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COMMISSION ON STRATIGRAPHY

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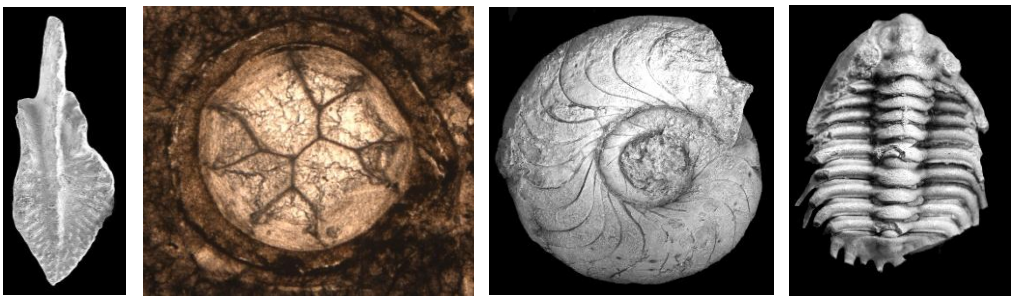
# SUBCOMMISSION ON DEVONIAN STRATIGRAPHY

## NEWSLETTER NO. 26

**R.T. BECKER, Editor**
**WWU Münster**
**Germany**



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**SDS NEWSLETTER 26**

**Editorial**

The SDS Newsletter is published annually by the International Subcommission on Devonian Stratigraphy of the IUGS Subcommission on Stratigraphy (ICS). It publishes reports and news from its membership, scientific discussions, Minutes of SDS Meetings, SDS reports to ICS, general IUGS information, information on past and future Devonian meetings and research projects, and reviews or summaries of new Devonian publications.

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## Content:

**Membership News**

## MESSAGE FROM THE CHAIRMAN

In 2010 our Subcommission continued to be a very lively, active and successful organization. Its members produced many highly interesting and often innovative publications and our meetings were well attended. This Newsletter gives evidence of the many scientific activities in the Devonian and of a well-functioning, intensive communication. Please read carefully my report to ICS, which summarizes the achievements, the non-achievements and the future tasks of SDS.

I was very sad to receive towards the end of the past year a series of notes concerning the death of long-term, highly regarded to outstanding members and of other Devonian workers. Early in October Jared MORROW lost his battle against cancer – he was even a few days younger than me. All who came to the wonderful Nevada field meeting in 2007 appreciated the superb job he did for SDS, not to mention his most important research on the Frasnian-Famennian boundary and on the Alamo Impact. His much too early departure may mean that many aspects of the Devonian of the Great Basin will be left unstudied for a long time. Only a week later, Tatjana KOREN died very unexpectedly and after short but serious illness. I was really shocked since I had met Tatjana twice in 2010 and we had good discussions and she had promised me to write a summary/revision of the Zinzilban graptolites. This will not happen any more and, apart from her very nice personality, her extensive knowledge of the Silurian-Devonian of Russia will be deeply missed. Equally suddenly and unexpectedly, our long-term German SDS member, Otto H. WALLISER died just at the end of the year. Tatjana and Otto were friends for many years. Otto led the Göttingen Devonian group successfully for decades and it is rather sad that only a small part of his immense knowledge ever made it into print. He will always be remembered as one of the few "nestors" of Devonian Event Stratigraphy. His contributions to the formal definition of the Silurian-Devonian, Eifelian-Givetian, Frasnian-Famennian and Devonian-Carbonifrerous boundaries will also become part of the ever-lasting Devonian research history.

In my function as CHAIRMAN I took part in the Prague 2010 ICS Workshop at the end of May and in early June. I gave three presentations: one on the problems of Devonian GSSPs, one on Devonian substages, and on, the SCS may forgive, on the revision of the Devonian-Carboniferous boundary. ICS was rather pleased with our numerous activities and our GSSP problems contributed significantly to the general GSSP discussion, one of the main topics of the workshop. Unfortunately, the question of formal substage recognition still was not settled. It is clear that there will be substages in other systems (e.g., Carboniferous, Triassic) but other subcommissions have not yet dealt with this issue to the same extent as we have. Until ICS, with the consent of IUGS, will formalize the substage definition procedure, we have to go ahead with our decided boundaries and have to publish them as SDS recommendations, currently without formal ICS ratification. Unfortunately, it was raining cats and dogs during our Devonian field trip day. Our Czech colleagues did their best to convince the Commission that it is not always raining on Devonian GSSPs.

The highlight of the year was certainly the SDS Old Red Sandstone Fieldtrip, wonderfully organized by our SECRETARY, and the subsequent Devonian program during IPC 3, including our Annual Business Meeting and the meeting of the D/C Boundary Task Group. I am sad that the excursion took place right in my main teaching period but the report written by John MARSHALL (see Reports section) will convince everybody who did not come that she/he really missed something, especially a free bagpipes concert. When I proposed the London "Devonian Events" symposium I did not anticipate how popular it would be. There were 37 contributions and we had to expand the schedule to cover a full day. The partly controversial discussions concerning the D/C boundary can be followed in the report by M. ARETZ, who was appointed as Task Group Leader, with Carlo CORRADINI as the vice-leader from the Devonian side.

This Newsletter includes many interesting topics, from new research data concerning Morocco, NW China, and Myanmar, to updates of the running investigations in the Kitab Reserve, in the frame of the Emsian revision. I have added abstracts and contents of several important Devonian publications. Together with Carl BRETT, we will work for a proceedings volume that contains papers of our London symposium. Please take notice of the considerable current activities of IGCP 580 (see Publications section).

There will be two important Devonian meetings this year. The first, very soon, in conjunction with combined regional GSA meetings in March in Pittsburgh. Our main meeting will be the Field Symposium in Novosibirsk, with excursions to the Urals and Kuznetsk Basin, in late July and August. I am sure this will be a very nice occasion and I am looking forward seeing many of you there. I like to thank all, who send texts for this Newsletter – please continue to do so next year.

R. Thomas BECKER

## OBITUARY:
## Jared R. MORROW, 1959 – 2010

D. Jeffrey OVER (SUNY Geneseo)
Eberhard SCHINDLER (Senckenberg Forschungsinstitut und Naturmuseum Frankfurt)

Corresponding Member Dr. Jared R. MORROW passed on 7 October 2010, the day before his 51st birthday, of cancer, at his home in San Diego, California. Jared is best known to the SDS for his work on the Frasnian-Famennian boundary and impact studies, notably the Upper Devonian Alamo Event in the western US. He shall be remembered as a fine scientist, dedicated to students, a great organizer and leader, avid outdoorsman, and just a nice and humble person. Meeting Jared automatically meant to like him – often a long-lasting personal friendship resulted. It is hardly possible to think of not having the chance to meet him any more.

Jared was born in Modesto, California, earning a bachelors degree at Humboldt State University, Arcata, California, after which he completed a masters degree at Washington State University, Pullman, Washington, under the supervision of Gary WEBSTER. During this time he also worked for Petro-Tec as a geologist and as a technician for the USGS at Menlo Park, California. In 1997 he completed his PhD at the University of Colorado under the supervision of Erle KAUFFMAN and Don EICHER, as well as the tutelage of Charlie SANDBERG (USGS) and John WARME (Colorado School of Mines). While at Colorado he received a Fulbright Scholarship and spent 1993-94 in Germany at the Universität Göttingen where he worked with Otto WALLISER. In 1998 Jared took a teaching position at the University of Northern Colorado, in Greeley, Colorado, where he was tenured; in 2006 he accepted a position at San Diego State University where he worked until his death.

As an academician in predominantly teaching colleges Jared was remarkably productive. He published as first author and co-author numerous significant papers on Upper Devonian stratigraphy, geology of the Great Basin, conodont paleoecology and stratigraphy, and the geology of bolide impacts – a partial list is here:

http://www.geology.sdsu.edu/people/faculty/morrow/

Furthermore, Jared supervised students, edited volumes, organized symposia, and was active in professional service. Notable also were the field trips, Jared was a mountain goat of a field geologist, and participated in or led trips in Europe, North Africa, North America, and literally going

places where no geologist had gone before. Jared was the primary organizer of the SDS trip in 2007 that accompanied the meeting in Eureka, Nevada, which visited numerous classic sites spanning the Devonian in Nevada and Utah. For many Devonian workers – at least for those not coming from the US – this was the last time they met Jared. He will always be remembered by his colleagues and friends.

## OBITUARY:
## Tatyana N. KOREN, 1935-2010

Nikolay SENNIKOV, Tatyana TOLMACHEVA & Olga OBUT

Tatyana Nikolaeva KOREN, a prominent Russian paleontologists and biostratigrapher, professor, active and long-term member of the International Subcomission on Devonian Stratigraphy, passed away on 15th October 2010 at her home in Sankt-Peterburg after a heavy illness. She was an honored Scientist of the Russian Academy of Sciences, and for many years the head of the Stratigraphy and Paleontology Department of the All-Russian Scientific Research Geological Institute (Sankt-Petersburg). Tatyana had been a Titular Member and Vice-Chair of the International Subcommission on Silurian Stratigraphy, and was as well one of the leading persons of the Russian Stratigraphic Committee.

Tanya was born on March 3rd, 1935, in Leningrad. After graduation from the Geological Department of Leningrad State University in 1956, she was employed in the Department of Urals Studies of the All-Russian Scientific Research Geological Institute and started Silurian graptolite research under the supervision of Prof. Aleksander M. OBUT. Tanya become a graduate student and received her PhD (candidate degree in Russia) in 1964. Her thesis entitled "Silurian graptolites from Urals and their stratigraphic significance" was the first study on the topic after the pioneer work by B.B. TCHERNYSHOV, who made in the forties of the 20th century a monographic study of the Urals Silurian graptolite fauna, including a first zonation. Tanya was a

member of the cohort of young Soviet graptolite working group (including Drs. M.B. ZIMA, R.E. RINENBERG, D.T. TSAI, N.F. MIKHAILOVA, R.F. SOBOLEVSKAYA, Z.M. ABDUAZIMOVA, and others), lead by Prof. A. M. OBUT. She gradually broadened her scientific interests in graptolites and from 1964 she started the investigation of the reference Silurian-Devonian Podolia section. This study was carried out as the section was proposed as a potential S/D boundary stratotype. In 1968, the first International geological excursion in USSR was held, where Tanya was one the guide persons. This was a starting point for her further very efficient international activity that she was so famous for. Tanya continued to publish data on Silurian-Devonian Podolia graptolites till 2001, in collaboration with J.F.V. RIVA and R.B. RICKARDS.

The establishment of the Lower Devonian boundary in 1968 by the appearance of graptolite index-species resulted in a heightened interest in Devonian graptolites worldwide. Tanya went on with research on Uralian graptolites and was the first to establish a graptolite zonation for the early Devonian. This was of really universal importance as, before, graptolites were believed to become almost extinct at the end of Silurian, and thus were not useful as an orthostratigraphic group for the Lochkovian and Pragian. Devonian graptolite research was also carried out at that time by A.M. OBUT (Russia), H. JAEGER (Germany), D.E. JACKSON, A.C. LENZ, and M. CHURKIN (USA and Canada).

The next turning point for Tanya, that opened a new page in her research, happened in seventies of the 20th century, when a working group for the Ordovician/Silurian boundary was established under the leadership of R.B. RICKARDS. Tanya was invited there. On the territory of USSR, the main interest of this working group was in Kazakhstan and the Kolyma region. Along with other soviet stratigraphers and paleontologists (M.M. ORADOVSKAYA, R.F. SOBOLEVSKAYA, I.F. NIKITIN, S.M. BANDALETOA, N.F. MIKHAILOVA, and D.T. TSAI) Tanya investigated numerous sections in Kazakhstan and Kolyma, collected graptolites, and in short terms presented two large monographs on the O/S boundary. From that moment, almost for 30 years, these publications remain desk books for Russian and foreign Paleozoic paleontologists and stratigraphers. Only the remoteness of the Kolyma section (Mirny Creek) was a reason that it couldn't compete with other candidates for the O/S boundary though it's one of the best-studied owing to Tanya's research.

Tanya continued Devonian graptolite studies in the seventies and eighties of the 20th century in Tadzhikistan, Uzbekistan, and Kirgizia, in collaboration with A.I. KIM, A.I., V.I. LAVRUSEVICH, V.L. KLISHEVICH, V.N. LYTOCJKIN, A.M. OBUT, and N.V. SENNIKOV. Central Asian studies were initiated by SDS in the framework of the subdivision of the Lower Devonian and during the designation of lower boundaries of its stages. These investigations completely proved earlier conclusions by Tanya KOREN concerning phylogenetic lineages and the zonation based on graptolites from the Urals and Podolia. Tanya published several papers about this matter in Russian and English with her colleagues R.E. RINENBERG, A.A. SUYARKOVA, O.H. WALISER, K.T. PICKERING, and D.J. SIVETER. In seventies to nineties, Tanya worked fruitfully in the international program on "Ecostratigraphy" and the IGCP on "Global bio-events and event stratigraphy" jointly with O.H. WALLISER, D. L. KALJO, A.J. BOUCOT, R.M. CORFIELD, La HERISSE, J. KRIZ, P. MANIK, T. MARSS, H. NESTOR, R.H. SHAVIER, D.J. SIVETER, V.VIIRA, T.J. TOLMACHEVA, L. HOLMER, L.E. POPOV, and E. RAEVSKAYA. During this time and up to her last days, she actively participated in many Russian and international conferences and meetings. She was an organizer of a number of large international forums in former USSR: in Alma-Ata (1977), of the SDS field meeting in Samarkand (1978), of the Pacific Geological Congress in Magadan and Khabarovsk (1979), and of the 27th session of the IGC in Moscow (1984). For many decades she was an active participant and organizing committee member of the All-Russian and International graptolite conferences (from 1969 until 2003). Many times she spoke at the International Geological Congresses.

Tanya always stressed her attention to zonal stratigraphy. As a result of her studies of Late Ordovician – Early Devonian graptolites, their evolutionary trends, taxonomic diversity, their relation to abiotic events, and their use for the creation of global standard zonations. Tanya successfully defeated her Doctor dissertation in 1986 on "Zonal stratigraphy and Silurian boundaries by

graptolites". This work was not just a Silurian graptolites study but it was dedicated as well to general stratigraphic problems, such as the position of zonal boundaries and the establishment of standard zones. During all her recent years of her life, she was dedicated to the development of these ideas, and she published a series of papers dedicated to Silurian graptolites and their zonation. One of her favorite brainchild that she always went back to, was the O/S boundary interval that she studied for many years in collaboration with R.B. RICKARDS, M. MELCHIN, D.L. KALJO, D. LOYDEL, P, STORCH, S.H. WILLIAMS, S.M. BERGSTROM, W.D. HUFF, J. RUSSEL, P. AHLBERG, and A.T. NIELSEN.

Tanya published more than 200 papers and books dedicated to the Lower Paleozoic of former USSR and Russia, as well as to other countries, on Ordovician, Silurian and Devonian graptolites and on stratigraphy. Most of her papers are well-known to Paleozoic workers.

In 2001 Tanya become a head of the Stratigraphy and Paleontology Department of the All-Russian Scientific Research Geological Institute (Sankt-Petersburg). During this time her manager and leader talent manifested greatly. She was not only a leader in Paleozoic biostratigraphy, who initiated revisions of regional correlation charts. Thanks to hear broad mind and knowledge, new geology projects connected with mapping and prospecting were also carried out by department. She was a very gifted and generous teacher and trained a lot of talented younger generation paleontologists and biostratigraphers, including T.Y. TOLMACHEVA, A.A. SUYARKOVA, I.Y. GOGIN, I. EVDOKIMOVA, and O. KOSSOVAYA.

Paleozoic research suffered a great loss. One more outstanding person passed away so suddenly. For many people Tanya was not only a colleague but a close friend and a remarkable person. We will always remember Tatyana as a very energetic, enthusiastic, sociable and open minded lady with strong personality and a kind and generous character.

## OBITUARY:
## Rimma Trofimovna GRATSIANOVA
## (23.07.1922 – 07.04.2010)

John A. TALENT (Macquarie University),
Lyubov SMOLINA (Rimma's daughter),
and Rimma's many friends in the Institute of Petroleum Geology of the Russian Academy of Science.

Rimma Trofimovna GRATSIANOVA, a long-time aficionado of latest Silurian, Early Carboniferous and especially Devonian brachiopods and stratigraphy of the Altai-Sayan region of south-west Siberia, passed away on 7th April 2010.

Though primarily of Russian descent, Rimma's maternal origins included *Khakas*, the principal native group of south-western Siberia. The Khaka horde had invaded and settled in the watershed of the Ob´ River in the time of Chengis Khan. Her empathy for these peoples was surely at the root of her passionate interest in the history, local economic practices, cosmology and the devastating changes generated over something like 400 years in these and other native peoples of Siberia by the colonizers from the west. That she had developed an encyclopedic knowledge of the vast spectrum of native peoples from one end of Siberia to the other is perhaps not surprising. This became apparent to one of us (JT) in 1979, after an excursion with the late Kirill SIMAKOV to his superb Late Devonian–Early Carboniferous sequences on the Omolon Block of the Russian north-east. We (Rimma, Kirill and JT) visited the vast ARSENYEV Museum in Khabarovsk. The first two or three galleries concerned the relationship of explorer Vladimir ARSENYEV, posted to Khabarovsk as a young army officer in 1900, and his guide, a remarkable tribal man by name of Dersu UZALA. He was reported to have belonged to the Goldi clan of the Nanai people, a Tungusk group. For anyone who may have seen the Japanese film-maker Akiro KUROSAWA'S film, *Dersu Uzala*, the display of ancient photos, clothing, diaries and other documents brought the film to life.

After the initial ARSENYEV-Dersu UZALA displays, the Khabarovsk Museum opens into an exhaustive panorama of the material culture of the 30 or more significant tribal peoples of Siberia. Rimma demonstrated that she knew them all — she could identify them from afar by their styles of clothing and embroidery, their musical instruments, and even variations in their cooking pots. She should have been an ethnologist.

ARSENYEV, incidentally, had kept a low profile during the Revolution, writing a children's book

about his explorations with Dersu UZALA in the forests of the watershed of the Ussuri River and its tributaries. He became world famous as an ethnographer, developing numerous foreign contacts, but this pattern became a liability after STALIN'S rise to power. He was repeatedly grilled by the GPU, but escaped imprisonment and near-certain execution by dying of heart disease in 1930. His wife was less fortunate. Like so many of the intelligentsia in the Far East, she was accused of being a Japanese spy and shot. His 17-year-old daughter was sentenced to ten years in a labour camp for propagating "anti-Soviet propaganda".

Rimma had been witness to the excesses of the 1930s and 1940s. For instance, during the collectivization era, the Soviet Union experienced enormous food shortages and, where food was available, this was often commandeered at gunpoint to feed the populations of the larger cities. Millions died from starvation. There was a rumor that food was readily available in the Kuban area, then having become relatively stable after a long period of political turmoil. Rimma's father, Trofim, in desperation, set out with his family (including Rimma) by train and foot to Krasnodar but found the food situation there to be as bad, if not worse than in the part of Siberia from whence they had come. They returned hurriedly to Siberia, always tired, always hungry, often terrified, completing a round trip of over 3000 kilometres.

Rimma undertook crash courses in medicine during the Great Patriotic War and worked in an evacuation hospital. She completed an undergraduate degree in geology at the Tomsk Polytechnical Institute and then commenced research for her Kandidat Nauk on the geology and palaeontology of the Altai and Salair. This was during the reign of L.L KHALFIN as departmental head. KHALFIN ruled his department with a proverbial rod of steel; his wars with his fellow earth scientists, such as the gentlemanly N.L. BUBLICHENKO, were astonishingly prolonged. Regarding himself as the father-figure of West Siberian geology, KHALFIN took it for granted that he would become at least the founding head of its Institute of Geology and Geophysics, if not head of the entire Siberian Branch of the Soviet Academy of Science. He was to be greatly disappointed. KHALFIN had, nevertheless, contributed significantly to the stratigraphy and palaeontology of western Siberia.

In 1954, Rimma accepted a research position in the eventually huge Institute of Geology and Geophysics of the recently founded Siberian Branch of the Soviet Academy of Sciences in Novosibirsk where she worked for the rest of her life, mostly in collaboration with Yevgeniy Aleksandrovitch ('Zhenya') YOLKIN. Both of them loved fieldwork in the Altai. On one occasion when traveling in convoy, their vehicle had become hopelessly bogged in mud and was even in danger of capsizing. Soon after Zhenya's field group had clustered around the vehicle and were deciding how best to attack the problem, Zhenya took Rimma aside and advised her to go well away, out of earshot, because, as he said, there would be a "lot of bad words!" It was symptomatic of the esteem in which Rimma was held by her colleagues.

Rimma was a formidable taxonomist, more inclined to taxonomic lumping than splitting. She published about 50 papers on Devonian and, in a minor way, Early Carboniferous and latest Silurian brachiopods. Her interest in Devonian brachiopod biogeography had been sparked by recognition of 'Tasman' elements in the faunas of the Altai and the Mongolo-Okhotsk Province, especially the notanoplids that she believed had a propensity for being pseudoplancktonic and thus capable of being carried across deep oceanic regions, presumably by floating algae. She produced four significant monographs, two as sole author, two as joint author:

1. GRATSIANOVA, R.T. Brachiopods and Stratigraphy of the Early Devonian of the Gorniy Altai (1967, 177 pp., 14 pls; published by Nauka);
2. ALEKSEEVA, R.E., GRATSIANOVA, R.T., YOLKIN, E.A. & KUL'KOV, N.P. Stratigraphy and Brachiopods of the Early Devonian of the Northeastern Salair (1970; Institute of Geology and Geophysics, Siberian Branch of the USSR Academy of Science, Trudy **72**: 190 pp., 22 pls);
3. GRATSIANOVA R.T. Brachiopoda of the Early and Middle Devonian of the Altai-Sayan Region: Strophomenida (1975, Institute of Geology and Geophysics, Siberian Branch of the USSR Academy of Science, Trudy **248**: 106 pp., 20 pls) and her last major work:
4. TALENT, J.A., GRATSIANOVA R.T. & YOLKIN E.A. Latest Silurian (Pridoli) to Middle Devonian (Givetian) of the Asia-Australia Hemisphere: Rationalization of Brachiopod Taxa and Faunal Lists; Stratigraphic Correlation Chart (2001, Cour. Forsch-Inst. Senckenberg 236: 221 pp.). This database has been used for expert-systems analysis of brachiopod biogeography during the latest Silurian (Pridoli) through to the end of the Givetian (mid-Devonian) (YOLKIN et al. 2000, Western Australian Mus Rec, Suppl **58**: 349–384; TALENT et al. 2011 in press).

The above project had been formulated during the XIV Pacific Science Congress in Khabarovsk in August 1979. Rimma had read widely about plate tectonics and had enthusiastically accepted this approach, flamboyantly articulated by our mutual friend, the late Leonid PARFENOV, who had spent a decade in Novosibirsk after graduating from the M.V. LOMONOSOV University in Moscow. Rimma's immediate 'boss', Yevgeniy Aleksandrovitch ('Zhenya') YOLKIN, had been reluctant to abandon the 'fixist' approach he had been taught in Moscow

by tectonicists including the redoubtable Vladimir Vladimirovich BELOUSOV, for many years the high priest of tectonics in the former Soviet Union. PARFENOV'S mobilist interpretations had met formidable opposition from BELOUSSOV and other academic 'heavies'.

