were presented at the 4th International Conodont Symposium (ICOS IV; CIFER et al. 2017b).

CM Zhor Sarah ABOUSSALAM

Sarah continued her wide range of Devonian conodont studies. In the focus were final samples from the Moroccan Meseta in order to progress with publications on the reef drowning and extinction (ABOUSSALAM et al. 2017 in prep.) and on the timing of Eovariscan reworking. The revision of the age of a supposed Devonian reef limestone in the Haouz region S of Marrakech (ABOUSSALAM et al. 2017 in press) should already have been published but there is a continuing delay with the volume in "Stratigraphy" in honor of the late Rich LANE. In 2016/2017 some new samples were collected in order to provide more precision for the age of reworked clasts in Famennian breccias of the Jebilet (Fig. 3), Rehamna, Khenifra, and Azrou regions. Rare conodonts showed the presence of a thick Emsian succession in a poorly studied region south of Meknes, which requires more future work.



Fig. 3. Re-sampled limestone clasts in the polymict "red conglomerate" at the base of the Jebel Ardouz succession W of Marrakech (western Jebilet).

Conodont data will also be supplied to the joint contourite project with Heiko HÜNEKE and his Greifswald team. Some faunas from the eastern Tafilalt were added to the joint publication on a rich pharcoceratid fauna from the upper Givetian (BOCKWINKEL et al. 2017).

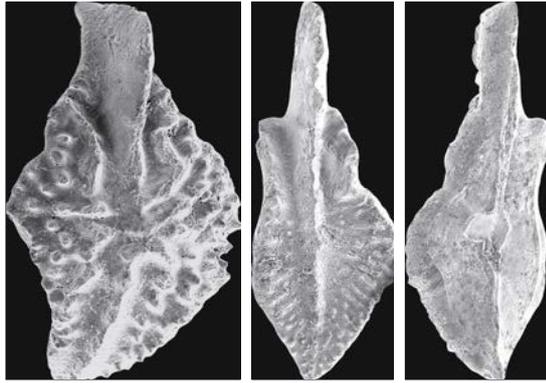


Fig. 4. Two new and unusual *Schmidognathus* from the terminal Givetian of Giebringhausen.

Concerning the Rhenish Massif, there are additional faunas from the Padberg section in the eastern Sauerland (joint project with Greg RACKI and co-authors). Numerous conodont samples were identified for the ongoing work in the Velbert Anticline region (Hofermühle, Wülfrath and Neandertal reefs; e.g. ELLERKAMP et al. 2017). Sarah also assisted Sören in the identification of his Frasnian assemblages from boreholes of the Hönne Valley (STICHLING et al. 2017). Because new questions arose concerning the upper Givetian conodont zonation, the still unpublished detailed data from Giebringhausen were updated as a contribution to ICOS 4 (ABOUSSALAM & BECKER 2017; examples in Fig. 4).

Close cooperation with Carl BRETT, Jay ZAMBITO, Gordon BAIRD and Alex BARTHOLOMEW led to a revision of the Givetian, around the global Taghanic Crisis, in Kentucky. A joint manuscript has been submitted (BRETT et al. 2017, 2017 submitted). This work was utilized as a part of the base for a new DFG Project on “The Afro-Appalachian Seaway”, which shall unite our Münster Group with Ahmed EL HASSANI, Lahssen BAIDER, and our American friends. It shall compare the complete Devonian sequences of SW Morocco with those of the Appalachian Basin, including eventual (quantitative) biogeographic comparisons. We are very eager to track the eastern North American sequences and events in the Aoucert and Smara region to the Tan-Tan region and western Dra Valley, and vice versa. It will take some time before we learn whether this ambitious project will receive funding.

CM Stephan HELLING



Fig. 5. Joint examination (with Oliver MAYER, Greifswald) of a steep Emsian cliff at Asserhmo N of Skoura (foot of the High Atlas).

At the end of last year and the beginning of 2017 I was involved in the planning and organization of the 88th Annual Conference of the Paläontologische Gesellschaft (March 26th to 30th in Münster). The editing of the congress abstract volume (*Münstersche Forschungen zur Geologie und Paläontologie*, vol. **109**) was one of the main duties. In the course of a teaching position (that started in 2016), I was much occupied to prepare for the first time many lectures for the winter term. After finishing that position in spring, I joined Thomas during a short field campaign in Morocco, partly together with Ahmed EL HASSANI, Lahssen BAIDDER, Oliver MAYER, Heiko HÜNEKE and some students of the Greifswald group (Fig. 5), mainly in the areas around Ouarzazate and Marrakech. I focused on sampling Lower Devonian trilobites (Pragian to Emsian) as reference material for my studies on the trilobite faunas from Taourirt n'Khellil (“Ait Issa”) and Ain-Al-Aliga (Oued Cherrat Valley region of the Meseta). Two papers will be published in 2018 with a description of these faunas.