The intransigence of the 'fixists' was exemplified at the Congress when, after Leonid PARFENOV had made a presentation on his emerging 'mobilist' interpretations, and how it could be illuminatingly applied to the fold-belts of the eastern USSR from the Altai to the Bering Strait, especially from Yakutia eastwards. BELOUSOV leapt to his feet asserting that what Leonid had said was rubbish. Leonid asked what was the basis for his conclusion, to which BELOUSOV angrily replied "Because I said so!" By this time, Mayya Konstantinovna VIKTOROVA, a brilliant translator who spoke perfect, unaccented English, and who had interpreted Leonid's presentation and BELOUSSOV'S attack on him, had rushed down the aisle of the large auditorium, stood between the opponents (professor and former student), keeping them apart, one hand on each of their chests and, with a smile, said "There appears to be a slight divergence of opinion!" The heated discussion was defused.

Over a decade, Zhenya YOLKIN'S views gradually evolved from the fixism of his university days to mobilism. He had been very willing to collaborate in attempting to test the two grand theories using data from brachiopods. The database, the fourth of the monographs (see above) authored or co-authored by Rimma was the result of the joint research in Novosibirsk (1981 to 1992) between our 'Gang of Three' that, subsequently, included Valya YOLKINA and Tanya KIPRIYANOVA. Our joint research produced 25 co-authored monographs, papers and extended abstracts. Rimma had commenced work on a fifth monograph, this time on chonetoid brachiopods of the Altai-Sayan region before, with failing health, she passed away on 7 April 2010.

One of the less agreeable spinoffs from disintegration of the USSR was a traumatic period of uncertainty regarding funding to keep research facilities alive, and especially to have sufficient funds to provide salaries for research scientists and their technicians. In desperation, Rimma's laboratory chief, Zhenya YOLKIN, mounted a campaign to use the skills of his group for identifying fossils from petroleum exploration wells drilled into the bedrock of the West Siberian Plain. As a consequence, during her last years before retiring, Rimma's research was punctuated by identification of Palaeozoic brachiopods from such bores. It was the sort of work that did not lead to publications…

Fittingly, Rimma's last publication (2007, 49 pp.) was a collection of her poems compiled by her Petroleum Institute friends and edited by Tanya KIPRIYANOVA; it was presented to Rimma at her retirement party in 2007.

The elegance of Rimma's writing (and of her copper-plate handwriting) was well known. A mutual friend, the late Al'girdas DAGIS, aficionado of Mesozoic brachiopods and Triassic and Jurassic ammonoids, once opined that of all the people he knew, not one could write Russian with anything approaching Rimma's skill. Stylistically, he compared her with greatest of Russian authors, Alexander PUSHKIN. It seemed that every few days there would be someone asking Rimma to linguistically polish the Russian (and sometimes English) of their manuscripts. She read German, French and Spanish with ease and was fluent in English.

Rimma had a heart as well as a brain. Colleagues with minor ailments would come to her for medical advice; it seemed that she always carried medicaments for such occassions — a characteristic that echoed her wartime experience and marriage to a medico from a famed family of medical practitioners, Dmitry GRATSIANOV. The GRATSIANOV home in Tomsk, an elegant example of Siberian wooden architecture with shuttered windows and an abundance of fretwork, is a national treasure that now serves as a State Guesthouse.

Though Rimma was much respected and much admired, she was in no way a political person. She was shy and, like most of her contemporaries, carefully refrained from discussing political matters. If she had any significant interest in that direction, it was sublimated to her passions for ethnology, biology (especially botany), history and fine arts. Rimma's knowledge of botany was vast. It seemed that she knew the scientific as well as popular names of all the trees, shrubs, grasses, herbs and fungi that grew in her beloved *taiga* (the Siberian forests), and knew which ones had medicinal properties.

Rimma had a comprehensive knowledge of Russian history and fine arts. Visits to Moscow and St Petersburg provided her with opportunities to visit the TRETYAKOV Gallery, the Russian Museum and the Ermitage. She was especially fond of the works of the Russian Realists: Vasily SURIKOV, Ilya REPIN, Vasily POLENOV, Ivan KRAMSKOI and, above all, Ivan SHISHKIN and Isaac LEVITAN who brilliantly captured Russian landscape with birch forests and placid rivers, and produced forceful portraits of their contemporaries, the conditions of the poor and of dramatic moments in Russian history. A few times every year she would refresh her knowledge of Russian art history by contemplating the large collection of paintings (over 6,000 items) held by the Novosibirsk Art Gallery, especially its considerable collection of the rather mystical works of Nikolai ROERICH (1874–1947) — great artist, writer, humanist and synthesizer of philosophical

knowledge, once nominated for the Nobel Peace Prize.

Rimma thought highly of non-violent visionaries such as Mahatma GANDHI, Nikolai ROERICH and, of course, Leo TOLSTOY. She was deeply concerned by poverty — of the underprivileged and otherwise marginalized — and by pollution and rapid urbanization. She had a profound insight into society and the dynamics of social power but few would have realized this. Rimma's occasional ritual visits to the Art Gallery — where she would pay homage to Nikolai ROERICH — would be followed by brief visits to the *Vosznesenskiy sobor* (Cathedral of the Ascension) and, downstairs on a corner of ulitsa Lenina, her favourite *pelmyeni* shop. There she would be welcomed by a bevy of plump ladies (dressed in white), as though she were a long-lost aunt, and served with what Rimma insisted were the best *pelmyeni* (with meat, fish and mushroom or vegetable fillings) in the entire Soviet Union.

Rimma loved walking contemplatively through the forests around Akademgorodok, especially if there happened to be sufficient time for her to amble along the little Zyranka River and around the lake in the Central Siberian Botanic Gardens — and even more so in late autumn when the birds could be seen spiraling slowly overhead and then heading south to escape the Siberian winter. Rimma was passionately fond of music, not only the music of the great Russian composers, but classical music considered in a global perspective. She loved the classical ballet and Russian opera presented by the Siberian Ballet and Opera companies in the enormous Novosibirsk Opera House, the largest in Russia — even larger than Moscow's Bolshoi Theatre. One of her greatest pleasures on weekends was listening to radio programs of classical music and literature (especially poetry). Rimma had a fabulous gift for being able to compose poetry faster than anyone could write it down. Apart from a slim volume produced on her retirement, most of her poetry was never published.

Visitors to the Institute of Petroleum Geology of the Russian Academy of Science, derived from the former Institute of Geology and Geophysics, will miss the stimulus of discussions with Rimma, her extensive knowledge on so many fields of intellectual endeavour, her generosity with information and opinions, and her balanced advice. We suspect, nevertheless, that few if any among the palaeontologic community inside or outside Russia former Institute of Geology and Geophysics, will miss the stimulus of discussions with Rimma, her extensive knowledge on so many fields of intellectual endeavour, her generosity with information and opinions, and her balanced advice. We suspect, nevertheless, that few if any among the palaeontologic community inside or outside Russia had the full measure of what a remarkable person she had been.

## OBITUARY:
## Otto H. WALLISER
## 03.03.1928 – 30.12.2010

Helga GROOS-UFFENORDE (Göttingen University)
Eberhard SCHINDLER (Senckenberg Forschungsinstitut und Naturmuseum Frankfurt)

Otto Heinrich WALLISER unexpectedly passed away in Göttingen on 30 December 2010. This was only two weeks after he had accepted an invitation to the annual meeting of the German SDS in 2011, at which TM Cristina PERRI on behalf of the Pander Society was to have presented the Pander Society Medal to Otto in honour of his outstanding lifetime conodont research. This ceremony will now take place post-mortem in Marburg in May 2011.

Otto was born in Krettenbach near Crailsheim in southern Germany on 3 March 1928. He was only able to finish his schooling in Tübingen in 1948 after having been drafted into the army in the last months of World War II and after having been a prisoner of war. He studied geology and palaeontology at Tübingen University under Prof. Otto H. SCHINDEWOLF. The main interest at this time was the stratigraphy and palaeontology of Jurassic ammonoids from southern Germany.

In June 1954 he graduated from Tübingen University, but had already moved to the University of Marburg in April 1954 as an Assistant Professor under Prof. Carl Walter KOCKEL. In this small institute he met Günter BISCHOFF und Willi ZIEGLER studying Devonian and Lower Carboniferous conodonts of the Rheinisches Schiefergebirge. The interests of Otto, therefore, changed from Jurassic ammonoids to Devonian goniatites, in order to better understand Devonian stratigraphy. He also began to study Silurian and Devonian conodonts of Germany and adjacent areas. His famous publication 'Conodonten des Silurs' (Abhandlungen des Hessischen Landesamtes für Bodenforschung, **41**, 1964) focussed not only on their systematics, correlation purpose and detailed biostratigraphy – for the first time he reconstructed the conodont

apparatuses theoretically by means of statistical methods. As Mike MURPHY recently stated: "This work was the model for how conodont research should be done and still is the model".

In 1965 Otto WALLISER became Professor of Historical Geology and Palaeontology at Göttingen University. He was happy to meet there the internationally well-known, although then retired, Prof. Hermann SCHMIDT, a specialist on goniatites and Devonian stratigraphy with detailed knowledge of the Rheinisches Schiefergebirge.Together with his colleagues Prof. Henno MARTIN and Prof. Helmut WINKLER he organized the Sonderforschungsbereich' (SFB) 48: ‚Entwicklung, Bestand und Eigenschaften der Erdkruste, insbesondere der Geosynklinalräume' of the Deutsche Forschungsgemeinschaft (DFG) creating many jobs for students and young scientists between 1970 and 1980. The studies concentrated on the Damara Orogen in Namibia and the Palaeozoic of the German Rheinisches Schiefergebirge and Harz Mountains.

Between 1969 and 1974 Otto spent much of his time planning a new building for the Geological-Palaeontological Institute, in discussions with architects and controlling their work. The result was an internationally admired large institute including remarkable space for collections (with big compactus filling system) and a museum with 'Geopark'.

As Secretary General of the International Palaeontological Association (IPA) he visited China in 1979 and stimulated a Chinese/German cooperation programme on the Devonian of southern China and the comparison with German sections lasting until 1985.

Otto was very interested in biostratigraphy and bio-events. Therefore he initiated and coordinated theICGP 216 'Global Biological Events in Earth History', which was a very successful international programme. The results were published in two volumes (edited by KAUFFMAN & WALLISER, 1990 and WALLISER, 1996).

Otto was one of the first members of the International Subcommission on Silurian Stratigraphy and the International as well as the German Subcommission on Devonian Stratigraphy. For many years he stimulated discussions on stratigraphic boundaries and international correlations of Silurian and Devonian sequences. He submitted many handouts and documents to the SDS (e.g. 1983: Statement for the boundaries of the Devonian System, its series and stages, 1987 and 1988: Proposal of potential boundary stratotypes for the Frasnian/Famennian and the Eifelian/Givetian boundaries). He was especially happy to do fieldwork in Devonian sequences of Morocco for for many years often in cooperation with colleagues. His heart problems and the unexpected death abruptly finished the detailed studies on conodonts at the Eifelian/Givetian boundary.

From 1974 – 1976 Otto was the President (at that time called Chairman) of the 'Paläontologische Gesellschaft', from which he received Honorary Membership in 2009. Otto was a highly admired and honoured scientist. Since 1982 he was a member of the 'Akademie der Wissenschaften zu Göttingen', in 1989 he became a Corresponding Member of the 'Russian Academy of Sciences', and later of the 'Polish Academy of Sciences' in Warszaw and in Krakov. Award of the PANDER Society Medal has been mentioned above.

Otto WALLISER stimulated more than 50 diploma theses and initiated 25 doctoral theses. He published more than 125 papers on a wide range of subjects. Although not always placed in the "big" journals, they had an immense impact on scientific discussions and decisions. One example of his innovative ideas is surely the modern and detailed reconsideration and reinvestigation of global events in Earth history (see above, IGCP 216). Another one is Otto's often overlooked approach of introducing the idea of "Time-specific facies" into scientific discussions. It was just a few months ago that an entire session at the 3rd International Palaeontological Congress (IPC) in London was dedicated to this topic. It was a pity that he could not attend the meeting, but was delighted to see the issue "back on stage".

Many colleagues will miss the fruitful discussions with Otto, his extensive and broad knowledge, his modesty, his unselfish help with information, especially during fieldwork and in the laboratories, and his critical but balanced advice of a friend.

Otto WALLISER at the 1986 Global Bio-Events meeting (1st International Workshop of IGCP 216) together with T. KOREN (left) and Art BOUCOT (right)

# REPORTS

## INTERNATIONAL COMMISSION ON STRATIGRAPHY
## SUBCOMMISSION ON DEVONIAN STRATIGRAPHY

## ANNUAL REPORT (Nov. 2010

### 1. TITLE OF CONSTITUENT BODY

Subcommission on Devonian Stratigraphy

*Submitted by:*

R. Thomas BECKER, *Chair of SDS*

Westfälische Wilhelms-Universität, Institut für Geologie and Paläontologie, Corrensstr. 24, D-48149 Münster, Tel. –49-251-83 339 51, fax – 49-251-83 339 68; rbecker@uni-muenster.de

### 2. OVERALL OBJECTIVES, AND FIT WITHIN IUGS SCIENCE POLICY

SDS has continued in 2010 its work on the revision of existing but problematical GSSPs (Emsian, Devonian-Carboniferous boundary) and on the formal definition of substages. Reports on both were presented at the Prague ICS Workshop. Other activities cover the improvement of multidisciplinary international correlation, the Devonian chapter to the next GTS volume, the organisation of Devonian stratigraphic symposia, and the publication of its SDS Newsletter and of monographic books/journal volumes. SDS objectives for 2010 can be summarized as:

- Work on formal definitions of Pragian, Givetian, Frasnian, and Famennian substages
- Revision of the basal Emsian GSSP in Uzbekistan
- Revision of the D/C boundary in the frame of the new D/C Boundary Working Group and in close collaboration with the Carboniferous Subcommission
- Preparation for a new Devonian IGCP, as follow-up to the out-phased IGCP 499 (in co-operation with P. KÖNIGSHOF, Th. SUTTNER and others)
- Publication of volumes on Devonian stratigraphy, partly in co-operation with IGCP 499
- Compilation and distribution of SDS Newsletter 25
- Official Business meeting in conjunction with the 3rd International Palaeontological Congress (IPC3), London, June/July 2010
- Full-day Devonian symposium and one week field trip to the Old Red Devonian in conjunction with IPC3
- Support for additional international Devonian symposia ("STRATI 2010", Paris)
- Revision of Devonian chapter for the GTS 2010 volume
- Intensive cooperation with ICS (e.g., Prague ICS Workshop)
- Juvenation of SDS Membership and enlarging its scientific capacity by the hiring of new active members

All listed objectives fit the directions of IUGS and ICS:

- development of an internationally approved chronostratigrapical timescale for the Devonian with maximum time resolution;
- promotion of new and modern stratigraphical techniques and their integration into Devonian multidisciplinary schemes;
- application of GSSP decisions internationally and as a base for a better understanding of patterns and processes in Earth History, including Devonian major global environmental changes.

### 3. ORGANIZATION

**Officers for 2008-2012**

Chair: Prof. Dr. R. Thomas BECKER, WWU Münster, Germany

Vice-Chair: Prof. Dr. Ahmed EL HASSANI, Institute Scientifique, Rabat, Morocco

Secretary: Dr. John E. MARSHALL, University of Southampton, U. K.

The Subcommission has currently further 18 Voting Members that cover many major Devonian outcrop areas and many stratigraphical disciplines (see Appendix).

The SDS Membership covers currently the following 29 countries (in alphabetical order): Australia, Austria, Belarus, Belgium, Bolivia, Bulgaria, Canada, China, Czechia, Estonia, France, Germany, Great Britain, Iran, Italy, Latvia, Lithuania, Morocco, Myanmar, New Zealand, Pakistan, Poland, South Africa, Spain, USA, Uzbekistan, Tadzhikistan, Turkey, Vietnam. At national level several Devonian Subcommissions exist in various countries, partly under different organisational names (e.g., Germany, Russia, "Friends of the Devonian" at GSA meetings).

**Website**: http://www.unica.it/sds/

### 4. INTERFACES WITH OTHER INTERNATIONAL PROJECTS

SDS is traditionally strongly tied with IGCP projects that have a Devonian focus. Until 2010 this was IGCP 499 on "Devonian land-sea interaction: evolution of ecosystems and climate" (DEVEC), led by P. KÖNIGSHOF and colleagues from the Senckenberg Institute, Frankfurt a. M., Germany.

Plans for a successor project on "Climate change and biodiversity patterns in the Mid-Paleozoic" by P. KÖNIGSHOF, Th. SUTTNER, and others, have advanced far. Formal support was also awarded to a new IGCP proposal on "The Early to Middle Paleozoic Revolution: Bridging the Gap between the Great Ordovician Biodiversifaction Event and the Devonian Terrestrial Revolution", brought forward by B.D. CRAMER, T.R.A. VANDENBROUKE, and others.

## 5. CHIEF ACCOMPLISHMENTS AND PRODUCTS IN 2010

**Chronostratigraphic definitions**:

The main arguments for formally defined substages were summarized in a presentation at the Prague ICS Workshop:

- Some Devonian stages are much longer than usual Phanerozoic stages (Famennian: ca. 15Ma, Emsian: up to 17 Ma)
- There are significant global events and extinctions within stages that give natural subdivisions
- Substages are widely in use but without any agreement
- Devonian biostratigraphy is so detailed that good tools for global correlation within stages are available
- There are classical regional stages in various regions that can serve for international subdivision (e.g., equivalents of Belgian Strunian and Czech Dalejan)

PRAGIAN SUBSTAGES

The 2008 decision to utilize the current basal Emsian GSSP as future GSSP of a formal Upper Pragian substage ("Zinzilbanian substage") has been substantiated during the discussion at the London Business Meeting. However, any formal decision has to await the Emsian revision and the clarification of the process of formal substage recognition by ICS.

REVISION OF BASAL EMSIAN GSSP

Four research lines concerning the Kitab Emsian GSSP have been followed intensively and led to publications/abstracts. These are:

- A revision of Emsian ammonoids of the Kitab Reserve (Becker et al. 2010, SDS Newsletter 25)
- A revision and new description of all Pragian to Eifelian trilobites from Uzbekistan, including the new material from around the anticipated future Emsian GSSP level ("*excavatus* boundary"; Owens et al. 2010, Memoirs of the Association of Australasian Palaeontologists 39)
- Magnetostratigraphy of the Zinzilban GSSP and "dynamic time warp" correlation with the Barrandian (Hladil et al. 2010 submitted)
- Work on Zinzilban and correlative Pragian/Emsian conodonts (e.g., Valenzuela-Ríos & Martínez-Pérez 2010, London Abstract; Martínez-Pérez et al. 2010 submitted to Rivista Italiana di Paleontologia e Stratigrafia)

The resampling of the interval around the expected entry of *Polygnathus excavates* by several independent workers, above the current GSSP, especially of its "Morphotype 114" (as the currently discussed best future GSSP candidate level), unfortunately, resulted in a very poor recovery of polygnathid conodonts. Based on the previous publications, this was not expected and the consequences are not yet clear and have to await the final results. Possibly it will be necessary to move to one of the adjacent sections within the Kitab Reserve of eastern Uzbekistan. A revision of the dacryoconarid stratigraphy has not yet been completed. The promise for a review of the Zinzilban graptolites (given at the Prague Meeting) was severed by the unexpected death of T. KOREN.

EMSIAN SUBSTAGES

The decision on an intra-Emsian substage GSSP also will have to await the Emsian GSSP revision. Due to medical problems of Czech investigators, the announced revision of relevant Barrandian dacryoconarids from the Emsian has not yet been finalized or published. Especially important is the revision of the *Nowakia elegans-cancellata* transition. New Moroccan data (Becker et al. 2010, London Abstract) showed the necessity to distinguish between the successive, transgressive Upper Zlichov (ca. *nothoperbonus* Zone) and true Daleje Events (within *laticostatus* Zone) around the future substage boundary. Tafilalt sections contain just below thick Daleje Shale equivalents polygnathid conodonts that, based on previously studied other areas (e.g., La Grange Limestone, France), may serve as an alternative to nowakiids but research has only just started.

GIVETIAN / FRASNIAN SUBSTAGES

The continuing uncertainty concerning the formal recognition of substages by ICS has further delayed the submission of proposals concerning Givetian and Frasnian substages, which already have been subject to formal vote by SDS. Important new Givetian data have just been published online in "Palaeogeography, Palaeoclimatology, Palaeoecology" (ABOUSSALAM & BECKER 2010, BRETT et al. 2010, ELLWOOD et al. 2010, MARSHALL et al. 2010). New Frasnian data were presented in several talks at the London Meeting. There is an important clarification of the relationships of the global Middlesex or *punctata* Event, and of the timing of the Alamo Impact (MORROW et al. 2009).

At the SDS Business Meeting it was decided to submit summaries of formal substage proposals at the same time to ICS and, and as official SDS recommendations, to Episodes. This will allow their preliminary use whilst the procedure of substage ratification is further clarified. The decided definitions are as follows:

base of **Middle Givetian**:
base of *Polygnathus rhenanus-varcus* Zone
base of **Upper Givetian**
base of *Schmidtognathus hermanni* Zone
base of **Middle Frasnian**
base of *Palmatolepis punctate* or MN 5 Zone, isotope spike
base of Upper Frasnian
entry of *Palmatolepis semichatovae* (ca. base of MN 11 Zone)

FAMENNIAN SUBSTAGES

Since most relevant data have now been published, the formal vote on an Uppermost Famennian substage will take place at the end of 2010 (results to be expected in SDS Newsletter 26). A voluminous Ph.D. by S. HARTENFELS (defended in summer 2010 - to be published early in 2011) on Famennian conodonts from Germany, Poland, and Morocco will provide a huge new data base for the unsettled discussion concerning the Middle/Upper Famennian stage boundary. Data from a similarly voluminous, still unpublished study on the Famennian of Franconia (conodonts by H. TRAGELEHN) should also become available in 2011. Equally important are new results concerning the Polish Kowala section (RACKA et al. 2010, Palaeogeography, Palaeoclimatology, Palaeoecology 297 (3/4)). But decisions on the bases of the Middle and Upper Famennian may have to wait until 2012.

REVISION OF THE D/C BOUNDARY

The new D/C Boundary Task Group met right after the London SDS Business Meeting and a special conodont workshop took place in the afternoon of the same day (1st July), in conjunction with the Pander Society Workshop organized by Stephen A. Leslie. Following the joint proposal by the SDS and SCS Chairmen, Markus ARETZ, the SCS Secretary, was elected as new Task Group Chairman, with Carlo CORRADINI, the SDS Homepage Webmaster, as Vice-Chairman. Presentations, partly repeating the contributions to the SDS Event Symposium of the previous day, gave summaries of the new critical data concerning the current La Serre GSSP (S.I. KAISER), the taxonomy of siphonodellids and protognathodids (C. CORRADINI & S.I. KAISER), and new data on the new Kule (Uzbekistan, S.I. KAISER, R. T. BECKER & H. MATYJA) and Lalla Mimouna sections (Maider, Morocco, R.T. BECKER, Z.S. ABOUSSALAM & H. HARTENFELS). The partly HEATED discussion showed that much more work is needed in order to reach a consensus of conodont specialists concerning the taxonomy, origin, and evolution of the two critical conodont lineages, especially of the siphonodellids. In this context it was very disadvantageous that H. TRAGELEHN could not attend after an unfortunate traffic accident just before the meeting. His new insights, briefly outlined in SDS Newsletter 25, that are based on new Franconia collections, currently cannot be followed by other specialists. His manuscript has been completed in the meantime and will be submitted for publication in January. Russian siphonodellid collections examined jointly during the workshop added further questionsmarks.

In summary it is clear that a breakthrough of conodont revisions has not yet been reached but it is a positive sign that many new data come in. Workers on neritic faunal groups are monitoring the current conodont discussions closely and eventually will have to contribute new data, too. The proposal to lower the boundary to the level of the main Hangenberg Event (base of Hangenberg Black Shale) and mass extinction has become a serious alternative.

**Publications**:

- BECKER, R. T. (Ed.) 2010. SDS Newsletter 25. - 100 pp., Westfälische Wilhelms-Universität Münster. [a formal publication, with **ISSN No. 2074-7268**]
- BRETT, C.E., SCHINDLER, E. & KÖNIGSHOF, P. (Eds., online 2010). Sea-level cyclicity, climate change, and bioevents in Middle Devonian marine and terrestrial environments. – A thematic issue of Palaeogeography, Palaeoclimatology, Palaeoecology, 10 contributions).

SDS Members also contributed significantly to a new Devonian volume (No. 39) of the Memoirs of the Association of Australasian Palaeontologists, published in November 2010.

**Meetings**:

- SDS Annual Business Meeting at the 3rd International Palaeontological Congress, associated with a full-day (total of 38 contributions) symposium on "Devonian Bioevents: Timing, Palaeoecological and Evolutionary Patterns" (organized by the Chairman), followed by a joint SDS/SCS meeting of the International Task Group on the Devonian/Carboniferous Boundary.
- Palaeozoic sessions co-organized by French SDS Members at the 4th "French" Congress on Stratigraphy (STRATI 2010), August/Septembre 2010 (with official SDS support): Session 21 on "Refining the Palaeozoic time scale" and Session 22 on "Interactions between Palöaeozoic stratigraphy, geography and climates". These were

augmented by a Palaeozoic excursion to Brittany.

**Membership**:
Six new members elected in 2010 come from Austria, Czechia, Russia, and Canada. Unfortunately, two very active and experienced members (J.E. MORROW from the U.S. and T. KOREN from Russia) died this year.

## 6. CHIEF PROBLEMS ENCOUNTERED IN 2010

The open/unsolved procedure for the formal ratification of formal substages delayed the submission of formal proposals to ICS that have already been voted on by SDS. The unexpectedly poor recovery of critical conodonts from higher parts of the Zinzilban GSSP section slowed the Emsian revision process. The inaccessibility of important new conodont data from the Saxothuringian zone of Germany at the London Workshop prevented progress towards a revision of siphonodellid taxonomy and biostratigraphy. Currently, there are largely different opinions concerning the origin of its critical lineages.

SDS is still lacking formal members from a range of countries with extensive and important Devonian outcrops, such as Algeria, Libya, Brazil, Bolivia, Argentine, Turkey, Thailand, Kirgisia, and Caucasian countries. New contacts with Devonian stratigraphers from Algeria, Argentine, and Thailand partly bridge this gap.

## 7. SUMMARY OF EXPENDITURES IN 2010

| | |
|---|---|
| INCOME | |
| carried over from 2009 | 356 $ |
| IUGS subvention 2010 | 2000 $ |
| Sum | 2356 $ |
| EXPENSES | |
| SDS Newsletter 26, printing/mailing | 500 $ |
| Support for three members to attend IPC3 (SDS Business Meeting, Devonian Symposium and D/C Boundary Meeting) | 1400 $ |
| balance early 2011 | 456 $ |

## 8. WORK PLAN, CRITICAL MILESTONES, ANTICIPATED RESULTS AND COMMUNICATIONS TO BE ACHIEVED NEXT YEAR (2011)

- International Conference: "Middle-Upper Devonian and Lower Carboniferous Biostratigraphy of South Urals and Kuznetsk Basin", in memory of Evgeny A. Yolkin **(SDS Field Meeting)**, Ufa, Novosibirsk, Russia, July 20 - August 10, 2011 (for 1st Circular see SDS Newsletter 25: p. 56 – 2nd Circular available on SDDS Homepage or on http://www.ipgg.nsc.ru)
- Finalize and submit proposals for the formal definition of Givetian and Frasnian substages to ICS and Episodes.
- Editorial work for of a Proceedings Volume of the London SDS Devonian Event Symposium in "Palaeogeography, Palaeoclimatology, Palaeoecology" (C.E. BRETT, R.T. BECKER & E. SCHINDLER, Eds. – 20 possible manuscripts offered at London)
- Publication of SDS Newsletter 26 in early 2011
- Compilation of conodont results from the various specialists groups that re-sampled the interval for a revised basal Emsian GSSP in the Zinzilban Gorge
- Update/finalization of the Devonian chapter (BECKER, HOUSE & GRADSTEIN) for GTS 2012 (GRADSTEIN et al.)
- Update of SDS homepage
- Active participation in joint Devonian/Carboniferous Boundary Task Group with a focus on conodont revisions and pelagic-neritic correlations
- Progress on Famennian substage definitions
- Preparation for the votes on new SDS officers (due in 2012)

## 9. BUDGET AND ICS COMPONENT FOR 2011

| | |
|---|---|
| INCOME | |
| balance from 2010 | 456 $ |
| EXPENSES | |
| SDS Newsletter 27 | 500 $ |
| support for SDS members to attend the 2011 International SDS Field Meeting, Russia | 1500 $ |

**request for support/subvention from IUGS/ICS 2000 $**

## APPENDIX A

### Subcomission officers

CHAIRMAN + SDS NEWSLETTER EDITOR
R. Thomas BECKER
Westfälische Wilhelms-Universität, Geologisch-Paläontologisches Institut, Corrensstr. 24, D-48149 Münster, Tel. –49-251-83 339 51, fax –49-251-83 339 68; rbecker@uni-muenster.de

VICE-CHAIRMAN
Ahmed EL HASSANI, Département de Géologie, Institut Scientifique, B.P. 703-Rabat-Agdal, Marokko; elhassani@israbat.ac.ma

SECRETARY
John E. MARSHALL, School of Ocean and Earth Science, University Southampton, Southampton

Oceanography Centre, European Way, Southampton SO14 3 ZH, U. K., jeam@soc.soton.ac. uk

WEBMASTER

Carlo CORRADINI, Dipartimento di Scienze della Terra, Università di Cagliari, Via Trentino 51, I-09127 Cagliari, Italy; corradin@unica.it

**List of voting members, country, special fields, email:**

1. A. BLIECK: France, micro- and macro-vertebrates; alain.blieck@univ-lille1.fr
2. C.E. BRETT: Eastern U.S., sequence and cyclostratigraphy; carlton.brett@uc.edu
3. J.-G. CASIER: Belgium, ostracods; casier@naturalsciences.be
4. CHEN Xiuqin: Nanjing, brachiopods; xqchen@nigpas.ac.cn
5. J. HLADIL: Czechia, stromatoporoids, tabulate corals, various modern stratigraphic methods; hladil@gli.cas.cz
6. N. IZOKH: Siberia, Asian Russia, conodonts; izokhn@uiggm.nsc.ru
7. MA Xueping: Beijing, brachiopods; maxp@pku.edu.cn
8. R. MAWSON: Australia, conodonts; rmawson@laurel.ocs.mq.edu.au
9. J. OVER: U.S., conodonts; over@geneseo.edu
10. M.C. PERRI: Italy, conodonts; perri@geomin.unibo.it
11. G. RACKI: Poland, brachiopods, event and sequence stratigraphy; racki@uranos.cto.us.edu.pl
12. J. DAY, USA/Canada, brachiopods, sequence stratigraphy; jeday@ilstu.edu
13. E. SCHINDLER: Germany, tentaculites, event stratigraphy; eberhard.schindler@senckenberg.de
14. V. TSYGANKO: European Russia, corals; tsyganko@geo.komisc.ru
15. J.I. VALENZUELA-RIOS, Spain, conodonts; jose.i.valenzuela@uv.es.
16. U. JANSEN, Germany, brachiopods; ulrich.jansen@senckenberg.de
17. G. YOUNG: Australia, micro- and macrovertebrates, general stratigraphy; gyoung@geology.anu.edu.au
18. ZHU Min: Beijing, vertebrates; zhumin@ht.rol.cn.net

## MINUTES OF THE SDS BUSINESS MEETING

**Lecture Theatre 1.47, Imperial College, London, UK**

**Thursday 1st July 2010** John MARSHALL, SDS Secretary

The SDS business meeting for 2010 took place during the 2010 International Palaeontological Congress (IPC3).

**Attendance** The Chair (R.T. Becker), Vice-Chair (A. EL HASSANI) & Secretary (J.E.A. MARSHALL), **TM's** A. BLIECK, C.E. BRETT, CHEN Xiu-Qing, N. IZOKH, U. JANSEN, MA Xueping, J. OVER, E. SCHINDLER, J.I. VALENZUELA-RÍOS, **CM's** G.C. BAIRD, K. BAKHAREV, A.J. BARTHOLOMEW, F. BIGEY, D. BRICE, R. BROCKE, P. BUDIL, P. BULTYNCK, C. BURROW, C. CORRADINI, S. KAISER, E. LUKŠEVIČS, H. MATYJA, B. MISTIAEN, L. SLAVIK, C. SPALLETTA, **Guests** SCS Secretary M. ARETZ, O. ARTYUSHKOVA, O. BABEK, C. CRÔNIER, A-C. DASILVA, J. DENAYER, C. DOJEN, I. EVDOKIMOVA, B. HUBERT, HUI Luo, J. KALVODA,O. KOSSOVAYA, LI Chun-Xiang, LIAO, Jau-Chyn, V. MANTSUROVA, R. OWENS, E. V. PAZUKHIN, E. PINTE, E. POTY, QI FENG, N. SAVAGE, O. TEL'NOVA, M. TUITE, WAN Zhen-Zhu, J. ZAMBITO.

**1. Introduction and apologies for absence**

The meeting started at 9:05. The Chairman welcomed the participants with thanks to the organizers of the IPC3 for supporting the SDS Devonian Session and the Business Meeting. The agenda was distributed. The SDS membership had been notified of the meeting by an email circular. But it was noted that 5% were being returned as incorrect. The membership is urged to update their addresses, with notes to the Secretary or Chai, as soon as any change occurs.

The list of apologies was reported: **TM's**, CASIER, HLADIL, TSYGANKO, RACKI; **CM's** KIM, OBUT, KIRCHGASSER, RAKHMONOV, SANDBERG, SLAVIK, TALENT, TURNER, VER STRAETEN.

**2. Approval of 2009 Minutes**

The Chair reported that SDS Newsletter 25 had been circulated in March 2010. It included the minutes of the 2009 Annual SDS Business Meeting in Cincinnati. The Chair then asked for any corrections to these minutes. There were none and the minutes were approved unanimously.

**3. Chairman's Business**

The SDS had been very active although not everything had been achieved. It was deeply mourned that our long standing and very active former TM from Novosibirsk, Evgeny YOLKIN had died. Also, the famous Devonian ostracode worker

G. BECKER from Frankfurt, member of the German SDS, died at the end of 2009 and Tom DUTRO from New York, who led SDS Field Trips to New York State, in June 2010.

The SDS Newsletter had included the ICS report and a very useful summary of publications. We had had the very excellent meeting in Cincinnati organised by Carl BRETT and colleagues. The field trips to the Devonian of Kentucky, Ohio, and Michigan were outstanding. The Chair reported that he had been in Oslo in January 2010 to see Felix GRADSTEIN and Jim OGG, the main editors of the forthcoming new edition of the Geological Timescale book (GTS). He was busy compiling the Devonian chapter. This was to replace the GTS 2004 and had already been scheduled for 2004, 2010 and 2011 but 2012 seemed more likely. It will include very detailed correlation charts with the detailed zonations of conodonts, ammonoids, dacryoconarids, graptolites, ostracodes, and fish groups. They are based on updated correlation charts as produced by K. WEDDIGE. Jim OGG, the ISS Chair, has informed us that the Devonian charts would be nicely drawn by Time Scale Creator (open access freeware). All the data would be input into TSC. All SDS members would be able to download the charts to check them using TSC **(www.tscreator.org).** The Devonian chapter is still missing the coloured GSSP illustrations, which have to include photos of the defining taxon from the GSSP bed. E. SCHINDLER noted the contribution of Manfred MENNING (Chairman of the German Stratigraphic Commission) with his compilation of Devonian, Carboniferous and Permian charts. These included ammonoids, conodonts, miospores, fish, graptolites and ostracodes. The Time Scale Creator is seen as a very useful tool that includes an easy learning programme. A view reiterated by P. BUDIL.

The Chair although happy with the stratigraphic charts regarded them as not being perfect. There were serious problems with time scaling using now obsolete ages. The time scale was linear to Ma. The last summary by B. KAUFMANN (2006) had, for example, partly used sediment thicknesses to scale between the tie-points (especially in the Famennian). After the Oslo IGC the geochronology group of Mark SCHMITZ and Mike VILLENEUVE had recalibrated all Devonian dates and made a number of decisions. Age dates were now graded with 6$^{th}$ class ages discarded. 1$^{st}$ and 2$^{nd}$ class ages were regarded as optimal. The recalibration has changed some age dates by 2-3 my with some error bars now < 1 my. This will form the basis of the vertical scaling. The Emsian to early Eifelian interval was now very different. The Tioga Ash and Hunsrück ages were regarded as high quality data points whereas the Wetteldorf ages were of low quality, with up to 5 Ma of uncertainty. It is clear that more and better Wetteldorf zircon ages are required. The late Emsian to early Eifelian interval now has a 15-17 my duration, which appears to be extremely long. Nacho VALENZUELA-RÍOS noted that some dates were probably in error and we had to be careful in using obsolete dates. In contrast, zonations were good but ages change. We have to work towards getting the fossils as accurate as possible and then link the absolute dates to our zones.

It was noted that the Hunsrück bentonite was well correlated as it occurred with ammonoids and darcryoconarids. The Tioga Ashes were similarly reliable. The Secretary observed that this was all in our control. We needed a systematic programme of zircon dating. Carl BRETT noted the problems with the Esopus Formation. There was a 417-415 age above the Kalkberg, the upper part of the lower Lochkovian. This gives the S/D boundary estimate of 416/417 Ma. But there were no dates in the Silurian below.

It was affirmed that the geochronology group wanted the Devonian as a case study for the Phanerozoic. But it was emphasized that the acquisition of dates was very tedious. It takes up to 6 months of analytical work to get a high-resolution absolute date. We also needed to focus more on counting Milankovitch cycles. We should aim to get the precise numbers of cycles within clearly fixed conodont zones. The Chair noted that Sven HARTENFELS had in his PhD counted all the thin limestone cycles in the Famennian of Rhenish sections from ca. the *velifer* to Middle *expansa* zones.

The Secretary noted that Jessica WHITESIDE from Brown University, who had worked on Triassic/Jurassic cycles, intended to 'adopt' the Devonian. We needed to make contact. Nacho VALENZUELA-RÍOS noted that it was important to be careful with the statistics of cycle counting. Lots of work had been done by Ivo CHLUPÁČ on the Barrandian. It was also recognized that there were 160 cycles in the *Hollardops* Limestone Member of the basal Upper Emsian in SW Morocco. Ladislav SLAVÍK noted that it could be difficult to count precise cycles in the Barrandian Emsian-Eifelian. Carl BRETT reported on joint work from Morocco where Upper Emsian cycles had been counted from localities 70 km apart where the limestones pinched and swelled. There were the same number cycles. Ladislav SLAVÍK noted that we needed scales of cycles with palaeontological ranges. Ultimately we should work towards a calibration of zones and cycles in separate basins.

It was noted that the GTS was now orbitally tuned down to the Cretaceous; we need to do this at some stage for the Devonian. Nacho VALENZUELA-RÍOS remarked that it was important to have an agreement to what constituted a cycles. It was

generally agreed that we should have a cycle session at some future SDS meeting.

There was a SDS document submitted by Charlie SANDBERG, dealing with the conodont age of the Alamo Impact and of Belgium Frasnian reefs. Apologies were given for his absence since, very sadly, his wife Dorothe, who was at the Nevada SDS Field Meeting, had died. The document will be placed in the next Newsletter (see Document section). Peter KÖNIGSHOF reported that samples studied by Willi ZIEGLER and Charlie SANDBERG had now been returned from Denver. But it was often still difficult to find things. Peter KÖNIGSHOF is officially the curator of this collection. This meant that new data were now available. The Alamo Breccia was from the upper part of the *punctata* zone. Therefore it did not correlate with the base of the mid Frasnian transgression. It was equivalent to the Cassaquoy rather than the Middlesex transgressions. The extinction of the $F_2$ Lion Mud Mound reefs was now in the upper part of MN zone 8 and recognized globally. It was equivalent to the upper Rhinestreet Event.

The Chair reminded us about the excellent Kitab Reserve meeting (Uzbekistan) in 2009. Some reports were in the last SDS Newsletter, others are still awaited. A goniatite report had been included in SDS Newsletter 25 but more were expected for other groups. We need to know about research progress and better understand the Pragian-Emsian problems. Nadia IZOKH reported on the Kitab meeting. Information on conodonts, dacryoconarids/tentaculitids, corals, brachiopods and bryozoans were to be published in a Supplement of the *Journal of Geology and Geophysics*, Novosibirsk. This was expected at the end of 2010. A summary would be available for the SDS Newsletter and a pdf on the website.

Ladislav SLAVÍK reported on results from Uzbekistan including graphic logs and isotopes. This was still in progress but the data was needed for the Novosibirsk meeting. The gamma ray and MS logs were done. The first preliminary results showed there were no polygnathids at the proposed future basal Emsian boundary interval. Results were being discussed by Nacho VALENZUELA-RÍOS and NADIA IZOKH. The Chair wondered why the polygnathid record has disappeared; obviously they were always rare, with only 2 specimens. Nadia IZOKH reported that Bed 32/33 contained lots of *P. excavatus*. But they didn't find good ones 2 years ago when the unit was re-collected in 2009. It was emphasized that the different groups needed to interface. Reports were required for the Newsletter plus pdf's for the SDS homepage.

**4. ICS Matters**

The SDS Chair had attended the ICS meeting in Prague. This had included an ICS workshop for 2.5 days that had mostly discussed the GSSP concept. However, there had been a discussion about the use of Ma to represent geochronological ages as distinct from my or myr to represent intervals of time. The Secretary (who was not in Prague) clarified the concept of geological time as distinct from an interval of time. Geological time only happens once. [For further reference see http://www.geosociety.org/TimeUnits/ and AUBRY, M.-P., VAN COUVERING, J.A., CHRISTIE-BLICK, N., LANDING, E., PRATT, B.R., OWEN, D.E., and FERRUSQUÍA-VILLAFRANCA, I., 2009, Terminology of geological time: Establishment of a community standard. *Stratigraphy*, **6**, 100-105]

There was also a discussion on the use of stages and ages. In future, geochronology shall strictly use ages and not stages.

The discussion on GSSP's included a number of presentations upwards from the base of the geological column. The Chair gave a presentation on Devonian substages and the current status of the Devonian-Carboniferous boundary. He reported that there were still big problems in the sub-division of the Ordovician and that the Ordovician-Silurian boundary required revision.

Guidelines were issued on writing a GSSP proposal. As regards the Devonian there were problems with the Pragian and the first entry of its marker, *Eognathodus sulcatus*. It does not enter at the GSSP but is already present one bed below. Elsewhere (Nevada) it could start even earlier. There was also the problem that the Mid-Late Devonian boundary index conodont from the GSSP bed had never been figured. There were specimens of *Ancyrodella rotundiloba* figured from the beds above the boundary. Those at the boundary were different from those published by KLAPPER (1985) in the *Palaeontographica* monograph. There appears to be no ancyrodellid lineage at the GSSP but it is defined by the first appearance of the oldest *Ancyrodella* representatives. It is surprising that this got through the GSSP approval system. The new guidelines require more details and rigor, including specimen curation.

However, there were no rules, as yet, about sub-stages. The Chair noted that there was a recommendation from Felix GRADSTEIN to Stan FINNEY (ICS Chair) that the procedure should be the same as for stages. Stan FINNEY now needed to discuss this with the IUGS. The Chair had raised this issue already at the Oslo IGC and clear direction was required. He reported that the Triassic Smithian and Spathian are also widely used and that they should become formal substages of the Olenekian. The Visean also was recommended for sub-stages but the Carboniferous Subcommission is currently still busy with their remaining stage definitions.

As regards sub-stages and the SDS, the recommendation is a publication with a formal recommendation. Nacho VALENZUELA-RÍOS stressed that a defined stratotype was required. It was agreed that Pierre BULTYNCK, Sofie GOUWY, Thomas BECKER, Sarah ABOUSSALAM, and others should publish accounts of the Givetian sub-stages including the regional reference section to show that the procedure works. These should be published together, probably in *Episodes*, as a series of short papers, although yet to be ratified by the ICS. The papers should be sent as formal substage proposals to ICS, awaiting a decision on their procedures (which are now unclear for several years). Tatiana KOREN emphasized that we must do sub-stages. The Silurian subdivision was created in the 1960's. We now recognize that the Silurian stages are sub-stages and that the current British series become the true stages.

**5. Devonian Substages**

*5.1 Pragian and Emsian sub-stages*

There had been no progress on Emsian sub-stages. But some progress had been made on the Daleje Event in Morocco. There was some discussion about the Lower and Upper Emsian. A nowakiid monograph was in preparation but progress was slow. Jiří FRÝDA reported that it would still take some time and would not be finished this year. Stanislava BERKYOVÁ had been doing some work on the conodonts and tentaculitids. Jiří FRÝDA was leading a task group on this boundary.

Pierre BULTYNCK noted that the La Grange nowakiids were published but there were still problems in the upper part with *Polygnathus gilberti*. There was a lack of ongoing dacryoconarid work.

Nacho VALENZUELA-RÍOS had been studying the Lower-Upper Emsian boundary and studied several tons of limestone. The collections included *P. gilberti* in the late *laticostatus-inversus* Zone and several new taxa. The conodonts were important for a future definition and the papers should include new data from the Pyrenees and a report on the dacryoconarids by Eberhard SCHINDLER.

*5.2 Eifelian sub-stages*

Again there was only limited discussion. Carl BRETT noted the base *kockelianus* Stoney Hollow Event and this was now recognised as an important eustatic signal. However, we should define Eifelian sub-stages last.

*5.3 Givetian and Frasnian*

These were covered by the decision to publish in *Episodes*. We needed an additional *hermanni* Zone section from America. Jeff OVER reported that there was no new information on the Frasnian substages. Nacho VALENZUELA-RÍOS noted that the Givetian subdivision worked well in the Pyrenees.

*5.4 Famennian*

We can now propose a vote on the sub-division of the Uppermost Famennian. The Nevada volume with the new data by Kaiser et al. has been published (*Palaeontographica Americana*). In addition Sven HARTENFELS had submitted his PhD thesis on the middle/upper Famennian which totalled 400 pp. and numerous plates. However, the conodonts (almost 80,000 Pa elements) were not so helpful for the definition of an Upper Famennian base. It was suggested that the base of the *Annulata* Event should be used for the mid-upper Famennian boundary. *Scaphignathus velifer velifer* and *Palmatolepis rugosa trachytera* range into the first shale (or black limestone) but not the Upper *Annulata* Event layer. However, many sections only contained a single shale. So, the onset of the black shale was important. This was known from Australia, South China, Iran, Morocco and Europe (Carnic Alps, Bulgaria). This definition used a physical event (with ammonoids) so we needed to think about it. Nacho VALENZUELA-RÍOS was concerned about the lack of conodonts.