In cooperation with the LWL Museum für Naturkunde in Münster I started to work on some rare trilobite specimens from the eastern Rhenish Massif, mainly upper Emsian to lower Eifelian in

age. This work will continue until the end of 2017 and the results will be published next year.

Research students

Due to his limited time outside a full-time job in applied geology, **Stephan EICHHOLT** makes slow progress with his Ph.D. studies on Givetian/Frasnian reef facies developments in the Moroccan Meseta. A manuscript on the Oulmes (Ain Jemaa) Biostrome and reefal blocks of many other localities to the east (Meknes-Azrou-Fes regions) should be finished in 2018.

Sören STICHLING is in the second year of his Ph.D. study on the facies history and stratigraphy of the Hönne Valley Reef Complex (northern Rhenish Massif). It is funded by the Rheinkalk GmbH/Lhoist Group, who supply extensive cores of old and new boreholes. He gave a presentation at the annual meetings of the Paläontologische Gesellschaft in Dresden and at the ICOS symposium in Valencia (STICHLING et al. 2016, 2017). A manuscript on the final reef phase (e.g., Fig. 6), extinction and post-reefal beds is close to completion (planned for “Facies”).

Anna SAUPE continued her M.Sc. project on agglutinating foraminifere assemblages from the Rhenish Massif, Thuringia, Montagne Noire, and Morocco (Khenifra region). Results of biofacies analyses were presented at the Münster Meeting of the Paläontologische Gesellschaft (SAUPE et al. 2017) as well as the annual meeting of the national SDS in spring 2017 in Hof (Franconia).

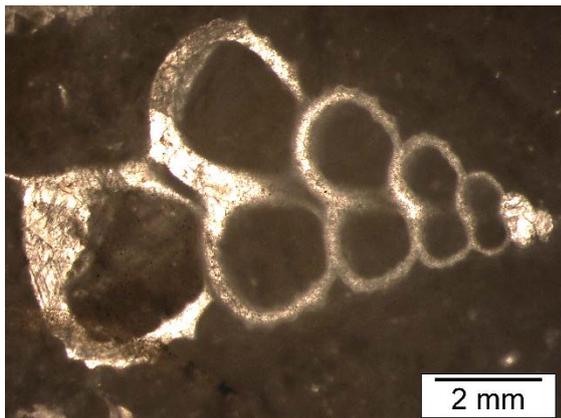


Fig. 6. Gastropod from the terminal (top lower/basal middle Frasnian) biostrome of the Hönne Valley Reef Complex (northern Rhenish Massif) at the Beul.

Till SÖTE has started a M.Sc. project on the comparison of lower Famennian goniatites from the Canning Basin with Rhenish type material, based on morphometric data. As noted above, he has

published in 2017 the results of his B.Sc. Thesis, including data (by RTB) on the local ammonoid record (SÖTE et al. 2017).

Julia RICHTER finished her M.Sc. Thesis on the upper Emsian to lower Givetian and upper Famennian microfacies and conodont stratigraphy of the isolated Immouzer-du-Kandar Palaeozoic south of Fes. It was possible to track down the precise position of the Chotec Event whilst the Kacak Event is locally not evident as a facies break. The origin of a thick pile of (reworked) volcanic pebbles below the studied upper Famennian sequence remained enigmatic.

Felix LÜDDECKE presented his B.Sc. Thesis at the 4th International Conodont Symposium (ICOS IV) and participated in the post-conference fieldtrip to the Prague Synform and the Carnic Alps. His thesis dealt with the conodont biofacies analysis of a monotonous, middle Famennian carbonate succession (Upper Ballberg Quarry, Rhenish Massif). Results are online at DOI 10.1007/s12549-017-0288-x and published in the IGCP 596 issue of *Palaeodiversity and Palaeoenvironments*. The paper includes a new approach to conodont biofacies and a new icriodid species (LÜDDECKE et al. 2017). In Mai 2017, Felix and Sven spent ten days in southern France, partly with Markus ARETZ and Elise NARDIN (both Toulouse), to take conodont and microfacies samples for Felix’s upcoming M.Sc. thesis. It will concentrate on the so far insufficiently studied Famennian part of the Talweg de la Fontaine-de-Santé section.