The Uppermost Famennian vote would be held shortly. The Lower-Middle Famennian would also be voted on, choosing between the base of the *rhomboidea* (as recommended by Maurice STREEL) and base of the *marginifera* Zone (proposals by Thomas BECKER, Willi ZIEGLER, Charlie SANDBERG, etc.).

**6. SDS Publications**

The Nevada volume was now out, including the fieldguide on CD.

There was the new IGCP publication edited by Peter KONIGSHOF on *Devonian Change*. This was supported by the SDS and had been published by the Geological Society of London (Special Publication **314**).

Also from the IGCP 497/499 meeting in Frankfurt there was a special volume of *Gondwana Research* (volume **17**) on *The Rheic Ocean: Palaeozoic Evolution from Gondwana and Laurussia to Pangaea* edited by Damian NANCE.

Carl BRETT gave an update on the SDS Palaeo$^3$ volumes. It had been held up by two late contributions but was now with Fred KOP at Elsevier. The first volume would go to into the journal next month. It should have a 2010 date, at least as electronic pre-print. Contributions were still required for the second volume.

There will be a *Memoirs of the Australasian Palaeontologists* Memoir **39** (Siluro-Devonian Studies 1, Editor: D.J HOLLOWAY & J.R LAURIE), to be published in July/August. It includes an Uzbekistan Lower/Middle Devonian trilobite paper in memory of E.A. YOLKIN (OWENS et al.).

The GTS 2012 was forthcoming.

There was some discussion about a volume from the SDS session at the London IPC3. Possible places to publish included *Neues Jahrbuch für Geologie und Paläontologie*, *Bulletin of Geoscience*, *Acta Palaeontologica Polonica, Palaeo*[3] and as a *Geological Society of London Special Publication*. A show of hands showed that there might be 10 manuscripts. A deadline was set for the end of 2011.

**7. Future Meetings**

Future meetings with SDS contributions include:

The 2010 meeting in France, as part of the 4th Congress of Stratigraphy, August 13th-September 2rd. This included Palaeozoic stratigraphy, palaeogeography and climate. Contributions were to be sent to Bruno GRANIER.

There was to be a German SDS session at the October 2010 GeoDarmstadt meeting in Germany.

IGCP 580 *Application of Magnetic Susceptibility on Palaeozoic sedimentary rocks* have a November meeting in South China including a 4-5 day fieldtrip. There was a link to this on the SDS webpage.

In September 2010 there will be a meeting on biostratigraphic events in La Plata City as part of the 10th Argentinian Congress on Biostratigraphy and Palaeontology.

In 2011 we have the main SDS meeting in the Urals, Novosibirsk (conference), Salair and the Kuznetsk. The first circular was on the SDS website. Nadia IZOKH reported that an email circular had also been sent out. This would be a meeting in memory of Evgeny A. YOLKIN and would also include some Carboniferous.

In 2011 there was the 8th Baltic Stratigraphy Conference in Riga at the end of August. This would last for 10 days, including a Devonian fieldtrip.

In 2012 there will be the IGC in Brisbane, Australia. A symposium on the "Devonian of Asia and Australia" has been formerly proposed to the organizers by the Chair. There were possible Devonian fieldtrips to East Australia and the South-east Asian Devonian in Thailand. It was reported that Norman SAVAGE was leading an informal trip in November (1st-5th) of 2010 to Thailand. There was brief discussion of a more formal SDS meeting in Thailand for later years, possibly in connection with a new Devonian IGCP.

For the 2013 meeting we were invited back to Morocco by Ahmed EL HASSANI. This would be a joint Devonian and Carboniferous meeting in spring, with 5 days of fieldwork in SE Morocco, concentrating on new sections that were not visited during previous meetings. We would meet in a Tafilalt hotel. Subsequently, visits to the Devonian and Lower Carboniferous would follow, involving the Carboniferous group of A. ARETZ and H.G. HERBIG.

Also in 2013 the ICOS meeting would be in Mendoza, Argentina. It would be in July with pre and post field excursions to San Juan and Salta. Maria Cristina PERRI was one of the organisers.

Then in 2014 we had the IPC4, venue yet to be decided.

**9. SDS Membership**

*9.1 New CM's*

The following new CM's were elected.

Thomas SUTTNER (conodonts, reefs), Austria, proposed by R.T. BECKER & E. SCHINDLER , Petr BUDIL (trilobites and the Kacak Event), Czech Republic, proposed by J. HLADIL and R.T. BECKER

Irina EVDOKIMOVA (ostracodes), Russia, proposed by V. TSYGANKO & T. KOREN

Elena SOKIRAN (brachiopods), Russia, proposed by V. TSYGANKO & T. KOREN

Olga ARTYUSKOVA (conodonts), Ufa, Russia, proposed by N. IZOKH & R.T. BECKER

David Johnston (conodonts), western Canada, proposed by R.T. BECKER &. J OVER

*9.2 New TM's*

TM's are only elected at IGC's. The Chair reminded SDS members that he had done the maximum of two terms and he was required to step down in Brisbane. An election would be held with senior SDS members accepting voting proposals and counting the votes. The term of the Vice Chairman will also end in 2012. The new Chairman will pick a secretary.

**8. Financial Report** (this item was taken out of order)

| | |
|---|---|
| INCOME | |
| carried over from 2009 | 356 $ |
| IUGS subvention 2010 | 2000 $ |
| (including an extra allocation by the ICS Chair) | |
| Sum | 2356 $ |
| | |
| EXPENSES | |
| SDS Newsletter 26, printing/mailing | 500 $ |
| Support for three members to attend IPC3 | |
| | |
| (SDS Business Meeting, Devonian Symposium and D/C Boundary Meeting) | |
| | 1400 $ |
| Sum | 1900 $ |
| balance early 2011 | 456 $ |

We had to report that we had supported KIM from Uzbekistan to attend the London IPC3. But he had been refused a visa. This was despite the best efforts of the IPC3 organising committee and Thomas BECKER.

**10. AOB**
Carl BRETT gave thanks to the Secretary for organizing the spectacular trip to Orkney (and Scotland) this was despite the complete lack in invertebrate fossils.
The meeting closed at ~11:20 for a short break before the *Task Group D-C boundary* meeting.

## Task Group Devonian-Carboniferous Boundary

**Task Grouper Leader**
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### REPORT ON THE WORKSHOP OF THE TASK GROUP FOR DEFINING THE DEVONIAN-CARBONIFEROUS BOUNDARY

**Date**: 02.07.2010 during the 3rd International Palaeontological Congress
Started: 11.35 after the SDS business meeting
Ended: 13.30 - because the auditorium was booked for another workshop
**Venue**: Imperial College London
**Number of Participants**: 37
**Task group members**: M. ARETZ, C. CORRADINI, R.T. BECKER, D. BRICE, S.I. KAISER, J. KALVODA, J.E.MARSHALL, H. MATYJA, S. NIKOLAEVA, V. PAZUKHIN, E. POTY and C. SPALLETTA;

**Guests**: O. ARTYUSHKOVA, O. BABEK, N. BAICHAREV, P. BULTYNCK, X. CHEN, I. EVDOKIMOVA, U. JANSEN, T. KOREN, O. KOSSOVAYA, E. KULAGINA, J.-C. LIAO, E. LUKSEVICS, V. MANTSUROVA, B. MISTIAEN, N. NADEZHDA, J. OVER, R. OWENS, M.C. PERRI, N. SAVAGE, P. SARTENAR, N. SENNIKOV, E.SCHINDLER, O. TEL'NOVA, M. TUITE, N. VALENZUELA-RÍOS.

**Remark**: During the afternoon, interested task group members and guests had the opportunity to examine conodont samples from the boundary interval in the Urals brought to London by V. PAZUHKIN.

The workshop was opened by the SDS Chairman Thomas BECKER, who announced the decision of the SDS and SCCS chairs to nominate as task group leader and vice-leader Markus ARETZ (Toulouse) and Carlo CORRADINI (Cagliari).

Then Markus ARETZ shortly outlined the composition of the group (see SCCS Newsletter 2009) and a concept for working phases in the next years. The goal is the precision of redefinition of the current level of the Devonian-Carboniferous boundary. It is the aim of the group to come up with a proposal which finds wide acceptance in the geological community and that the new boundary will be stable for long time. It is clear that the new boundary will be supported by a "check-list" which helps identifying it when the marker criterion cannot be identified in some localities.

The task group will and has to communicate at all steps of the process with interested people outside the working group. It is planned to hold further workshops at the upcoming major meetings of SCCS, SDS and ICS. The SDS chairman (BECKER, Münster) and vice-chairman (EL HASSANI, Rabat) and the SCCS secretary (ARETZ, Toulouse) plan to organize a field meeting (including 2 days in house) in southern and central Morocco in early 2013, which will largely deal with the Devonian-Carboniferous boundary.

According to ICS rules task groups should finish their work within 8 years. In the case of this task group, which was established in 2008, work should

be done by 2016! Thus the task group leader set the aim to finish a proposal in 5 years from now, which then has to go through SCCS and ICS.

To achieve the ambitious time frame, the program of the task group should be divided into 3 phases:

- 1st phase: *search for a criterion*
- 2nd phase: *discussions on possible sections*
- 3rd phase: *bring data together and propose a solution for the problem*

In the current 1st phase the following points should be respected:

- The criterion and the organism we will pick are open.
- Input from all organisms and facies is wanted and needed!
- The position should not be too revolutionary, thus somewhere around the current boundary and respecting the old *Gattendorfia* based boundary.
- Biostratigraphical data have to be supported by data on sequence stratigraphy, chemostratigraphy, magnetostratigraphy, ash layers, etc.

Thus the group should:
- produce data,
- find a common language for the conodont taxa,
- explore groups like foraminifers, miospores, ammonoides, etc., and
- explore the possibilities of event stratigraphy.

After the opening review and outline three presentations were given:

Thomas BECKER presented the general problems of the boundary and several classical sections around the world, as well as some section his team is currently working on in Morocco.

This talk was followed by a presentation of Carlo CORRADINI who outlined the problems of the *praesulcata-sulcata* lineage and the current stage of knowledge of *Protognathodus* species in the boundary level. He summarized a series of problems with the FAD and distribution of the protognathodids and especially emphasized the rareness and facies dependence of this group. Hence he concluded that none of these condonts has the potential as the primary marker for the D-C boundary (apart *Si. praesulcata* and *Si. duplicata*, but choosing one of those species the boundary would have been move sensibly from the present position); he also suggested to explore the possibilities to use an event based boundary, but in this case a solution should be find for those boundary section where the Hangenberg event looks to be not present.

The third presentation was given by Jiri KALVODA who presented the newest results of our Czech colleagues in the Lesni lom Quarry (Moravia).

After these presentations a lively discussion started in which following points were discussed:

- Is there any potential within the lineage *praesulcata-sulcata*, which has been overlooked, and is the CORRADINI-KAISER model right?
  The majority of the conodont workers present at the workshop do not see much use in the *Siphonodella* lineage. However, Carlo CORRADINI suggested that there model should be independently tested by other conodont specialists. It became clear that the short presentation on early siphonodellid taxa of H. TRAGELEHN in the last SDS Newsletter has not helped to solve problems. Inappropriate figures and text have caused more problems than they gave solutions. Thus, before the material of TRAGELEHN is published in an adequate form, it should not be included into any discussion of the siphonodellids!
- What is the difference between *Siphonodella* and other polygnathids?
  This question was raised by Thomas BECKER and started a discussion about principal conodont taxonomy. However, little agreement was seen here , and because it is not the focus of the D-C boundary task group to solve problems of conodont taxonomy (although all conodont specialists did not follow the view of Thomas), the task group leader had to stop the discussion after some minutes.
- Are protognathodids useful?
  The opinions seem to be rather split. There was no agreement on the usefulness at all or if some taxa may help. This needs much further work in the coming months and years. For the moment there might be some potential for *P. kockeli*, but a big problem is the facies dependency, its rareness and a “late” appearance in many sections.
- Is the Hangenberg Event a good boundary?
  This idea received much support. It was underlined that this event could offer the possibility for correlation into very different facies and also that the event could be recognized by very different techniques and biostratigraphic markers. It was outlined and strongly suggested that the task group should work on the possible practicability of this event horizons. However, it was also said that the base of the black shale is very likely diachronuous because of its transgressive character, and thus the later sea-level drop or the maximum flooding surface might be the best levels for the boundary.
  In any case, agreement was reached that (1) this level is widely recognizable, and (2) a biostratigraphic criterion could in all cases be

supported by a wealth of other data and criteria in this level.

- What are the ideas of people working in shallow water successions?
  Eddy POTY and Thomas BECKER discussed this when referring to sections in Belgium, where Eddy questioned the long duration of the gap, which is commonly assigned. He was arguing with the short duration of the Hangenberg Event ($6^{th}$ order?) and also made reference to the ongoing debate on the conodont ages and zonations. The absence of the *praesulcta-sulcata* lineage in the Belgian shallow water sections seems to become less important than previously thought.

Discussions had to stop then when we were running out of time. However, when summing up it becomes evident that the Hangenberg Event should be a prime target for the task group. For the boundary discussion we need more data, as outlined above, and all task group members and interest researchers are asked to generate and/or communicate them.

It also became clear that the task group would benefit from an agreement about the conodont taxonomy, but this has to be reached in the conodont community.

To prepare the next workshop (data and venue open), we ask all experts to work on precise charts for the biostratigraphic, geochemical and event stratigraphy in the level of the Hangenberg Event. We would like to know how the Hangenberg interval is represented in different facies and how well it can be correlated world-wide.

## The Early to Middle Paleozoic Revolution: Bridging the Gap between the Great Ordovician Biodiversification Event and the Devonian Terrestrial Revolution
## A Proposal to the International Geoscience Programme (IGCP)
## Co-Leaders:

B D. CRAMER (Lawrence, USA) Ž. ŽIGAITĖ (Vilnius, Lithuania)
T.R.A. VANDENBROUKE (Lille, France) K. HISTON (Modena, Italy)
R. ZHAN (Nanjing, China) G.L. ALBANESI (Córdoba, Argentina)
M.J. MELCHIN (Antigonish, Canada) M. CALNER (Lund, Sweden)

The presence of at least eight major perturbations to the global carbon cycle in roughly 40 million years demonstrates that the Late Ordovician to Early Devonian interval was among the climatically least stable episodes of Earth history. Following the Great Ordovician Biodiversification Event and prior to the Devonian Terrestrial Revolution, this interval represents a unique opportunity to study in detail the cause-and-affect relationships of significant global planetary change within a biologically fully populated ocean-atmosphere-biosphere system but prior to the development of a significant global terrestrial biosphere.

The Late Ordovician to Early Devonian interval contains several of the most severe paleoclimate and paleobiological events in Earth history including paleobiodiversity and global carbon cycle events near the base of the Katian, Ordovician-Silurian boundary, Llandovery-Wenlock boundary, middle Homerian, middle Ludfordian, and Silurian-Devonian boundary, among others. This interval of Earth history also contains the acme and amelioration of the Early Paleozoic Ice Age, which provides an important historical analogue for researchers of modern climate change. Additionally, the Late Ordovician-Early Devonian interval contains the roots of the invasion of life onto land. The Earth did not go quietly into the Middle Paleozoic and the primary research objective of this project is to investigate this dynamic and important interval in the history and evolution of life and our planet.

Late Ordovician to Early Devonian strata are of global economic and environmental significance as source rocks, host rocks, targets, aquifers, and potential sites of sequestration and containment. Much of the North African and Arabian oil and is either sourced from or housed in Late Ordovician to Early Devonian strata. Silurian carbonates are the host rocks of globally significant deposits of mineral resources such as gold, zinc, and lead. Two of the largest salt deposits on the planet were deposited during the Silurian Period, and the globally expansive Late Ordovician to Early Devonian carbonate platforms are utilized as a source of limestone for chemical, industrial, and architectural use worldwide. The broad epicontinental platforms common during this interval often act as local or regional aquifers for municipal and agriculture water use, and in some areas, are being targeted as potential sites for CO2 sequestration and hazardous waste containment studies as well. Improved understanding of the temporal, geospatial, and ultimately causal relationships between these resources and Late Ordovician-Early Devonian global planetary change has direct economic and environmental significance, and additionally, is critical to understanding the Early to Middle Paleozoic Revolution.

Specifically, this project will investigate the biological, chemical and physical evolution of the ocean-atmosphere-biosphere system during this dynamic interval of Earth history by addressing in detail the relationships between climate, sea level, tectonics, biology, oceanography, volcanism, and the stratigraphic record of Early to Middle Paleozoic global planetary change. This project will be conducted in collaboration with the International Subcommissions on Ordovician, Silurian, and Devonian Stratigraphy (SOS, SSS, SDS), and will be accomplished in successive steps over the five-year duration of the project (2011-2015).

2011 – Improving global biostratigraphic and chronostratigraphic correlation
2012 – Reconstructing global sea levels, sequence stratigraphy and paleogeography
2013 – Identifying biological, chemical and physical indicators of global planetary change
2014 – Addressing evolutionary paleoecology, paleobiodiversity and paleobiogeography
2015 – Oceanographic and climate modeling of Early to Middle Paleozoic events

## IGCP-proposal

*(currently under review – decision of the IGCP Board expected in spring 2011)*

### CLIMATE CHANGE AND BIODIVERSITY PATTERNS IN THE MID-PALEOZOIC

### Proposed Leadership:

KÖNIGSHOF, Peter (Germany)
SUTTNER, Thomas J. (Austria)
BONCHEVA, Iliana A. (Bulgaria)
OBUT, Olga T. (Russia)
TA HOA, Phuong (Vietnam)
THASINEE, Charoentitirat (Thailand)
WATERS, Johnny A. (Usa)
KIESSLING, Wolfgang (Germany)

**Brief outline of the project**

The Mid-Paleozoic conforms to a time interval of dynamic long-term climate change, which was accompanied by substantial variations in biodiversity. Within the framework of this project we intend to increase and refine the documentation of biodiversity mainly in tropical realms during Early Devonian-Early Carboniferous times and identify links to climate change. Groups distinctive for different ecosystems, especially indicating terrestrial, neritic and pelagic marine environments, are land plants, phytoplankton, foraminifers, sponges, corals, arthropods, cephalopods, echinoderms, brachiopods, bryozoans, conodonts and fishes. In addition to general diversity patterns of different fossil groups, we will study three distinctive intervals in detail, which should document biodiversity and the intensity of evolutionary-pressure during (1) greenhouse (Givetian), (2) beginning climate change (Early Middle Frasnian, e.g, *punctate*-Zone) and (3) icehouse conditions (Late Famennian–Tournaisian).

The rapid rise of land plants during the Middle Devonian was coupled with strongly decreasing atmospheric $CO_2$ values from 4000 ppm to nearly present day values of about 350 ppm during the latest Devonian (compare ROYER, 2006). This dynamic climate shift was followed by a complete reorganisation of ecosystems with tremendous consequences for marine communities at global scales. The interaction between developments on land, such as the formation of top-soil and its influence on the geochemical composition of marine environments are considered as important factor probably responsible for evolutionary trends in biodiversity. Therefore geochemical analysis of carbon, oxygen and strontium isotopes as well as the total organic content and sulfur of sedimentary rocks will be measured to reconstruct prevailing paleoenvironmental conditions. Additionally, geophysical data related to the magnetic susceptibility and the natural gamma radiation of sediments (in cooperation with IGCP 580) will be used as auxiliary methods for high resolution correlation of biostratigraphic well-documented units belonging to different bathymetric sequences within the tropical belt (Laurussia, Siberia, peri-Gondwana and N-Gondwana).

Results of this project should show whether climate change (e.g. interaction of $CO_2$ and temperature) from greenhouse conditions during the Early-Middle Devonian to icehouse conditions during the Late Devonian-Early Carboniferous represents a major trigger for variations in biodiversity or if a combination of multiple factors is responsible for such changes.

Related to this study, a network of taxonomic workers will be established, which will help to update the systematics of Mid-Paleozoic terrestrial and marine organisms. These datasets will be made available to the public by using existing e-infrastructures such as the *Paleobiology Database*.

The benefit of this project regards scientific as well as social purposes. On the one hand results of the project might help to understand our present day situation and climate change in future by documentation of Mid-Paleozoic climate change and its effect on biodiversity. On the other hand, our novel combination of global earth system sciences

and analytical paleobiology will help to integrate and educate young researchers responsible for the preservation of knowledge in future.

**Aims and background**

The Mid-Paleozoic represents a time when significant changes took place in terms of evolutionary development as well as in biochemical cycling and climate changes. Several severe bio-events (e.g., KAUFFMAN and WALLISER 1990) are evident and continental glaciations are known during the Late Devonian (Famennian, middle *Siphonodella praesulcata* conodont zone) and the Early Carboniferous (Mid- to Late Tournaisian). Global cooling is already suggested at the Frasnian/Famennian boundary based on declining $CO_2$ levels (e.g. CROWELL, 1999, ISBELL et al., 2003). Another important step in terms of climate, sedimentology and ecosystem evolution was attributed to the global increase in terrestrial biomass, which enhanced carbon burial with possible global effects on carbon budgets and atmospheric $pCO_2$. Increasing colonization of the land by plants in combination with soil-forming processes and changing runoff led to major changes of sediment input into the marine system. Both, rapid evolution of terrestrial ecosystems (e.g. ALGEO and SCHECKLER 1998; KERP 2002, MARSHALL et al. 2010) and climate change had a pronounced influence on sedimentation and biodiversity not only in the terrestrial but also in the marine realm. These transformations resulted in a diverse series of ecological turnovers and extinction events, together with pronounced geochemical signatures in the marine record, which are characterized by short-term perturbations in the global carbon cycle (BUGGISCH and JOACHIMSKI 2006). Furthermore, the Mid Paleozoic was also a time of dramatic paleogeographic changes, such as the Variscan orogeny. The configuration of continental blocks provides data concerning the extent and duration of a major equatorial ocean during the Middle Paleozoic. Oceanic circulation patterns may have had a profound influence on biodiversity and perhaps on climate change as is the case today (e.g. DOPIERALSKA 2009). Therefore, a high-quality record of fossils in terms of assemblages or ecological-evolutionary units (e.g., BOUCOT and LAWSON 1999; BRETT et al. 2009), sediments and geochemical data is necessary to provide quantitative estimates of paleoclimate and indicate the temporal scales of paleoclimate processes. To achieve these goals, for example calibration of stable isotope data with sedimentologic and paleontologic data is necessary. In this respect paleontology has been a key component in paleoclimatic research because fossils, together with sedimentary rocks, are the repository of nearly all paleoclimatic data, particularly quantitative data, for example stable isotopes are most commonly measured from fossils (e.g. conodonts, brachiopods, ostracodes, foraminifera etc.). On the other hand, understanding the evolution (taxonomy and systematics), paleobiology, and paleoecology of organisms is vital to paleoclimate interpretations of stable isotope records. For example, vertical or horizontal migrations during ontogeny, as well as seasonally in reproduction, will have large consequences for estimates of ocean temperatures from marine microfossils. Paleobiology and paleoecology are also crucial for the interpretation of shifts in paleobiogeographic patterns in terms of paleoclimatic change.

The primary goal of this project is to assess the intensity of climate change (e.g., $CO_2$-temperature coupling) and biodiversity response of the Mid Paleozoic in marine and terrestrial sequences. Questions to be addressed are:

- What rules governed biodiversity dynamics (short-term and long-term dynamics) in the Mid-Paleozoic, and was $CO_2$ the dominant driver of Mid-Paleozoic climate?
- How did $CO_2$ variations affect Mid-Paleozoic biodiversity?
- What is the $CO_2$ threshold for initiating glaciations in the Mid-Paleozoic and are they similar to each other?
- How did the changing environment influence the generation and persistence of evolutionary innovation (short-term scale and long-term scale in different settings) in the Mid-Paleozoic?
- Are the major biotic changes in marine and terrestrial facies settings linked with Milankovitch scale changes?
- Are ecological-evolutionary units consistent and do they show significant differences in different basins?
- What is the dimension of shifting ocean chemistry (e.g. ocean acidification) through time and what was the impact on marine organisms and/or the fossil record?
- Is climate modeling a useful tool in the Mid-Paleozoic?
- To what extent do current hypothesis on $CO_2$ variations and global warming fit the geologic evidence in the Mid-Paleozoic?

The questions will be addressed by multi-disciplinary cooperation including new approaches such as climate modeling. The integrative kind of research needed throughout the proposed project can only be carried out by a worldwide network. To answer the questions above, it is planned to organize collaborative fieldwork in selected areas (see workplan) as well as using the existing network (e.g., National and International Subcommissions on Devonian and Carboniferous Stratigraphy) in order to quantify biodiversity of life through a synthesis of phylogeny and morphology of important organisms in different depositional settings (terrestrial, neritic and pelagic) within a well-constrained temporal

framework. This will provide a more powerful description of evolutionary patterns and will yield a better understanding of biogeographic shifts, patterns of survival across extinction intervals, as well as long-term patterns of innovation and ecological changes (ecological-evolutionary units). Based on a rigorous biostratigraphic framework (long-term dynamics) the project aims to use also geochemical proxies for stratigraphic purposes (short-term dynamics) in order to define biotic changes and their link with Milankovitch cycles. Within this context the main focus will be on "climate-sensitive organisms" occurring in terrestrial and shallow water realms and/or organisms which provide useful information on paleoclimatic data (see above). Studies on climate change and biodiversity response requires a large data set. A suite of different databases exist but most current paleontological databases contain restricted range of information (e.g., taxonomic databases, bibliographic databases, collections databases among others). The most comprehensive database is currently the *Paleobiology Database*, which is being developed by a large number of professional paleontologists. One of the PIs (Wolfgang KIESSLING) is the most prolific data provider worldwide and member of the advisory board.

Another key issue to be addressed is the implementation of young scientists and scientists from developing countries. The majority of project leaders have been also members of IGCP 499 ("Devonian land-sea interaction: evolution of ecosystems and climate" – DEVEC) a project that was terminated in 2009 after six years of successful research focusing on paleoecosystems in different facies settings, which led to a better understanding of the complex Earth System during the Devonian. In the framework of this project more than 530 papers in ISI-listed journals have been published to date, including Special Volumes on different topics (e.g., Becker and Kirchgasser, 2007; Königshof, 2009; Brett et al. in press). Based on the long-lasting cooperation between the Devonian and Carboniferous Subcommissions and networks within different Paleozoic working groups we expect a huge scientific outcome also for the proposed project. Additionally, there is a linkage to the existing IGCP 580 on "Magnetic Susceptibility, Correlations and Paleoenvironments", which will provide additional climate proxies in order to get a more profound picture of climate changes and biodiversity respond in the Mid-Paleozoic.

As we have stated above, this proposed project has the focus on climate change and biodiversity response within one of the most interesting times in Earth history. The project aims to foster a worldwide interdisciplinary collaboration on the above mentioned topics. In the meantime a wide range of countries have expressed an interest in the proposed project which illustrates their dedication. The general topic is timely, particularly with regard to the present discussions on global warming and the possible impact on biodiversity.

## SDS/IPC3 OLD RED SANDSTONE FIELD TRIP REPORT

J.E.A. MARSHALL

Apparently I forgot to ask any of the participants to write up an account of the Old Red Sandstone (ORS) fieldtrip. I tend to regards such accounts a bit like a restaurant review where obviously the chef is not supposed to influence the reviewer or the report and so did nothing. I rather assumed that Thomas BECKER, being absent, would have a carefully chosen spy writing a witty and erudite account. Sadly not, so it's down to me. But at least I will have dates and times in the correct order.

The trip was an interesting challenge. How to entertain the SDS, a group of normally steadfastly determined invertebrate palaeontologists, with terrestrial rocks. We were helped by the recent recognition of Devonian marine events within the ORS. We also acquired a number of serious Devonian fish and plant workers who had been waiting on this opportunity, and then, there were those attracted by the famed scenery of Scotland.

Most of the group, representing 13 nationalities, assembled at Euston Station, London, on the early evening of the 22nd June. This was to take the sleeper train north for a painless journey at considerably less than the price of an average London hotel. I staggered in, carrying some 25 kg of geology guides, maps and handouts. This was the penalty of using public transport. On departure, most participants, who had been travelling for at least a day, promptly disappeared to sleep but a hardy few repaired to the train bar. This is a carriage with loose armchairs and seemed to defy safety logic. However, we survived. Amongst our fellow travellers was a noted TV gardener, but with everybody being from elsewhere this brush with celebrity was ignored. However, Ian TROTH did manage to acquire his breakfast 'muffin' the following morning.

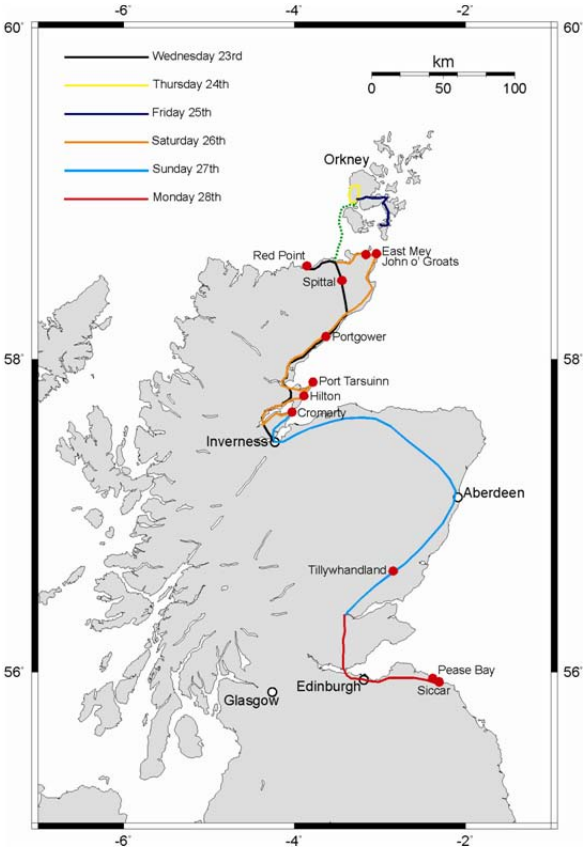


Fig. 1. Excursion route.

**Wednesday 23rd June**

We arrived in Inverness, nicely on time to find both our first coach and most, but not all, of the remaining participants. They had stayed overnight in Inverness and had lavishly breakfasted on all things Scottish. They had already done some geology on the way in from Inverness Airport and were equipped with observations and views! The rest of us snatched what passed for food from the railway station kiosk and we were on our way. The mission was to get to Orkney, the heart of the ORS Orcadian Basin, as fast as we could and without missing the ferry. In this way we could avoid the déjà vu of repeating the same route on our return south. So we headed north over the Kessock Bridge and a spectacular view of the Great Glen.

Our first stop was to the Jurassic Boulder Beds at Portgower where our missing participant managed to find us. Portgower is a geological classic where syndepositional debris flow deposits accumulated on the downthrown side of the Helmsdale Fault. It is full of Devonian lacustrine flagstone clasts of a type not found on the other side of the fault. This tells us something about the sense and timing of movements along the Helmsdale Fault and somewhat larger neighbour, the Great Glen Fault. The tide was a little high but we were quite happy to be outside with the sea and the birds whilst the outcrop was slowly revealed.

We then had our first buffet lunch and rest room stop in nearby Helmsdale before journeying on the spectacular and sometimes tortuous coastal road past some picturesque cliff top castles and onto the blanket bogs of Caithness. Here we made a stop at Caithness Stone Industries in Spittal where we met our colleague Mike NEWMAN who had chauffeured the Baltic fish contingent up from Edinburgh. At Caithness Stone Industries we saw the many inventive things you can make by laser guided cutting and etching Devonian lacustrine sediments. For some reason nobody felt compelled to buy the fetching black Devonian toilet bowl cut from a single piece of lake sediment. However, we were treated to a tour of the quarry and works. Here we learnt that Alex BARTHOLOMEW needs to practice a little more before he can pursue a career in flagstone splitting. We also collected our exclusive SDS/IPC3 commemorative drinks coaster made from Caithness Flagstone and etched with an image *of Pterichthyodes milleri*, a well-known Orcadian armoured Devonian fish.

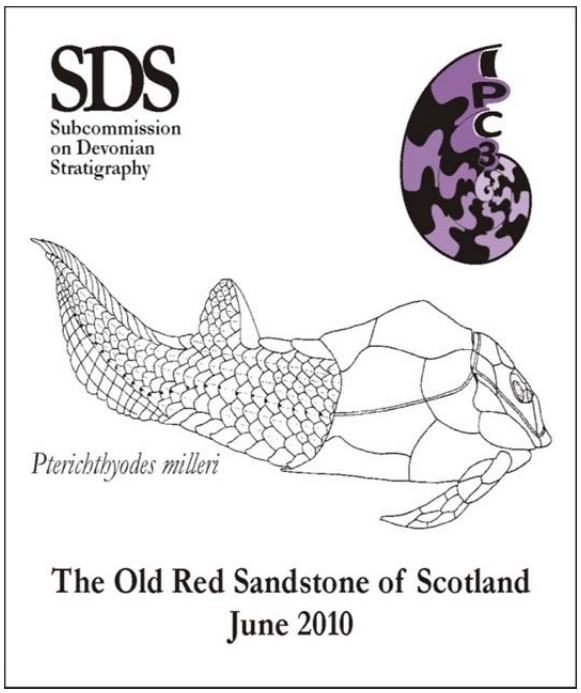


Fig. 2: SDS/IPC3 drinks coaster

We then continued to the north coast and Red Point. This is a classic locality cliff top locality where basement rocks are unconformably overlain by ORS. Here we saw a number of different relationships between the basement and Devonian sediments with both a steeply shelving lake beach and then deeper lake sediments abutting onto a lake island. This was our longest tramp across the bogs and the only time it really rained during our time in the field. We then retreated in good time to Scrabster (Thurso) to catch the Orkney Ferry. Most trip participants took to the deck for the spectacular views of high ORS cliffs around the coast of the

island of Hoy including the Old Man of Hoy, a free standing stack of Upper ORS some 137 m in height. We then reached Stromness, Orkney, and we were met by John BROWN and trundled our cases the short distance to the Stromness Hotel. After a bit of room confusion (our hotel contact had gone on maternity) we, the organisers, repaired to the bar to find most participant had either gone to bed or were sight seeing around the narrow streets. Some returned later on discovering the local fish and chip shop had shut at 9pm. We were no longer in a 24 hour world.

**Thursday 24th June**

The next day we started by working locally on foot around the Stromness Flags just north of Stromness Town. We had our first technical issue when we discovered that another group had made off with our pack lunches. Fortunately we were sufficiently local that we were able to return and collect before lunch, the chef probably feeling it was ground hog day. In the Stromness Flags the party were introduced by John BROWN to the lacustrine cycle with its deep permanent lakes with laminated sediment and shallow playa lakes with mudcracks and incipient mud cracks. We had the first of many discussions as to the origin of the incipient mud cracks. We also saw lacustrine cherts and stromatolites. It was quite cool in the wind and after reaching the Sandwick Fish Bed we were glad when lunch and shelter arrived together with our second coach of the trip. We then had an essential tourist interlude visiting Skara Brae (a 5,000 year old Neolithic village with Devonian flagstone streets, hearths, dressers, beds and cool boxes) and the Skaill House Museum. After suitable refreshment we then travelled the short distance to Yesnaby and the spectacular cliff top stromatolite locality.

From there we went to Cruaday Quarry where the Sandwich Fish Bed is well exposed. Sadly our plan to get the quarry turned over before we arrive failed. Our liquid inducement to the digger driver was apparently insufficient. Here the fish aficionados went into action and collected a good number of scraps and partial specimens with which to load their cases. We then returned to Stromness and dinner via the Stones of Stenness. Somewhat like Stonehenge but more compact and with the added advantage that they were available to hug. Fortunately nobody took up the challenge of dancing naked around them.

**Friday 25th June**

This was Givetian terrestrial Taghanic day. Leaving Stromness we drove down to the Southern Isles via the Italian Chapel on Lamb's Holm. Somewhat like the Sistine Chapel but smaller and made from available wartime scrap. This is all that remains of a large prisoner of war camp that housed the Italians who built the anti-submarine barriers that now connect the Southern Isles to the Mainland. From there we went to the section at Roeberry on South Ronaldsay. Here there is a complete section through the Eday Marl that represents a significant Givetian cool arid climatic event. At the top of the Eday Marl there is a very distinctive trace fossil marker bed (Roeberry Member) that can be traced across Orkney. From Roeberry the group went to Wha Taing on Burray where there is a lake preserved at the base of the Eday Marl that represents an episode of warming prior to the sustained cool arid event. Then it was time for a late lunch that was taken in the *Orkney Fossil and Heritage Centre* on Burray. Here there is an excellent collection of complete specimens of fossil fish from Orkney. The museum café was quite compact so lunch was taken in shifts. The party then moved through Kirkwall to the Bay of Berstane. Here there is a more complete section through the upper part of the Eday Marl including the Berstane Member where scolecodonts (worm jaws) are present indicating a marine influence. This is equivalent to the Taghanic Onlap. Despite the presence of many invertebrate starved palaeontologists no invertebrate fossils were found. But the party did generously donate lots of anonymous scraps to the leader to carry home for further investigation, thus replacing the load of geological guides, maps and handouts he had happily shed. Then it was a visit to Kirkwall that sadly coincided with the cathedral closing. However, sightseeing and shopping was done. We then were entertained to a reception at the Orkney Islands Council hosted by Councillor MCLEOD.

**Saturday 26th June**

The following morning we took the 06:30 ferry back to Scrabster and our third coach. We then drove east along the north coast of Caithness to the foreshore at East Mey within long lens distance of Mey Castle, former summer residence of the Queen Mother. Here under the direction of Mike NEWMAN we collected fish from a number of lake units. Alex BARTHOLOMEW (who else) managed to find a spectacular osteolepid specimen. We then continued east to John O'GROATS for an early lunch and the fish bed. This is the notional northern tip of the British Mainland and home to a random set of gift shops and cafes. Here we had lunch, enlivened by a couple getting engaged, having just cycled the 1400 km from Land's End, at the other end of the UK. We had our obligatory group photo beneath signpost. We were much entertained by the professional photographer who seemed unable to get his horizon straight. Presumably the result of a working life spent leaning into the wind. He also had near apoplexy at being asked to letter-up the sign as *Devonian Subcommission* so we had to settle for *Old Red Sandstone SDS*. We then went to look at the John O'GROATS fish bed but the tide was too high. So, Elga MARK-KURIK will have to return to tick off this life-long ambition.


Fig. 3. The excursion party.

From John O'GROATS we took the road south. We made a stop at Wilkhaven on Tarbat Ness, where we looked at the Port Tarsuinn Member, an aeolian proximal equivalent of the Eday Marl and again with a trace fossil layer in the upper part of the unit. We then travelled to Cadboll to look at proximal lakes developed within the largely fluvial facies and also viewed the replica Pictish Symbol Stone. We then hastened to Cromarty where we stayed in the Cromarty Arts Centre and the Royal Hotel. We took a quick tour of Hugh MILLER'S Cottage. Hugh MILLER was an itinerant stone mason who made many early discoveries of ORS fossil fish. He then became a popular author (his *Old Red Sandstone* ran into 20 editions) and ultimately a campaigner for disestablishment of the Church of Scotland. We then returned to the Hotel for a buffet dinner and a talk by Bob DAVIDSON on *Devonian fish and Early Fish Collectors*.

**Sunday 27th June**

The first locality the next morning was guided by Bob DAVIDSON and a walk along the Cromarty shore to collect loose nodules from the Cromarty nodule bed. This is another correlative of the Sandwick Fish Bed. We then returned into Cromarty and had certain trouble in locating our fourth coach. We finally found it and set off to Perth and the ORS in the Midland Valley of Scotland. Our new driver was more used to driving the bus routes of Inverness and we made painful progress towards lunch at Huntly. We then routed through Aberdeen and to Tillywhandland, a lake deposit of Lochkovian age. Here we were met by Bob DAVIDSON (who had sensibly driven himself) and he had laid out an excellent display of local fish and eurypterids including some reconstructed models. After a talk from Bob and a brief look at the lacustrine laminite we drove into Perth and the Travelodge. At this point we discovered that the coach plumbing had leaked over our luggage. We then were treated to dinner in the local Harvester, a somewhat different standard to what we had been enjoying.

**Monday 28th June**

After a breakfast at McDonalds (for our homesick US contingent) we then picked up our fifth coach and speedily drove south towards Edinburgh with a brief stop to view the iconic Forth Road and Rail Bridges.

We travelled south of Edinburgh stopping at Pease Bay. Here we saw the really rather red Upper Old Red Sandstone with its transition from fluvial fish bearing Famennian into an increasingly arid sequence of palaeosols culminating in the 2m thick supermature calcrete. Above this we viewed the transition out of the Upper ORS into Carboniferous rocks that are of a late Tournaisian age. The transition is marked by a flooding event and the occurrence of cementstones. We also found the first marine invertebrates we had seen in the entire fieldtrip.

Fig. 3. Bob DAVIDSON with Cromarty nodules

After lunch at the Pease Bay Holiday Park we then went the short distance south to Siccar Point and HUTTON'S Unconformity, by now a mere 20 km from the border with England. Most of the group managed the steep descent to this spectacular outcrop. This was a key locality where James HUTTON first recognised the enormity of geological time. The party were impressed. Alex BARTHOLOMEW had morphed into a Scotsman during lunch by suddenly sporting a kilt. At Siccar Point he then produced bagpipes which he could not only play but could also play whilst marching. A fitting end to the fieldtrip and a spectacle that was much enjoyed by the participants.

After this entertainment we then drove back north into Edinburgh and the *National Museum of Scotland* store. The main museum in the city is undergoing major refurbishment so we were treated to a tour of the store and some of its palaeontological treasures followed by a reception. Finally we went into a somewhat rainy city centre and were dropped off at Waverley Station to catch the sleeper south to London and the IPC3. Following an amusing time at left luggage the group dispersed into the city centre. Some heading straight for Edinburgh Castle others to wander Princes Street.

Thanks are due to all those who co-led the geology (John BROWN, Bob DAVIDSON and Mike NEWMAN) and Ian TROTH for appearing from Rio, coming on the 2005 recce and who generally swept up the bits. We thanks all those who helped, particularly Orkney Islands Council and the National Museum of Scotland for the receptions. Thanks also to the IPC3 organising committee and Tricia ELLIS-EVANS of Pace Projects (IPC3 professional conference organisers) although sadly I never did share her enthusiasm for the intricacies of value added tax. XU Honghe provided the pictures.

Fig. 4. No comments.

## SDS DOCUMENTS

# REVELATION ON PRECISE TIMING OF THE DEMISE OF EUROPEAN F2 REEFS AND MUDMOUNDS

Charles A. SANDBERG

### Preamble

This discourse is written to inform colleagues of important changes in my thinking on Frasnian and Famennian conodont biochronology and regional and intercontinental correlations. This is the third epiphany I have experienced during the past two years as a result of re-studying conodont collections entered in the D/C Conodont Database (CHARPENTIER and SANDBERG, 1992).

**(1)** The first epiphany was based on recognition that the entry of *Mesotaxis johnsoni*, which appears above *Palmatolepis punctata* in Gilbert KLAPPER'S M.N. Zone 5, was within Unit A of the Alamo Breccia. Thus, this conodont must have originated prior to the Alamo Impact, confirming that the impact event occurred late within the *punctata* Zone. This led to the epiphany that the start of mid-*punctata* Zone T-R cycle IIc was represented by onset of stromatoporoid reefs incorporated in huge C blocks of the Breccia (MORROW et al., 2009).

**(2)** The second epiphany resulted from my research for a paper, still in progress, with Paul MYROW as senior author. Carbon isotope curves for the Pinyon Peak Limestone at the type locality and at Mowitza Mine are nearly identical even though the conspicuous deflection is at the base of the upper member at one locality and within the lower member at the other. Convinced by the similarity of the curves, I restudied the conodont faunas and concluded that the Early *expansa* Zone T-R cycle IIf transgression was represented not by introduction of open-marine faunas in the upper member but by the unconformity below the Cove Fort sandstone bed at the base of the lower member. My re-study showed that a progressive deepening is represented by an upward change in conodont biofacies through both members of the Pinyon Peak. Thus, I had to abandon my long-held belief that the base of the upper member correlated with the bases of the Leatham Formation and Sappington Member of the Three Forks Formation.

**(3)** The third epiphany, the subject of this document, is recognition that the demise of European F2h buildups occurred not just within the Late *hassi* Zone but more precisely within M.N. Zone 8, which must straddle the Early-Late *hassi* Zone boundary.

### Introduction

The current epiphany resulted from re-study of some important German conodont collections that were made under my G. K. GILBERT Fellowship during 1984–1986 in collaboration with the late Willi ZIEGLER. Because of the obligation to return these collections to Forschungsinstitut Senckenberg via the visit of Peter Königshof in a few days, during the past month I have been re-identifying critical collections entered in the database as well as identifying and entering a few that had remained unstudied for the past quarter-century. This dormancy resulted from Willi not having sent entire residues as well as having taken back some slides, most importantly all those from the Heimberg section, in preparation for our joint 1990 paper on the Standard Late Devonian Conodont Zonation. While working on the German collections, I came to the belief that they documented an earlier record of *Palmatolepis proversa*, the indicator of M.N. Zone, 9, which is equated by Gil KLAPPER to the base of the Late *hassi* Zone. Consequently, I photographed key specimens from these collections and have been discussing them in weekly phone conversations with Gil KLAPPER.

While studying sample 84-GER-MART-13a, I found what I regard as the earliest form of *Palmatolepis proversa*, as diagnosed by ZIEGLER and SANDBERG (1990), associated with the early form of *Pa. hassi* in Bed 13a from Martenberg. However Gil KLAPPER disagrees with this identification because the specimen has a wide lobe. This disagreement stems from a difference in our (ZIEGLER and SANDBERG) phyletic, rather than his shape analysis, approach to taxonomy. Bed 13 had been considered to represent the *punctata* Zone, but this sample came its top 3 cm. ZIEGLER (1962) and ZIEGLER and SANDBERG (1990) considered *Pa. proversa* to have originated simultaneously with *Pa. punctata*. However, I now recognize that *Pa. proversa* evolved from *Pa. punctata* and hence its entry would have occurred slightly later, as in Bed 13a.