Maro-Pascal ELLERKAMP started to write up his account of the Hofermühle (NW Velbert Anticline, western Rhenish Massif) gastropod fauna, which has been dated as upper Givetian to basal Frasnian (conodont data by Sarah) and which includes two new, rare taxa. There was a focus on the impact of the Taghanic Crisis on gastropod successions (see ELLERKAMP et al. 2017).

The B.Sc. of **Lars OTTO** dealt with the poorly studied Mauxion Quarry adjacent to the famous Bohlen section of Thuringia. He analyzed the microfacies and conodont faunas from just around the *Annulata* Events. As at the Bohlen, the Wagnerbank is developed as a *Prionoceras*-rich interval.

Sven and I gave **Patrick KRISPIN** Famennian limestone samples from the famous Kowala Quarry in the Polish Holy Cross Mountains in order to clarify aspects of the pelagic micrite origin by high-

resolution SEM analysis. First results are very promising.

Stephanie ROSCHIG started in the frame of a B.Sc. project to use detailed ontogenetic morphometrics for a comparison of lower/middle Famennian sporadoceratid goniatites from the Rhenish Massif, southern Morocco, Iran, and Western Australia. There is more morphological variation than anticipated but, despite their more distant origin, Australian specimens are closer to the German material than the Moroccan representatives.

Sascha MIKOLAJEWSKI conducts a mapping project in the type-region of the famous Neanderthal, where the famous *Homo neanderthalensis* lived in caves of hardly studied Givetian reef limestone. Some of the local quarries have never been visited by a professional geologist! In cooperation with the mapping team of the Krefeld survey (Geologischer Dienst, notably with Martin SALAMON), Sascha concentrates on the Middle/Upper Devonian successions at the two limbs of the narrow Herzkamp Syncline, with the Neander valley in the N (southern end of Velbert Anticline) and the Millrath-Gruiten region in the SE (NW end of Remscheid-Altana Anticline). We hope to clarify the timing of reef extinctions in comparison to the Hofermühle and Wülfrath reefs to the north.

Publications (in chronological order)

Journal papers

BOCKWINKEL, J., BECKER, R. T. & ABOUSSALAM, Z. S. (2017). Ammonoids from the late Givetian *Taouzites* Bed of Ouidane Chebbi (eastern Tafilalt, SE Morocco). – *Neues Jahrbuch für Geologie und Paläontologie, Abhandlungen*, **284** (3): 307-354.

LÜDDECKE, F., HARTENFELS, S. & BECKER, R. T. (2017). Conodont biofacies of a monotonous middle Famennian pelagic carbonate succession (Upper Ballberg Quarry, northern Rhenish Massif). – *Palaeobiodiversity and Palaeoenvironments*, doi 10.1007/s12549-017-0288-x.

SÖTE, T., HARTENFELS, S. & BECKER, R. T. (2017). Uppermost Famennian stratigraphy and facies development of the Reigern Quarry near Hachen (northern Rhenish Massif, Germany). – *Palaeobiodiversity and Palaeoenvironments*, doi 10.1007/s12549-017-0287-y.

ABOUSSALAM, Z. S., BECKER, R. T., EL HASSANI, A.,

EICHHOLT, S. & BAIDDER, L. (2017 in press). Late Lower Carboniferous conodonts from a supposed Middle Devonian reef limestone of the Marrakech region (Morocco). – *Stratigraphy*.

KOLTONIK, K., PISARZOWSKA, A., PASZKOWSKI, M., SLAMA, J., BECKER, R.T., MARYNOWSKI, L., KRAWCZYNSKI, W. & HARTENFELS, S. (2017 submitted). Provenance of Famennian siliciclastics from the northern Rhenish Massif – paleostructural, paleogeographical and paleoclimatic implications. – *Gondwana Research*, 37 pp.

BRETT, C. E., ZAMBITO, J. J. IV, BAIRD, G. C., ABOUSSALAM, Z. S., BECKER, R. T. & BARTHOLOMEW, A. J. (2017 submitted). Litho-, Bio-, and Sequence Stratigraphy of the Boyle-Portwood Succession (Middle Devonian, Central Kentucky, U.S.A.). – *Palaeobiodiversity and Palaeoenvironments*.

SCHINDLER, E., BROCKE, R., BECKER, R. T., BUCHHOLZ, P., JANSEN, U., NESBOR, H.-D. & SALAMON, M. (2017 submitted). The Devonian in the Stratigraphic Table of Germany 2016. – *Zeitschrift der Deutschen Gesellschaft für Geowissenschaften*.

Popular science contribution

HARTENFELS, S., BECKER, R. T., NOWAK, H., ABOUSSALAM, Z. S., JUCH, D. & DROZDZEWSKI, G. (2017). Das letzte rheinische Riff ertrinkt – neue Erkenntnisse aus dem Oberdevon von Wülfrath. – *Archäologie im Rheinland*, **2016**: 60-62.