While studying occurrences of *Palmatolepis proversa* in other German samples, I found that it occurred in samples from the lowest 1 m of beds overlying the reef facies (Massenkalk) at Burg Berg and at Donsbach and Dünsberg Bach in Plattenkalk of the Iberg facies. The Massenkalk yields few, if any, diagnostic conodonts. As an example of the typical fauna of overlying beds, sample 84-GER-24 from 6 cm above the Massenkalk at Donsbach contains abundant *Ozarkodina nonaginta*, associated with *Ancyrognathus amplicavus*, its progenitor (with an identical platform, but lacking a lobe), *Ag. barba, Ancyrodella gigas* sensu Ziegler, *Palmatolepis hassi*,

*Pa. proversa*, and *Pa. proversa* morphotype S. The latter form is so-named because it has a short platform and a long outer lobe and thus resembles *Palmatolepis semichatovae*, to which it is, of course, unrelated. This fauna can be assigned unequivocally to M.N. Zone 8, which contains the highest range of *O. nonaginta* and the restricted range of *Ag. barba*. This fauna is thus within the *hassi* Zone of the Standard Zonation. However, the question of exactly where in this zone is the subject of my epiphany. Its position within the *hassi* Zone relates not only to the German buildups, but also to the Belgian F2h reef tract, as exemplified by the Lion Mudmound, studied by SANDBERG et al. (1992).

Subdivision of the *hassi* Zone has been a continuing problem, as exemplified by the following passages extracted verbatim from ZIEGLER and SANDBERG (1990):

**Late *hassi* Zone**
LOWER LIMIT: Defined by first occurrence of *Ancyrognathus triangularis* YOUNGQUIST, 1945.
UPPER LIMIT: Defined by first occurrence of *Palmatolepis jamieae* n. sp.
SYNONYMY: The Late *hassi* Zone corresponds to the early part of the former *Ancyrognathus triangularis* Zone (ZIEGLER, 1962a).
REFERENCE SECTION: Martenberg, Adorf (Diemelsee), West Germany (Text-fig. 3).
REGIONAL REPRESENTATIVE SECTIONS: Heimberg, West Germany (Text-fig. 7).
REMARKS: This is one of the few zones that we cannot define by the incoming of a new pelagic taxon, possibly because of an as yet undocumented eustatic fall at this time.
AGE IN TERMS OF OTHER FOSSILS: The Late *hassi* Zone is within the ammonoid *Manticoceras cordatum* Zone and within the *cicatricosa* entomozoan-ostracode Zone (BUGGISCH et al., 1978). In Belgium, SANDBERG et al. (1992, Text-fig. 12; Pl. 7, figs. 8-9) showed the Late *hassi* Zone beginning with *Ancyrognathus triangularis* (morph A), and *Ag. triangularis* s.s. appearing somewhat later. KLAPPER et al. (1996) correctly separated this form from *Ag. triangularis* and named it *Ag. amplicavus*.

The difficulty with precisely dating the demise of the F2h Lion mudmound within the Late *hassi* Zone is that the top of the mound was case hardened and phosphatized and that overlying beds of colonized debris flows contain detritus from the dead mound. SANDBERG et al. (1992) dated the overlying beds as Late *hassi* Zone, but the question remained as to exactly when, early or late, within this Zone the demise took place. Now the German evidence provides the answer to dating both the Belgian and German buildups — and *hence* my **epiphany**: The demise took place in M.N. Zone 8, which contains the highest range of *Ozarkodina nonaginta*. KLAPPER and BECKER (1999) showed the M.N. 8-9 boundary to coincide questionably with the Early-Late *hassi* Zone boundary. The M.N. Zone 8 bed at Donsbach contains *Ancyrognathus amplicavus* and *Ag. barba* in association with *O. nonaginta*. Thus, M.N. Zone 8 must extend slightly into the Late *hassi* Zone. Consequently, I am now certain that the European reef demise took place in the earliest part of the Late *hassi* Zone.

**Implications for Upper Devonian stratigraphy of the western United States**
**(1)** Alamo Breccia and post-Alamo mudmound at Mount Irish: At the type locality of the Alamo Breccia at Hancock Summit West, the first questionable, earliest form of *Palmatolepis hassi* occurs in faunas 3 and 8.5 m above the top of the Alamo Breccia whereas the fauna at 17 m is zonally undiagnostic. However, the fauna at 32 m contains *Ozarkodina nonaginta* and hence is definitely within the *hassi* Zone. However, the questions remain: Is this Zone 7 or, more likely, Zone 8? If the latter, how does this position relate to the demise of the reef overlying the Breccia at Mount Irish. Theoretically, the demise should coincide with the demise of the European buildups at the start of the Late *hassi* Zone. Faunas within crevices at the top of the reef or from directly overlying beds need to be studied and precisely dated.

**(2)** The stromatoporoid reef tract in extreme western Utah: This is not an F2h buildup. It lies above the Alamo Breccia, but not directly above it as at Mount Irish. However, it probably started within the Late *hassi* Zone. However, conodont evidence shows that the demise occurred early in the Early *rhenana* Zone because the *semichatovae* Subzone lies just a few meters above transitional beds atop the reef. Thus the question remains: Is the demise of this reef tract related to regional tectonics, that is, to the Antler orogeny and to the formation of the Pilot forebulge basin? Study of the stromatoporoids and the conodont faunas of the transitional beds above the reef would help answer this question.

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## METHODS IN TAXONOMY AND BIOSTRATIGRAPHY, AND SOME NOTE ON CHRONOSTRATIGRAPHY: THE DEVONIAN–CARBONIFEROUS BOUNDARY

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The Devonian–Carboniferous Boundary (DCB) was defined in the section La Serre trench E' (Montagne Noire, France) at the base of bed 89. The criterion chosen for its definition was entry of the conodont *Siphonodella sulcata*. The GSSP was accepted and ratified by the International Union of Geological Sciences (IUGS) in 1990 (PAPROTH et al. 1991). Difficulties soon arose in precise biostratigraphic correlation of the Global Boundary Stratotype Section and Point (GSSP) caused by problems in recognizing the First Appearance Datum of its marker, and, specifically, in discriminating *Si. sulcata* from its presumed ancestor *Si. praesulcata.* At the September 2007 Subcommission on Devonian Stratigraphy (SDS) meeting in Eureka, Nevada, on the base on new and recent studies on the La Serre fauna (KAISER 2005, later extended in KAISER 2009) it was proposed that the time had come for a task force to re-evaluate and possible redefine the boundary.

PAPROTH et al. (1991) had earlier stated that the La Serre section is "far from being an ideal GSSP". It was chosen because it seemed to be the only section showing the "evolutionary lineage of *Siphonodella preasulcata* to *Siphonodella sulcata*" in an area that was politically accessible at that time. Problems concerning the section were shortly listed by PAPROTH et al. (1991): "lack of other important stratigraphic guides...and the existence of reworking". These drawbacks were glossed over by the Working Group on the Devonian–Carboniferous Boundary; the GSSP was proposed and ratified by the International Commission on Stratigraphy (ICS).

At that time, nobody stressed the drawbacks:

1) Lack of other important stratigraphic guides such as spores was cited as a reason for discarding one of the other possible candidate for the GSSP, the Grüne Schneid section in the Carnic Alps (Austria), even though the limestone there are rich in ammonoids (but not in the boundary bed), trilobites, brachiopods, bivalves and radiolarians (Schönlaub et al. 1988). It failed to be included among the last four candidates.

2) Lack of an "ash layer for radiometric dating" no longer mattered after the Hasselbachtal section in Germany was chosen as an Auxiliary Stratotype Point (Claoué-Long et al. 1992, 1993, 1995).

3) Reworking in the La Serre section is dominated by oolitic grain- and rudstone. "The volume of the micritic and clayey matrix is insignificant in thin section" (Flajs and Feist 1988, p. 57). "Some beds suffered strong effects of pressure solution" (Flajs and Feist 1988, p. 62). According to the ICS rules for a GSSP, it should be defined in a continuous pelagic sequence. It should not be defined at the base of a bed, but within a bed, to minimize possible time gap—as may occur at bedding surfaces. None of the present GSSPs, with the exception of the GSSP for the base of the Lockhovian, follows this rule.

4) The reported possible presence of Si. sulcata in beds below the GSSP was already known (fragment in bed 85, Cowie et al. 1989, Paproth et al. 1991).

Why was La Serre section chosen and eventually ratified for the GSSP? It was chosen mainly for ease of accessibility, logistically and politically, not for its geologic and palaeontologic quality. Lack of other important index fossils, the distinctive lithology of the La Serre section, and the reworked

fauna should had given weight as reasons for re-evaluating the current GSSP, before discussing about the marker chosen for the boundary definition.

It is not novel that the DCB might need reconsideration; rather, it is surprising that reasons against nomination of La Serre trench E' section for the GSSP were ignored. That La Serre trench E' was not ideal for a GSSP was manifest to the DCB Working Group right from the time the criteria were suggested. The main peculiarity of the La Serre trench E' section that won it nomination for the GSSP seems to have been the presence of the *Siphonodella preasulcata-sulcata* lineage documented by FLAJS and FEIST (1988); anything to the contrary was ignored.

Many conodont workers pointed out difficulties in distinguishing the two species, even when attempting to apply the morphometric method used by Flajs and FEIST (1988). Researchers working with conodonts near the Famennian–Tournaisian boundary found difficulty distinguishing between *Si. praesulcata* and *Si. sulcata* if typical forms were not present. Intraspecific variations of the two taxa seemed to pass gradually from one to the other without biostratigraphic logic. This, of course, is to be expected when one applies form taxonomy, we have to take into account that we are dealing with remains of living creatures.

In the specific case of the La Serre Trench E' section ZIEGLER and SANDBERG (1996) pointed out that the assumed evolutionary lineage was an artifact created by the presence of the reworked fauna.

The *Siphonodella preasulcata-sulcata* lineage has been revisited by KAISER and CORRADINI (in press). They discriminate ten morphologies (groups) between two "extreme" forms fitting the original diagnoses. Because of this the wide intraspecific variability of the two species (or possibly only one species) is highlighted, especially where both forms make their appearance simultaneously — as occurs in several stratigraphic sequences.

Understandably there is a temptation to formally designate each 'strange form' not precisely fitting the holotype illustration and the original diagnosis. The significance of intraspecific changes may be exaggerated or underestimated; deformation due to tectonics and/or substantial diagenesis may be ignored or even accorded taxonomic significance. A plethora of names can lead to increased confusion instead of helping clarify taxonomic problems.

Both *Si. sulcata* and *Si. praesulcata* were originally described from North America. *Si. sulcata* by HUDDLE (1934) from the upper New Albany Shale, Indiana, and *Si. praesulcata* by Sandberg in SANDBERG et al. (1972) from the Sappington Member of Three Forks Formations of Montana. No subsequent study has been made in these localities to clarify the phylogeny and the relationship between the two nominal species. SANDBERG et al. (1978) stated that "the direct ancestor of *Siphonodella praesulcata* is unknown, but this species appears to have evolved from the *Scaphignathus subserratus* lineage". This assumption was based on the shape of the basal cavity, though between the last *Sc. subserratus* and the first *Si. praesulcata* there is a gap of several biozones (from the Middle *styriacus* to the Lower *costatus* zones, p. 104). The concept of *Scaphignathus subserratus* was emended by ZIEGLER and SANDBERG (1984) when proposing the new genus *Alternognathus* and two species, *A. beulensis* and *A. regularis*, embracing most of the forms originally described as *S. subserratus* by BEINERT et al. (1971). The possible derivation of *Siphonodella* from *Alternognathus regularis* leaves a gap of three biozones (from the Lower to the Upper *expansa* zones).

A new phylogeny, proposed in a recent study on German material presented by TRAGELEHN (2010) is represented in a figure without a caption and without explanation in the text. It was presented as a starting point for discussion at the Workshop on the DCB at the International Palaeontological Congress in London in 2010. Publication of such formally incomplete works should, ideally, be avoided, in order that the reader may not misunderstand the author's ideas — even for preliminary notes (the SDS Newsletter in which it was published, incidentally, now has an ISSN code). [Comment by the Editor: H. TRAGELEHN has been asked by the SDS Chairman to submit a summary of his work for the Newsletter - in order to stimulate the discussion]

TRAGELEHN (2010) reports that "the phenomenon of continuosly increasing phosphatization of the Pa-elements basal part (due to uncertain reasons) is not restricted to polygnathids forming the *Siphonodella*-branch". Several Devonian conodont genera are characterized by a more or less opened basal cavity or pit: e.g. *Schmidtognathus* and *Pseudopolygnathus*, some of whose species were originally referred to *Polygnathus*. One example will suffice: *Polygnathus sulcata* HUDDLE (1934). The genus *Siphonodella* was named by BRANSON and MEHL (1944), to replace their genus *Siphonognathus* BRANSON and MEHL (1934), used earlier for a fish group.

Many polygnathids are characterized by a large, more or less open basal cavity or pit, persisting from when the genus *Polygnathus* appeared in the Early Devonian. Many forms are still attributed to *Polygnathus*, a well established and widely used generic name, though some of its many species have been attributed to new genera. DZIK (1997), for example, named the multielement genus *Pinacognathus* including in it *praesulcata*, *sulcata*, *inornatus*, and at least two other forms left in open

nomenclature. *Polygnathus inornatus* is a form of *Polygnathus* charaterised by a pit followed posteriorly by a keel and an inverted cavity—differing completely from the siphonodellid basal cavity.

A wide basal cavity is present also in *P. symmetricus*. Elements A and B of genus N, represented by drawings in fig. 3 of TRAGELEHN (2010), are very similar to elements of *P. symmetricus*, commonly co-occurring with *Siphonodella* elements. Even had TRAGELEHN attributed them to a new genus there was no reason to changing the species name. It is not clear if the elements indicated with letters A-D in his fig. 3, correspond to the new species labeled from 1 to 4 in his fig. 2. Attribution of elements C and D to a new genus is not clear. C is similar to juvenile elements of *Si. praesulcata,* D to *Si. sulcata.*

Is a new genus necessary for a better understanding of the phylogeny of *Siphonodella*? Juvenile elements of *Si. praesulcata* are very similar to elements of *Pseudopolygnathus brevipennatus*. Possible evolution from *Ps. brevipennatus*, ending just before entry of *Si. praesulcata,* would fill the gap resultant from derivation from *Sc. subserratus* (= *Alternognathus regularis*).

Increasing the taxonomic problems concerning *Si. praesulcata* and *Si. sulcata* would not help solve the problem of the correct/useful location of the DCB. The real problem with these notional species is not their phylogeny but discriminating them and, above all, obtaining precise information on their stratigraphic range and geographic distribution.

In the Tournaisian, it is easy to detect symmetrical forms with a straight carina from less symmetrical forms whose carina is curved. The first can be attributed to *Si. praesulcata*, and the latter to *Si. sulcata.* Perhaps the same distinction can be applied for the latest Famennian forms. It seems that the two morphologies appear almost together, well before the present position of the DCB (KAISER and CORRADINI, in press; KONONOVA and GATOWSKY, written comm. to the DCB Working Group, 2010). There is thus a possibility that, despite clarifying the taxonomic problems, the major problems of defining the boundary will remain unaddressed.

Before making any new decision about the DCB, there is need for a detailed correlation chart of the worldwide distribution of *Si. praesulcata* and *Si. sulcata* based on study of original material from various regions by conodont specialists working together, should be made. A similar approach is needed for other genera occurring in this time-frame (*Protognathodus*, *Bispathodus*, *Pseudopolygnathus*, …). Only when renewed scrutiny of the taxonomy and evolution of these taxa has been completed might a more useful and hopefully more easily discriminable GSSP be chosen for the DCB.

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# EMSIAN CHRONOSTRATIGRAPHY – PRELIMINARY NEW DATA AND A REVIEW OF THE TAFILALT (SE MOROCCO)

R.T. BECKER & Z.S. ABOUSSALAM

## Introduction

During its Annual 2007 Meeting in Uzbekistan (BECKER 2009), SDS decided to revise the base of the Emsian since the current GSSP in the Kitab Reserve lies much lower than originally intended, at a level within the lower half of the Pragian of the Bohemian type region (see reviews by CARLS et al. 2008, 2009). It was decided to search for a new GSSP level near the entry of *Eocostapolygnathus excavatus* within the Kitab region. The entry of *Eoc. kitabicus* shall define a future Upper Pragian ("Zinzilbanian") substage. New and detailed conodont data from additional regions are required to ensure global correlations and to document the position of a revised Emsian base internationally. Successions from Celtiberia (e.g., CARLS & GANDL 1969, CARLS & VALENZUELA-RÍOS 2002) and Bohemia (SLAVIK 2001, 2004a) have shown the difficulties to find good Pragian-Lower Emsian polygnathid succession, even in hemipelagic outer shelf facies with good dacryoconarid faunas. This problematic is re-emphasized by our preliminary conodont data from the western Tafilalt Platform of SE Morocco that yielded ALBERTI (1980, 1981, 1998) a very detailed nowakiid sequence.

Because the Emsian is one of the longest Devonian stages, with a duration of 10 Ma or more (KAUFMANN 2006), SDS also re-emphasized the necessity to establish two formal substages, at a level close to the classical boundary between the Zlichovian and Dalejan of the Barrandian (see review by BECKER 2007). Unfortunately, the rather clear position of the Daleje Event within the *laticostatus* Zone and near the base of the *cancellata* Zone is still being miscorrelated with older transgressive episodes within the Lower Emsian. This preliminary account of some new Tafilalt conodont data and their comparison is used to search for Emsian chronostratigraphic levels in SE Morocco, with some comments on the global event succession.

## Locality and stratigraphic overview

The section that was measured bed-by-bed in spring 2010 and sampled near facies changes for conodonts lies in the western part of the Tafilalt Plattform, ca. 11 km W of Rissani. It belongs to the roughly West-East trending Jebel Ihrs (Fig. 1), which is the prolongation of the Jebel Amelane W of the pass of the main road from Rissani to Msissi. The strike of the gently dipping beds is almost parallel to the road (Fig. 2) and the precise sampling spot can be recognized opposite to the tart-like Mdoura outcrop by a small track that winds upwards through the ridge. The GPS coordinates are: N 31° 16´ 11.4´´, W 4° 24´ 8,8´´. Individual beds can be followed for several kilometres along the ridge, where (under the name Jebel Amelane) ALBERTI (1980, 1981) established a detailed succession of dacryoconarids, trilobites, and subordinate early ammonoids. These assemblages suggest a hemipelagic setting, as in the younger, Upper Emsian to Famennian strata. This is the first report of Lower Devonian conodonts from the western Tafilalt.

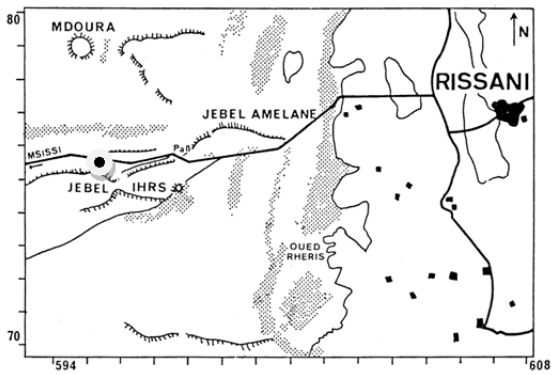


Fig. 1. Position of the measured section in the western Tafilalt.

There is still no formation terminology for the main part of the Tafilalt Devonian. BULTYNCK & WALLISER (2000) summarized the lithostratigraphy of the mixed shale-limestone succession and introduced informal names for various marker units. With some taxonomically justified changes

(KRÖGER 2008) these are adopted here and completed (Fig. 3). Our section starts low in the **"Pragian Limestone"**, which base is covered in the plain adjacent to the asphalt road. It is a ca. two meter thick succession of light grey, rarely greenish-grey to reddish (Bed 8b), solid or nodular, bioturbated, bioclastic limestones with few macrofossils (Beds 2-8d).

In the central, eastern, and southern Tafilalt, a subsequent shale unit yielded "Faunule 1" of KLUG et al. (2008) and DE BAETS et al. (2010). Apart from common asteropygids, locally already noted by ALBERTI (1980, 1981), the sudden onset of oldest Devonian bactritids is its most remarkable feature. Therefore, it is here named as ***Devonobactrites*** **Shale**. At Jebel Ihrs it is represented by a ca. 1.2 m thick, macrofossil-poor alternation of thin-bedded, grey, argillaceous nodular limestones, marls, and claystones (Beds 9a-15a), which are often covered by sand and debris. The overlying ***Deiroceras*** **Limestone** sensu KRÖGER (2008; = "*Jovellania* Limestone" in BULTYNCK & WALLISER 2000, = Unit A of KLUG 2001; Beds 15b-16d) is named after frequent, large orthocones (actinoceratids). These appear in Bed 16b, which is part of a locally inconspicuous, ca. 40 cm thick interval of grey

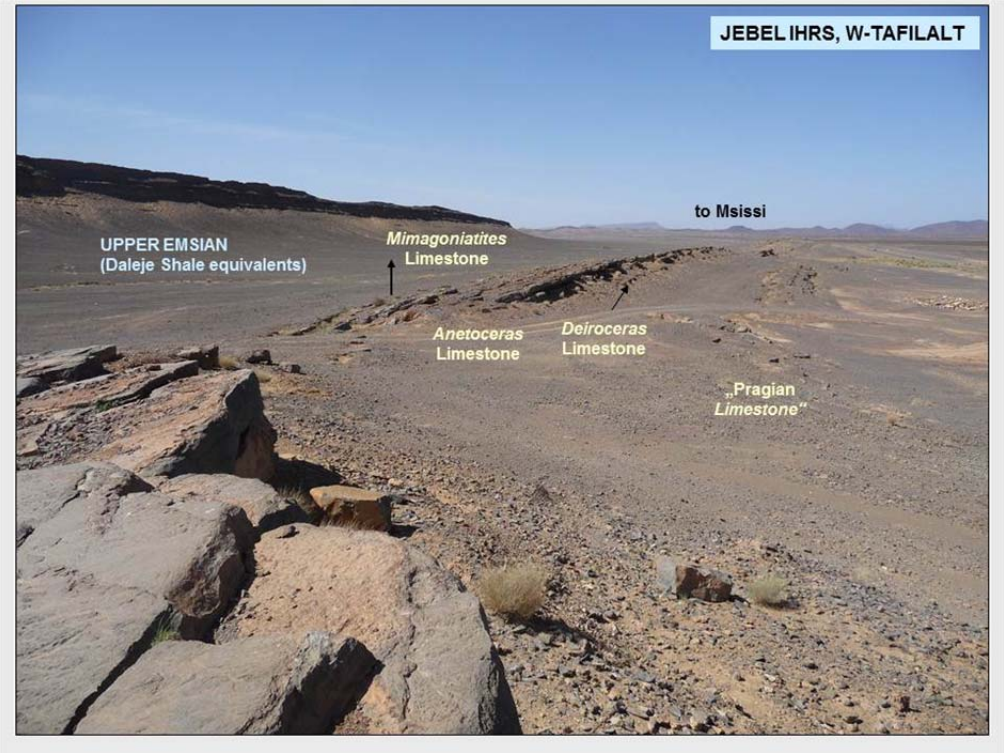


Fig. 2. Overview of the outcrop conditions and lithostratigraphy at Jebel Ihrs.

nodular and solid, bioclastic to crinoidal (Bed 16c) limestones. The widespread marker shale of the Tafilalt with a diverse, oldest ammonoid fauna, here named as ***Metabactrites-Erbenoceras*** **Shale** (Unit B in KLUG 2001, interval with "Faunule 2" in KLUG et al. 2008 and DE BAETS et al. 2010) is locally very thin (ca. 30 cm, Bed 17) and unfossiliferous. This points to a shallower, more condensed setting than in other Tafilalt regions.

The subsequent main Lower Emsian limestone ridge (*Erbenoceras* Limestone of KRÖGER 2008 and *Erbenoceras* Beds of DE BAETS et al. 2010) is composed of two distinctive units, which were already separated in BULTYNCK & HOLLARD (1980). The ***Anetoceras*** **Limestone** is often rich in *Erbenoceras* (local J. Ihrs record of ALBERTI 1981), with subordinate true *Anetoceras* (BECKER & HOUSE 1994, KLUG 2001; taxonomic revision in DE BAETS et al. 2009), and includes various macroscopic lithologies and microfacies types. There are light to middle grey, solid, bioclastic limestones, crinoidal limestones (Bed 19), orthocone-rich units (Bed 24b, 26d), sometimes with large placoderm plates, and recessive nodular interbeds. Burrowed top surfaces (e.g., top Bed 24d) indicate minor sedimentary breaks.

A thin more argillaceous interval (Bed 27a) separates the overlying, darker-grey to bluish-grey ***Mimagoniatites*** **Limestone**. The name-giving goniatite occurs frequently in Bed 29 (Fig. 3) and was noted locally by ALBERTI (1981). Upper surfaces are plain, often bioturbate and may display thin iron crusts and large, thick bivalves (?*Panenka*, top Bed 31a). Large orthocones are common in several beds. The transition to the overlying greenish

Shale-siltstones that form the regional Daleie Shale Equivaltwnts is formed by a change from thick to thinner-bedded limestones. We did not encounter limestones nodules in the basal "Daleje Shales" that could have been sampled for conodonts.

Fig. 3. Eroded juvenile *Mimagoniatites* cf. *fecundus* from the top of Bed 29.

A straight correlation with the section log given in ALBERTI (1980, 1981) is not possible since his thicknesses are consistently much higher than ours. This prevents a simple transfer of his dacryoconarid data into our log, especially within the *Anetoceras* and *Mimagoniatites* Limestones.

**Jebel Ihrs conodonts** (Figs. 5-6)

Two samples (Fig. 4, Beds 2 and 10; Bed 6 was barren) from the lower part and from just above the "Pragian Limestone" yielded only *Belodella* faunas. In multi-element reconstruction (e.g., MAWSON et al. 1995) *Bel. resima* (Fig. 5.6) and *Bel. triangularis* (Fig. 5.7) are regarded as elements of the same species. In the Middle and early Upper Devonian, *Belodella*-rich assemblages are typical for very shallow, neritic to peri-reefal settings. The J. Ihrs occurrence proves a wider ecological range, into the outer shelf facies with many planctonic dacryoconarids, in the Lower Devonian. This is supported by data from other regions (e.g., SLAVIK 2001). The lack of associated icriodids indicates a clear palaeoecological separation of both conodont groups. The western Tafilalt Platform appears to have been offshore but not very deep during the "Pragian Limestone" interval. This is supported by microfacies evidence of tempestites.

The *Deiroceras* Limestone (Bed 16c) yielded a relative rich and diverse *Criteriognathus*-icriodid – polygnathid assemblage. *Cr. miae* (Figs. 5.1-2) and two subspecies of *Latericriodus bilatericrescens* (*bilatericrescens*, Fig. 5.8, and *multicostatus*, Fig. 5.4) dominate in ca. equal numbers. The complete absence of *Caudicriodus* is surprising. There are at least three related species/subspecies of *Eocostapolygnathus, Eoc. "excavatus* ssp. 114" (Figs. 6.2-5)., *Eoc.* aff. *gronbergi* (Figs. 6.6 and 6.11), and *Eoc.* n. sp. aff. *pannonicus* (Figs. 5.11-16 and Fig. 6.1). The assemblage structure mirrors a considerable deepening in relation to the "Pragian Limestone" but the under- and overlying *Devonobactrites* and *Metabactrites-Erbenoceras* Shales represent two distinctive transgressive peaks that sandwich the moderately deep *Deiroceras* Limestone.

The crinoidal base of the *Anetoceras* Limestone (Bed 18b) yielded the second rich fauna, dominated, again, by the *Lat. bilatericrescens* Group (Fig. 5.3), but *Crit. miae* has become rare and *Caud. sigmoidalis* (Figs. 5.9-10) suddenly enters as a common element. The polygnathids have disappeared, which suggests, in accord with the lithofacies, a shallower setting and regression. The top of the *Anetoceras* Limestone (last thin light grey Bed 27b) gives evidence for overall shallowing upwards. The poor conodont fauna documents a return to the *Belodella* Facies. A single associated *Caudicriodus* (Fig. 5.5) is not stratigraphically significant.

The partly crinoidal and often tempestitic *Mimagoniatites* Limestone was deposited during a gradual deepening phase. This allowed the incursion of ammonoid and nautiloid faunas, and, finally (Bed 31b), at the top, of a pure polygnathid fauna. *Po. laticostatus* (Figs. 6.7-8 and 6.12-15) can be shown to have been a rather variable species, which emphasizes the importance of population concepts in early polygnathid taxonomy (see discussion in MAWSON & TALENT 2003). One specimen with a very peculiar, distinctive outer lobe and broadly rounded tongue (Figs. 6.9-10) is here identified as *Po*. cf. *vigierei*. Attempts to collect conodonts from thin marly limestones exposed within goniatite-rich Daleje Shale equivalents at a section between Hamar Laghdad and the eastern end of Bou Tchrafine produced rich benthic ostracodes but not a single conodont. Consequently, there is still no Tafilalt record of the important *Icriodus fusiformis-corniger ancestralis* Fauna that characterizes the basal Upper Emsian of the Dra Valley (e.g., BECKER 2007).

**Correlation with previous Tafilalt conodont data**

The pioneer work on Emsian conodont faunas of the Tafilalt goes back to BULTYNCK & HOLLARD (1980), who included a succession of numbered (Ia to IV) regional zones that require revision in the light of subsequent Tafilalt data and in comparsion with successions from elsewhere (Fig. 7). In general there are still only limited Lower Emsian data, based on the Bou Tchrafine section (central Tafilalt, BULTYNCK 1999, BULTYNCK & WALLISER 2000) and on the Ouidane Chebbi region (eastern Tafilalt, BELKA et al. 1999).

Until this report, no conodonts have been mentioned from the Tafilalt "Pragian Limestone". Its sparse assemblages allow the introduction of a local Lower *Belodella* Ecozone. Additional samples

will have to search for icriodids, which could provide a correlation with the Barrandian or Celtiberia.

Sample 16c falls in the Lower *gronbergi* Zone or *gronbergi* Subzone (higher part of Middle *exacavatus* Zone of YOLKIN et al. 1994). This is based on the recognition of its index species in the lower *Deiroceras* Limestone (sample OC-I-21 from Ouidane Chebbi, BELKA et al. 1999, pl. 2, fig. 7) and on *Eoc*. aff. *gronbergi* with an incipient inversion of the posterior end of its basal cavity as in typical *Eoc. gronbergi* (see species definition in KLAPPER & JOHNSON 1975). An upper range of forms here included in *Eoc. "excavatus* ssp. 114" into the *gronbergi* Zone is in accord with a cf. record in GARCÍA-LOPEZ et al. (2002). *Eoc. pannonicus* occurs in the Kitab area in the older *kitabicus* Zone but YOLKIN et al. (2008) illustrated a much higher continuation of descendents, up to the level of *Eoc. nothoperbonus*.

At Bou Tchrafine, BULTYNCK & HOLLARD (1980) noted two assemblages, Ia with *Eoc. "dehiscens"* (their pl. II, fig. 5 = *Eoc. excavatus*) and *Caud. sigmoidalis*, and Ib with *Crit. miae* from the "Calcaire bleu noir á nautiloides" (= *Deiroceras* Limestone; samples BK 496 and BTW 1). The following Assemblage II with *Lat. bil. bilatericrescens* was only found in the Dra Valley. The re-sampling at Bou Tchrafine (BULTYNCK & WALLISER 2000) extended the range of its key form into the *Deiroceras* Limestone, in accordance with BELKA et al. (1999) and our data. Therefore, there is no base any more for successive regional Ia, Ib and II assemblages. According to BELKA et al. (1999), Tafilalt faunas of the Lower *gronbergi* Zone may also have *Pandorinellina exigua* ssp., *Lat*. cf. *ultimus*, *Lat. bil. gracilis, Eoc. excavatus*, (not figured) and, at the base, last *Eoc. kitabicus* (recorded without illustration). The association of *Lat. bil. bilatericrescens, Lat. bil. multicostatus*, *Crit. miae*, *Po. "excavatus* ssp. 114", and *Po. gronbergi* suggests a correlation with the middle to higher parts of Conodont Step 19 of CARLS & VALENZUELA-RÍOS (2002). *Nowakia (Now.) zlichovensis maghrebiana* gives a basal Zlichovian age.

Viewed in isolation, Sample 18b suggests just a higher position within the *gronbergi* Zone. But BULTYNCK & WALLISER (2000) reported *Lat. latus*, the index of Conodont Step 20 of CARLS & VALENZUELA-RÍOS (2002), from the basal *Anetoceras* Limestone of Bou Tchrafine. This allows to recognize, at least locally, a *latus* Subzone, which correlates with the now outdated Assemblage III with *Eoc. gronbergi* in BULTYNCK & HOLLARD (1980). Relatives of *Lat. beckmanni* enter also at Bou Tchrafine and Ouidane Chebbi. The reverse occurrences of *Caud. sigmoidalis* in the *Deiroceras* and basal *Anetoceras* Limestones of the central and western Tafilalt are strange and indicate a strong biofacies influence on its distribution. Equivalents of the lower *Anetoceras* Limestone of the northern Maider (PLODOWSKI et al. 2000) yielded, as at Jebel Ihrs, only *Caudicriodus-Latericriodus-Criteriognathus* associations. These can be mistaken for much older levels (*Caud. celtibericus* Zone, SLAVIK 2004b, = Conodont Step 17) if their superposition to *gronbergi* faunas is not known. The comparison with the La Grange range of *Lat. latus* (BULTYNCK 1989) places the base of the Tafilalt *Anetoceras* Limestone close to the level of oldest *Eoc. nothoperbonus*., which has been used by YOLKIN & IZOKH (1988) as a zonal marker (contra: MAWSON 1995).

The main part of the *Anetoceras* Limestone is characterized by the entry of *Crit. steinhornensis*, which defines both Assemblage IV of BULTYNCK & HOLLARD (1980) and Conodont Step 21 of CARLS & VALENZUELA-RÍOS (2002). At La Grange, the entry of *Crit. steinhornensis* follows a little above first *Eoc. nothoperbonus* (BULTYNCK 1989). The *steinhornensis* Zone roughly equals the Upper *gronbergi* (better *catharinae* Subzone) of BULTYNCK (1989), proven by the name-giving index form at Bou Tchrafine (BULTYNCK & WALLISER 2000). CARLS & VALENZUELA-RÍOS (2002) record a slightly earlier entry of *Eoc. catharinae* (still in Conodont Step 20) than of *Crit. steinhornensis*. Our sampling at Jebel Ihrs is still too incomplete to identify this interval. *Eoc. perbonus* and *Lat. armoricanus* are important additional entries at Bou Tchrafine; the latter further confirms the correlation with La Grange. The *steinhornensis* Zone can also be recognized in the northern Maider (PLODOWSKI et al. 2000).

Strongly impoverished conodont faunas occur in the higher *Anetoceras* Limestone of all Tafilalt sections studied so far and prevent regionally the recognition of the *inversus* Zone. At J. Ihrs, a local Upper *Belodella* Ecozone is developed, whilst there are some icriodids and *Criteriognathus* at Bou Tchrafine, which suggest a deeper setting there. Samples (e.g., 4b of BULTYNCK & WALLISER 2000) from the basal *Mimagoniatites* Limestone may only contain *Lat. bil. bilatericrescens,* which resembles the contemporaneous monospecific faunas of the transgressive Black Marl Member of the Oui-n-Mesdour Formation in the western Dra Valley (BECKER et al. 2008). At the top of the *Mimagoniatites* Limestone, the *laticostatus* Zone of J. Ihrs can be easily correlated with Bou Tchrafine (BULTYNCK & WALLISER 2000), where *Eoc. vigierei* is also associated.

**Correlation with the Tafilalt ammonoid zonation**

BECKER & HOUSE (1994) introduced an international Lower Emsian ammonoid zonation that was revised and updated for the Tafilalt by KLUG (2001) and DE BAETS et al. (2010). The

*Devonobactrites* Shale pre-dates the oldest goniatites and represents zone LD III-A near the base of the Zlichovian. An alleged single *Chebbites* from the top of the *Deiroceras* Limestone (KLUG 2001) of Ras-el-Kebber has not yet been illustrated and is ignored until confirmation by re-sampling. The surprisingly diverse goniatites of the *Metabactrites-Erbenoceras* Shale define LD III-B that now can be correlated with the upper part of the *gronbergi* Subzone and with the upper *Now. (Now.) zlichovensis* Zone (dacryoconarid update in ALBERTI 1998). The same goniatite zone continues into the basal *Anetoceras* Limestone, which has *Now. (Now.) tafilaltana* above its base, and, at Bou Tchrafine, the *Lat. latus* Subzone (ca. *nothoperbonus* Subzone). The entry of *Anetoceras* s.str. defines LD III-C, ca. in the basal *Now. (Dmitriella) praecursor* Zone, and in the *steinhornensis* Zone or *Eoc. catharinae* Subzone. An upper subzone with "*Lenzites" gesinae* (Zone D in KLUG 2001) can be recognized in some Tafilalt sections and falls in the impoverished conodont interval (ca. *Now. (Now.) barrandei* Zone). The entry of *Mimagoniatites* defines LD III-D and falls in locally deviant *bilatericrescens* or *Belodella* ecozones (still *Now. (Now.) barrandei* Zone). Elsewhere, a correlation with the *inversus* Zone is based on the Vañes Beds of NW Spain (GARCÍA-LÓPEZ et al. 2002) and on the Khodzha-Khurgan Gorge of the Kitab Reserve (review in BECKER et al. 2010). The Tafilalt ammonoid succession does not allow to distinguish successive *Mimagoniatites* (III-D) and *Mimosphinctes* (III-E) zones.

The basal part of the Daleje Shale equivalents yielded ALBERTI (1981) at Jebel Amelane (= Ihrs) *Gyroceratites gracilis*. W of Hamar Laghdad *Gyroceratites* becomes abundant higher in the thick siliciclastics, where they are associated with common *Rherisites* (LD IV-A). Even higher, the oldest anarcestids appear (LD IV-B), which require a detailed re-study. However, it is difficult to distinguish autochthonous and hill wash faunas on the steep slope.

**Chronostratigraphic levels and Lower Emsian event sequence** (Fig. 7).

The unfavourable *Belodella* faunas of the "Pragian Limestone" make it difficult to correlate the Zinzilban GSSP level and the entry level of the *Eoc. excavatus* into the Tafilalt succession. However, the upper range of *Now. (Turkestanella) acuaria, Now. (Turk.) anteacuaria, Alaina?* cf. *hercyniana,* and *Guerichina africana* to the top of the "Pragian Limestone" and in the lower half of the *Devonobactrites* Shale (ALBERTI 1980, 1981, 1998) clearly show that both units much post-date the *kitabicus* boundary level. The current Emsian GSSP projects below the Tafilalt "Pragian Limestone", where *Now. (Turk.) acuaria* continues extensively. The transgressive *Devonobactrites* Shale expresses regionally the global Basal Zlichov Event (GARCÍA-ALCALDE 1997) in the top range of *Now. (Turk.) acuaria* and *Guerichina*, which equals a level within the *Lat. bil. bilatericrescens* Zone (upper part of *excavatus* Zone; CARLS et al. 2008). The search for correlative icriodid levels within or below the "Pragian Limestone" will be continued. The latter needs to be re-named due to its basal Emsian age of any current/future definition.

The *Metabactrites-Erbenoceras* Shale reflects a second eustatic event within the Zlichovian, which, due to its superb exposures in the easternmost Tafilalt, is here named as **Chebbi Event**. It post-dates the last graptolites and initiated the incredible initial ammonoid radion in the upper part of the *gronbergi* Subzone, as part of the "Devonian Nekton Revolution" (KLUG et al. 2010). A third global transgressive pulse, with a spread of hypoxic conditions, led to the deposition of dark *Mimagoniatites* Limestones of southern Morocco and Algeria (ALBERTI 1981). It has been termed the Upper Zlichov Event by GARCÍA-ALCALDE (1997) and, based on conodonts from NW Spain (GARCÍA-LÓPEZ et al. 2002) and the Khodzha-Khurgan Gorge, occurred near the base of the *inversus* Zone. It is tempting to correlate the three Lower Emsian T-R cycles of VER STRAETEN (2007) with the three deepening events of the Tafilalt but this is not yet supported by reliable biostratigraphy data. The Chebbi Event is well expressed in the far distant region of Victoria, where the deepening of the Taravale Limestone (e.g., MAWSON & TALENT 2003) allowed the appearance of oldest goniatites.

## Taxonomic Notes

***Eocostapolygnathus* BARDASHEV et al., 2002**

Based on its Upper Givetian to Frasnian type-species (*Po. dubius*), *Polygnathus* is a well-defined genus, which Pa element has a free blade continuing as distinctive platform carina and a small pit under the anterior to central platform. Middle/Upper Devonian forms with enlarged, often asymmetric pit or wide, shallow cavities fall in various other, widely accepted genera that are not (yet) distinguished by apparatus features (*Schmidtognathus, Klapperina, Pseudopolygnathus, Siphonodella*, etc.). Their recognition, whilst keeping early polygnathids with very large, deep to shallow, partly inverted basal cavity in *Polygnathus,* creates a strongly inconsistent taxonomy that prevents a meaningful diagnosis of the genus. The only generic name available for the *kitabicus-gronbergi* Group is *Eocostapolygnathus* BARDASHEV et al. 2002, which can be expanded to include species with a platform lingua (*Eolinguipolygnathus* BARDASHEV et al., 2002). The recognition of *Eocostapolygnathus* does NOT imply the recognition of the many new species introduced by BARDASHEV et al. (2002). *Po. laticostatus* may be regarded as the oldest true

*Polygnathus*, rather than placing it in the poorly defined, intermediate *Eucostapolygnathus* BARDASHEV & WEDDIGE, 2003. A past inconsistent taxonomy of closely similar *Eocostapolygnathus* species has produced very different and conflicting taxonomic opinions of authors, which complicates the biostratigraphic use of taxa.

***Eocostapolygnathus* "*excavatus* ssp. 114" sensu CARLS & VALENZUELA-RÍOS (2007)**

As noted by previous authors *Po. gronbergi* KLAPPER & JOHNSON, 1975 and *Po. excavatus* CARLS & GANDL, 1969 are very similar species or subspecies, which, for the purpose of a clear stratigraphy, should be restricted to forms close to their type material. Both share a short free blade, a narrow anterior platform with regular transverse costae, somewhat upturned margins, and distinctive adcarinal furrows. The basal cavity is large and deep, and anteriorly constricted. In *Po. gronbergi* the carina reaches the posterior platform tip, often as a series of nodes superimposed on the transverse ornament of a lingua ("semi-crossed" lingua of YOLKIN et al. 1994, fig. 3). The narrow posterior end of the basal cavity is slightly inverted. In *Po. excavatus* s.str. the carina does not reach the posterior end and the joined adcarinal furrows continue posterior of it, interrupting the transverse ornament. There is no inversion of the posterior basal cavity. Based on its type specimen (see MAWSON 1995) *Po. dehiscens* is characterized by its reduced anterior platform ornament. The type of *Po. lenzi* KLAPPER, 1969 has a pronounced carina almost extending beyond the platform and its anterior ribbing produces an incipient rostrum, as in *Po. pannonicus* (see comment in YOLKIN et al. 1994). Specimens with *gronbergi*-type ornament but lacking the incipient inversion of the narrow posterior end of the basal cavity have been informally named as "*excavatus* ssp. 114" (CARLS & VALENZUELA-RÍOS 2007, see also GARCÍA-LOPEZ et al. 2002). Several of our *gronbergi*-like polygnathids from Bed 16c show a widely flattened but not inverted posterior cavity (Fig. 6.4). Additional work is required to prove that this small difference justifies taxonomic separation.

***Eocostapolygnathus* aff. *gronbergi***

Several J. Ihrs specimens from Bed 16c differ from typical *Po. gronbergi* by their large but shallower basal cavity that tapers gradually, without marked constriction, under the anterior platform (fig. 6.11). At the narrow posterior end there is an incipient inversion trend. This form could be separated at subspecies level. The upper surface resembles *Po. abyssus* MAWSON, 1987, which, however, has a deeper, v-shaped basal cavity without incipient inversion.

***Eocostapolygnathus* n. sp. aff. *pannonicus***

Many specimens from the *Deiroceras* Limestone of J. Ihrs differ from *Po. gronbergi* by their curved, flat, often wider platform with dense, very regular ribbing. The carina may or may not reach the posterior platform end. The basal cavity is very large and flat, not anteriorly constricted, and without inversion. The closest known Lower Emsian form is *Po. pannonicus* MASHKOVA & APEKINAE, 1980, which, however, possesses weak longitudinal rostra on the outer anterior platform.