BECKER, R. T. & KERP, H. (2017). 88. Jahrestagung der Paläontologischen Gesellschaft, 26.-30. März 2017, Münster. – *GMIT*, 69: 78-80 [see www.gmit-online.de].

Abstracts

CIFER, T., HARTENFELS, S. & BECKER, R. T. (2017a). Konodonti in karbonatni mikrofacies na meji devon-karbon, na profilu La Serre C (Montagne Noire, Francija). - In: ROŽIČ, B. (Ed.), 23. Posvetovanje Slovenskih geologov (23rd Meeting of Slovenian Geologists), 17-22.

BECKER, R. T. & HARTENFELS, S. (2017). In pursuit for a revised Devonian-Carboniferous boundary – new data from the Rhenish Massif, Ardennes, southern Morocco, and South China. – In: HELLING, S. & HARTENFELS, S. (Eds.), 88. Jahrestagung der Paläontologischen Gesellschaft, Münster, 26.-30. März 2017, Programm, Kurzfassungen, Münstersche

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- ELLERKAMP, M.-P., BECKER, R. T., SCHLÖSSER, M. & ABOUSSALAM, Z. S. (2017). Upper Givetian / lower Frasnian gastropods from reef limestones of the Hofermühle South Quarry (Bergisches Land, Germany). - In: HELLING, S. & HARTENFELS, S. (Eds.), 88. Jahrestagung der Paläontologischen Gesellschaft, Münster, 26.-30. März 2017, Programm, Kurzfassungen, Münstersche Forschungen zur Geologie und Paläontologie, **109**: 33.
- SAUPE, A., HARTENFELS, S. & BECKER, R. T. (2017). Foraminifer and carbonate facies around the Famennian *Annulata* Events (Upper Devonian) at Ziyar I (Moroccan Meseta). - In: HELLING, S. & HARTENFELS, S. (Eds.), 88. Jahrestagung der Paläontologischen Gesellschaft, Münster, 26.-30. März 2017, Programm, Kurzfassungen, Münstersche Forschungen zur Geologie und Paläontologie, **109**: 76.
- BRETT, C. E., ZAMBITO, J. J., BAIRD, G. C., ABOUSSALAM, Z. S., BECKER, R. T. & BARTHOLOMEW, A. J. (2017). Biostratigraphy and sequence stratigraphy of the Middle Devonian (Givetian) in central Kentucky, USA. - In: LIAO, J.-C. & VALENZUELA-RÍOS, J. I. (Eds.), Fourth International Conodont Symposium, ICOS IV, "Progress on Conodont Investigation", Cuadernos del Museo Geominero, **22**: 149-151.
- STICHLING, S., BECKER, R. T., HARTENFELS, S. & ABOUSSALAM, Z. S. (2017). Conodont dating of reef drowning and extinction in the Hönne Vallesy (northern Rhenish Massif, Germany). - In: LIAO, J.-C. & VALENZUELA-RÍOS, J. I. (Eds.), Fourth International Conodont Symposium, ICOS IV, "Progress on Conodont Investigation", Cuadernos del Museo Geominero, **22**: 163-165.
- LÜDDECKE, F., HARTENFELS, S. & BECKER, R. T. (2017). A new approach to Middle Famennian conodont biofacies (Upper Ballberg Quarry, northern Rhenish Massif). - In: LIAO, J.-C. & VALENZUELA-RÍOS, J. I. (Eds.), Fourth International Conodont Symposium, ICOS IV, "Progress on Conodont Investigation", Cuadernos del Museo Geominero, **22**: 171-174.
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- HARTENFELS, S., BECKER, R. T. & KUMPAN, T. (2017). Uppermost Famennian to Lower Tournaisian stratigraphy at Borkwehr near Wocklum (northern Rhenish Massif, Germany). - In: LIAO, J.-C. & VALENZUELA-RÍOS, J. I. (Eds.), Fourth International Conodont Symposium, ICOS IV, "Progress on Conodont Investigation", Cuadernos del Museo Geominero, **22**: 195-197.
- CIFER, T., CORRADINI, C., GIRARD, C., HARTENFELS, S. & KSAISER, S. I. (2017b). A new Devonian/Carboniferous boundary section in the stratotype area (La Serre, Montagne Noire, France). - In: LIAO, J.-C. & VALENZUELA-RÍOS, J. I. (Eds.), Fourth International Conodont Symposium, ICOS IV, "Progress on Conodont Investigation", Cuadernos del Museo Geominero, **22**: 199.
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Devonian theses

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