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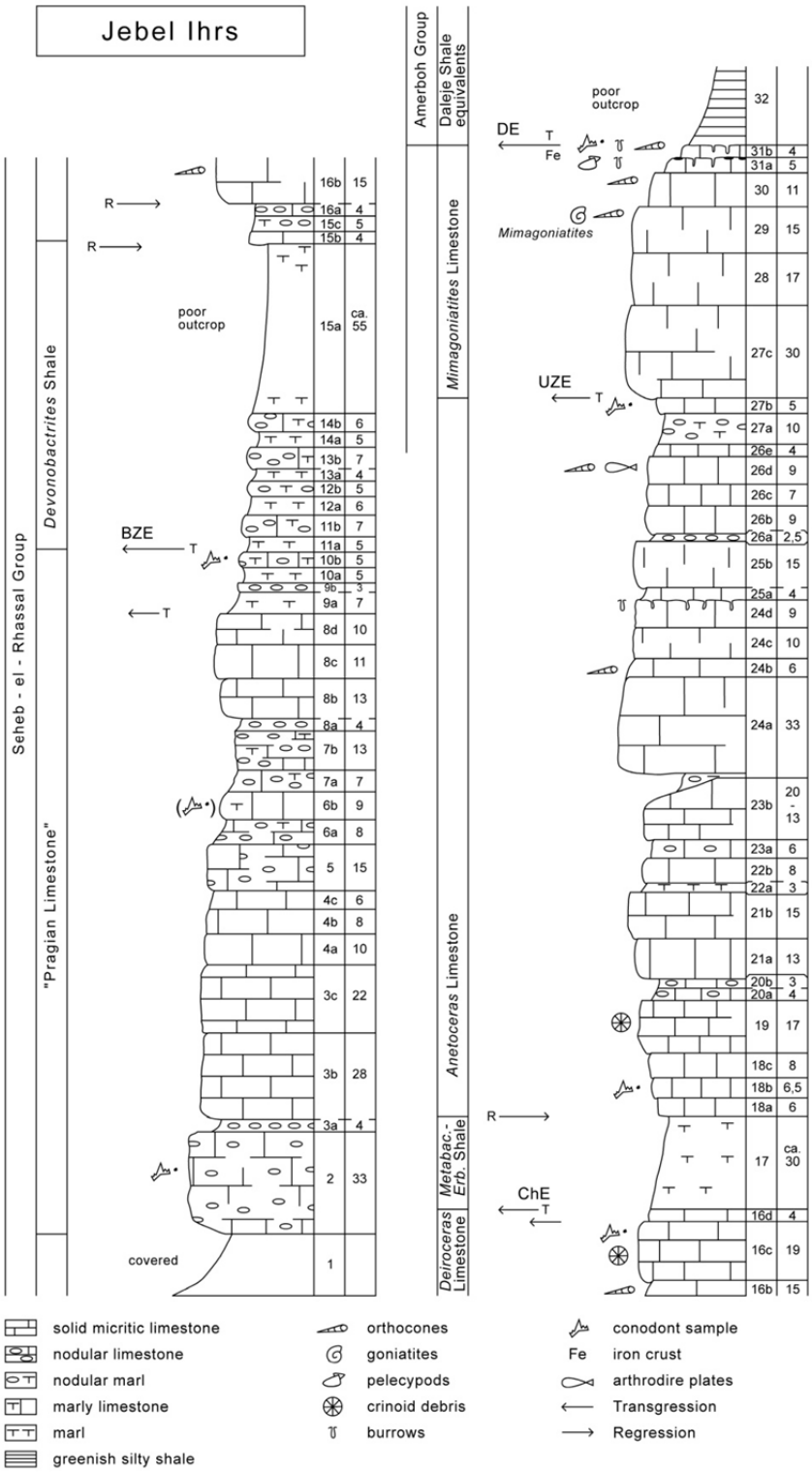


Fig. 4. Lithostratigraphy, position of conodont samples and relative sea level fluctuations at Jebel Ihrs. BZE = Basal Zlichov Event, ChE = Chebbi Event, UZE = Upper Zlichov Event, DE = Daleje Event.

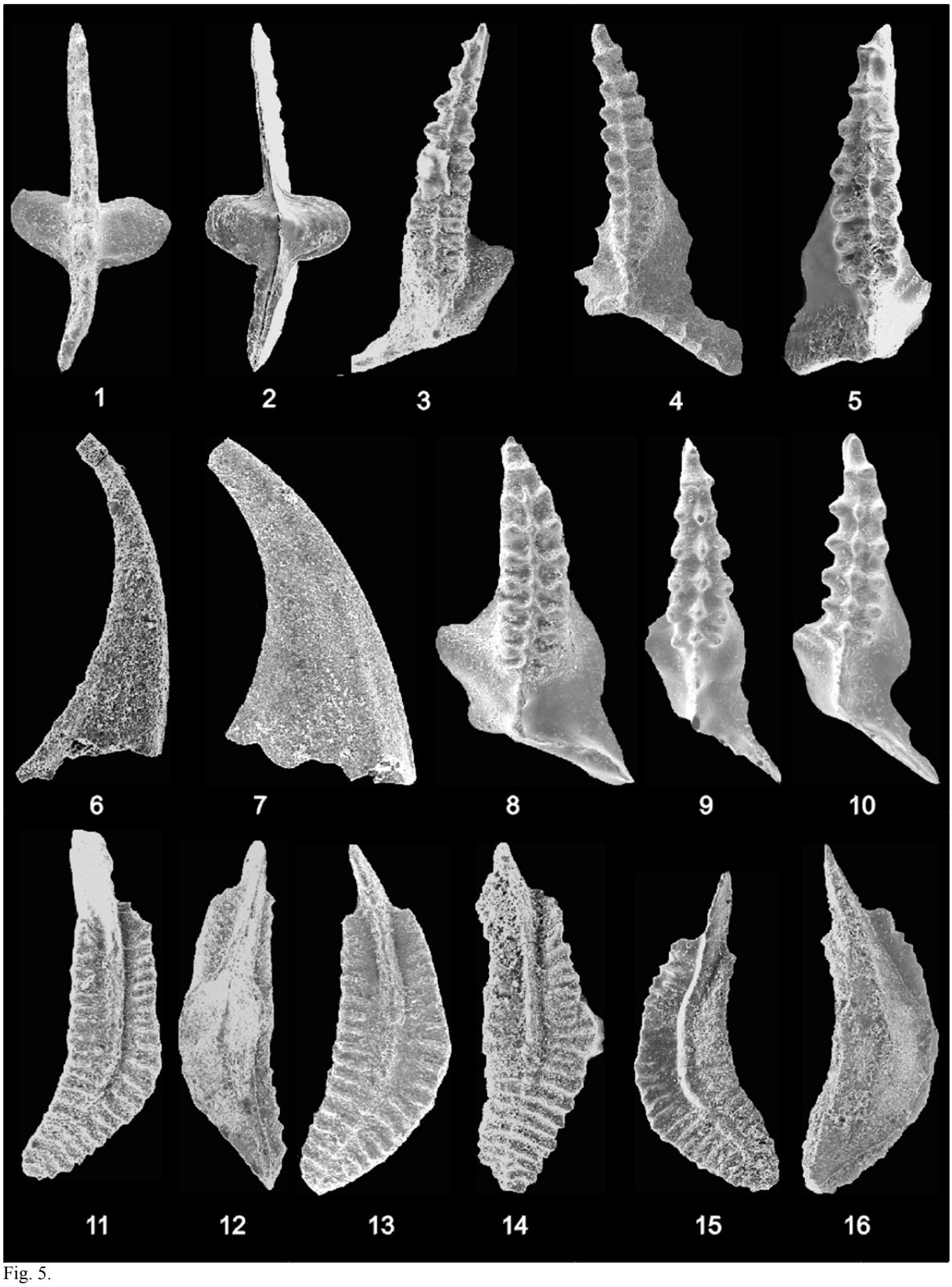


Fig. 5.

Characteristic conodonts from the Lower Emsian of Jebel Ihrs. **1-2**. *Crit. miae*, Bed 16c, two specimens, upper view x 65, lower view x 75. **3-4**. *Lat. bilatericrescens multicostatus*, two specimens from Bed 18b, x 65, and Bed 16c, x 45. **5.** *Caudicriodus* sp., Bed 27b, upper view, x 85. **6**. *Belodella resima*, Bed 2, x 85. **7**. *Bel. triangularis*, Bed 10b, x 60. **8**. *Lat. bilatericrescens bilatericrescens*, Bed 18b, upper view, x 85**. 9-10**. *Caud. sigmoidalis*, two specimens from Bed 18b, x 75 and x 85. **11-16**. *Eoc*. n. sp. aff. *pannonicus*, five specimens from Bed 16c, upper view x 65, lower view x 60, upper view x 75, upper view x 60, and upper and lower views x 60.

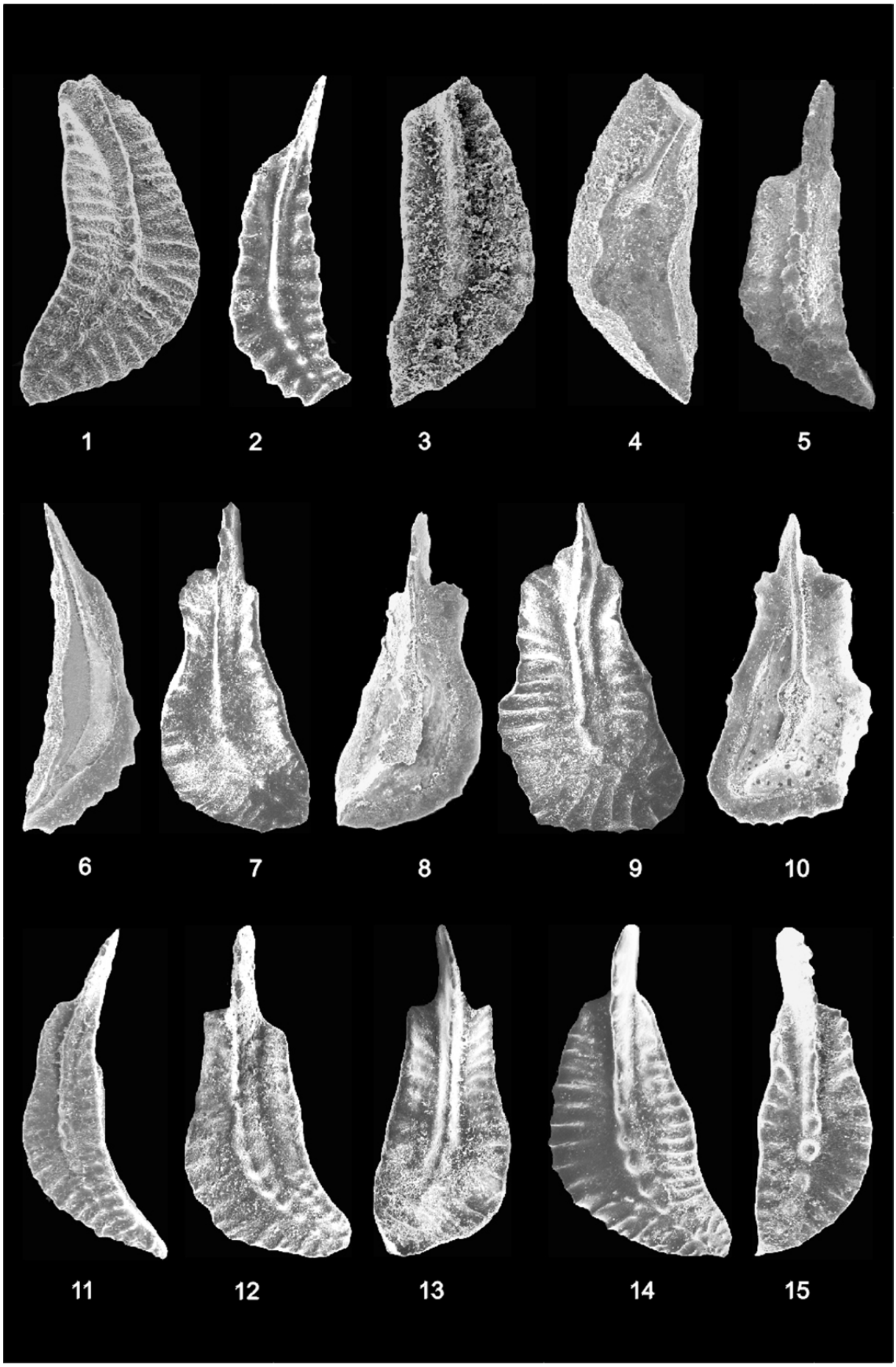
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Fig. 6. Polygnathids from the Lower Emsian of J. Ihrs. **1,** *Eoc*. n. sp. aff. *pannonicus*, typical specimen with very wide platform, Bed 16c, upper view, x 75. **2-5**. *Eoc*. "*excavatus* ssp. 114", four specimens from Bed 16c, upper view of small, narrow morphotype, x 100, upper and lower views of wider specimen, x 75, and upper view of small specimen with weak ornament, x 100. **6** and **11**. *Eoc*. aff. *gronbergi*, two specimens from Bed 16c, upper view, x 85, and lower view, x 85. 7-8 and **12-16**. *Po. laticostatus*, five specimens from Bed 31b, upper and lower views, x 50, upper views, x 55, x 55, x 65, and x 85. **9-10**. *Po*. cf. *vigierei*, Bed 31b, upper and lower views, x 50.

Fig. 7. Correlation of Emsian international conodont zones, the Tafilalt lithostratigraphy, Bou Tchrafine (BT)-Ouidane Chebbi (OCh) and J. Ihrs conodont succession, and the Tafilalt ammonoid (BECKER & HOUSE 1994, KLUG 2001, DE BAETS et al. 2010) and dacryoconarid (ALBERTI 1998) sequences.

<table>
<tr><th></th><th>polygnathid zonation</th><th>icriodid-ozarkodinid zonation</th><th>Tafilalt lithostratigraphy</th><th>J. Ihrs conodonts</th><th>BT and OCh conodonts</th><th>Tafilalt ammonoid zonation</th><th>key</th><th>Tafilalt dacryoconarids</th></tr>
<tr><td rowspan="3">UPPER EMSIAN</td><td rowspan="2">serotinus</td><td rowspan="2">corniger corniger</td><td>Anarcestes Limestone</td><td rowspan="3"></td><td rowspan="3">Linguipo. serotinus</td><td>Anarcestes simulans</td><td>D1</td><td rowspan="2">Now. (Now.) richteri</td></tr>
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<tr><td rowspan="4">gronbergi</td><td rowspan="4">bilatericrescens bilatericrescens</td><td>Metabactrites-Erbenoceras Shale</td><td></td><td></td><td>Chebbites reisdorfi Metabactrites formosus</td><td>B</td><td></td></tr>
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<tr><td>Devonobactrites Shale</td><td></td><td rowspan="4"></td><td>Devonobactrites obliqueseptatum</td><td></td></tr>
<tr><td rowspan="2">"Pragian Limestone"</td><td rowspan="2">Lower Belodella</td><td rowspan="2">Guerichina africana</td></tr>
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<tr><td>PRAGIAN</td><td>?</td><td></td><td>"Pragian shales" (with few limestone interbeds)</td><td></td><td></td><td></td><td>Now. (Turk.) acuaria ssp.</td></tr>
<tr><td>LOCHK.</td><td></td><td></td><td>Jovellania Limestone (s.str.)</td><td></td><td></td><td></td><td></td><td>Paranowakia intermedia</td></tr>
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# THE DEVONIAN (FAMENNIAN) SEQUENCE IN THE WESTERN JUNGGAR AREA, NORTHERN XINJIANG, CHINA

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## 1. General Geology of the Devonian

Devonian deposits surrounding the Junggar Oldland were characterized by geosynclinal volcanic and clastic associations, with greatly varied lithofacies and thickness (ranging from 1500 to 12000 m). Continuously exposed complete Devonian sections are rare due to subsequent tectonic activities. Nevertheless, individual lithologic formations may be well exposed, especially in the area of Xar Burd Mountain-Hoboksar in western Junggar (Fig. 1), where the Lower Devonian marine deposition was continuous with the Upper Silurian. Marine transgression reached a highstand during the deposition of the Emsian, which is mainly characterized by a suite of carbonate deposits with abundant corals, bryozoans and brachiopods (see MA et al., 2009 for a general summary of Devonian lithologic formations). Then the sea level fell during the Eifelian, during which time the lithology is mainly characterized by tuffaceous clastics with corals and brachiopods. During the Givetian and Frasnian, terrestrial deposits (fine to coarse clastics, partly tuffaceous, even volcanics) with plant fossils predominated, except for a Frasnian interval that is characterized by thin-bedded limestones with common brachiopods (*Schuchertella* sp., productellides, "*Ptychomaletoechia*" sp., *Eleutherokomma* sp., *Adolfia bicostata* Su) and minor conodonts (*Ancyrodella* sp., *Icriodus alternatus*, according to XU, 1999).

From the Givetian, the sedimentary framework in the western Junggar area changed dramatically. The Givetian and Frasnian in the Xar Burd Mountain area are mainly characterized by terrestrial deposits, while in the Tarbagatay Mountains area, marideposits predominated, locally with terrestrial deposits intercalated. However, during the Famennian, the pattern was reversed: the Xar Burd Mountain area was characterized by marine deposits; towards the west the lithofacies changed to alternating marine and terrestrial facies in the Baiyang-Emin area and alternating marine and terrestrial facies to terrestrial facies in the Tarbagatay Mts area.

## 2. The Upper Devonian (Famennian) in the Hoxtolgay area

The most common name used to represent the Famennian in the Hoxtolgay (=Heshituoluogai in present day spelling) area is the Hongguleleng Formation, whose type locality is located about 1.5 km northwest of Bulongguoer Reservoir (HOU et al., 1993), about 30 km east of Hoboksar Town (Fig. 1). Originally when named in the 1970', this formation was proposed to represent the Famennian and included all the marine and part of terrestrial sedimentary strata in the section (see XU et al., 1990 for a complete sequence). XU et al. (1990) speculated that the whole section formed a syncline and that the uppermost Devonian and lower Carboniferous strata were absent. XIAO et al. (1992) redefined the Hongguleleng Formation, which consisted of two members and was overlain by the Early Carboniferous Heishantou Formation. Judging from figure 1-5 of XIAO et al. (1992), the basal part of their Heishantou Formation is actually equal to the Upper Member of the Hongguleleng Formation of HOU et al. (1993), who took the overlying *Syringothyris*-bearing interval as the start of the Carboniferous and used the term "Unnamed Formation" for the Early Carboniferous interval. Nevertheless, there are obvious different opinions among previous workers in thickness of the Famennian Hongguleleng Formation (346 m in

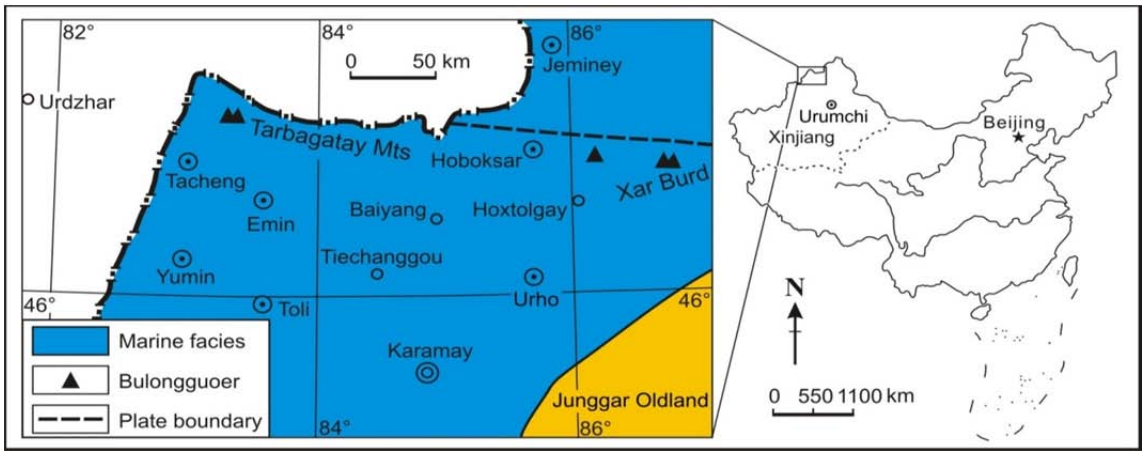


Fig. 1 Location of the studied section and Famennian land and sea areas of western Junggar.

XIAO et al., 1992 with the Upper Member excluded and 236 m in HOU et al., 1993), nature of the contact with the underlying Frasnian Zhulumute Formation, and age of the Lower Member (limestone) of the Hongguleleng Formation. During the last few years, we remeasured the section and results are reported in the following paragraphs.

**2.1 Contact between the Hongguleleng Formation and the underlying Zhulumute Formation**

In the type area, the upper part of the Zhulumute Formation is made up of cross-bedded sandstone and minor conglomerate of terrestrial origin (Fig. 2), bearing very common plant fossils including *Lepidodendropsis rhombica* DOU and *Leptophloeum rhombicum* DAWSON. Towards the top, there is a covered interval of several meters between the two formations. Two ditches were dug, one of which was deep enough to reveal the contact of parallel unconformity. The top of the underlying Zhulumute Formation weathers to a layer of loose sandstone about 25 cm thick. The base of the Hongguleleng Formation is characterized by mudstone and shale in one ditch but shale-limestone intercalations in the other ditch about 600 m southwards.

**2.2 The Famennian sequence in the type section**

The Hongguleleng Formation is 180.4 m thick according to our new measurement in the type section. It may be divided into three members as indicated by HOU et al. (1993).

**2.2.1 The Lower Member**

The lower member (units 2-3 of Figs. 2 and 3: 88.8 m thick) is mainly composed of gray thin-bedded bioclastic or shelly limestones and fine calcareous shales (with larger amount upwards), bearing abundant fossils, including brachiopods *Leptagonia, Rugosochonetes*, *Leioproductus*, *Praewaagenoconcha?, Schizophoria, Ptychomaletoechia, Rugaltarostrum, Athyris, Cleiothyridina*, cyrtospiriferids, "*Mesoplica*" etc. (Fig. 3) and corals *Nalivkinella*, *Amplexus, Hebukephyllum, Tabulophyllum, Neaxon, Amplexocarinia* (LIAO & CAI, 1987). Conodont data suggest that this member has a range from the Famennian *Pa. crepida* through *Pa. marginifera* Zones because of occurrences of *Ancyrognathus bifurcatus, Polygnathus semicostatus, Icriodus cornutus, Palmatolepis minuta minuta, Pa. glabra pectinata* etc. (ZHAO and WANG, 1990) or from the late Frasnian Upper *rhenana* Zone through early Famennian Middle *crepida* Zones (XIA, 1996) or from (upper) *linguiformis* Zone through marginifera Zone (CHEN et al., 2009).

The brachiopod fauna is characterized by the association of productids, rhynchonellids, and cyrtospiriferid spiriferids (a typical post F-F extinction fauna) and the absence of atrypides (an important group in pre-Famennian strata). Therefore, brachiopod data are consistent with the opinion of ZHAO and WANG (1990). Conodonts discovered from this interval include *Polygnathus, Ancyrognathus, Icriodus*, and *Palmatolepis*?, which are not suitable for age determination. More samples are being processed.

**2.2.2 The Middle Member**

The middle member (units 4-6 of Figs. 2 and 3: 64.8 m thick) consists of purple-red and green (tuffaceous) siltstone, shales-mudstones, and marly limestones, intercalated with minor siliceous mudstone, yielding rare corals, brachiopods, cephalopods, ostracods, trilobites, crinoid stems, and trace fossils at various horizons. There are three relatively important fossil horizons: the basal 0.8 m thick interval of unit 5 with a small-sized brachiopod fauna; the lower part of unit 5 with a cephalopod fauna; and the upper part of unit 6 with common monospecific trilobites. Unit 5 (9.6 m thick) is detailed as follows (in descending order):

5-3: 5.8 m thick. Grayish green, thin-bedded siltstone and mudstone, yielding minor trilobites and simple rugose corals and rare brachiopods and crinoid stems.

5-2: 3 m thick. Purple marly "nodular" limestone intercalated with thin-bedded grayish gray siltstone and mudstone. Loose and mostly fragmented ammonoids (Fig. 3) and nautiloids were picked up from ground of this layer along strike. The cephalopods most likely come from the lower part of 5-2. This is the only layer in the section with ammonoid fossils (Fig. 3, names provided by R.T. BECKER who indicates a probable UD IV-A age based on overall taxa). This corresponds to the topmost part of the Upper *trachytera* Zone to the lower part of the Lower *postera* Zone. In the Hebukehe section about 15 km southwestwards, a possible corresponding cephalopod layer (about 1 m thick) is present, with many large-sized coiling (generally 10 cm in diameter, up to 20 cm in diameter) as well as orthoconic cephalopods. Rare trilobites, brachiopods, and the trace fossil *Zoophycos* are present. Whether the two cephalopod layers can be precisely correlated needs further work.

5-1: 0.8 m thick. Fresh grayish (weathers to earthy yellow) dense marly limestone, yielding some small-sized brachiopods (productides, orthides etc.), and rare trilobites, corals, ostracodes, crinoid stems, and worm tubes. It may show a positive relief (Fig. 2), but may not be so laterally. CHEN et al. (2009) found a conodont assemblage of the *trachytera* Zone at this level.

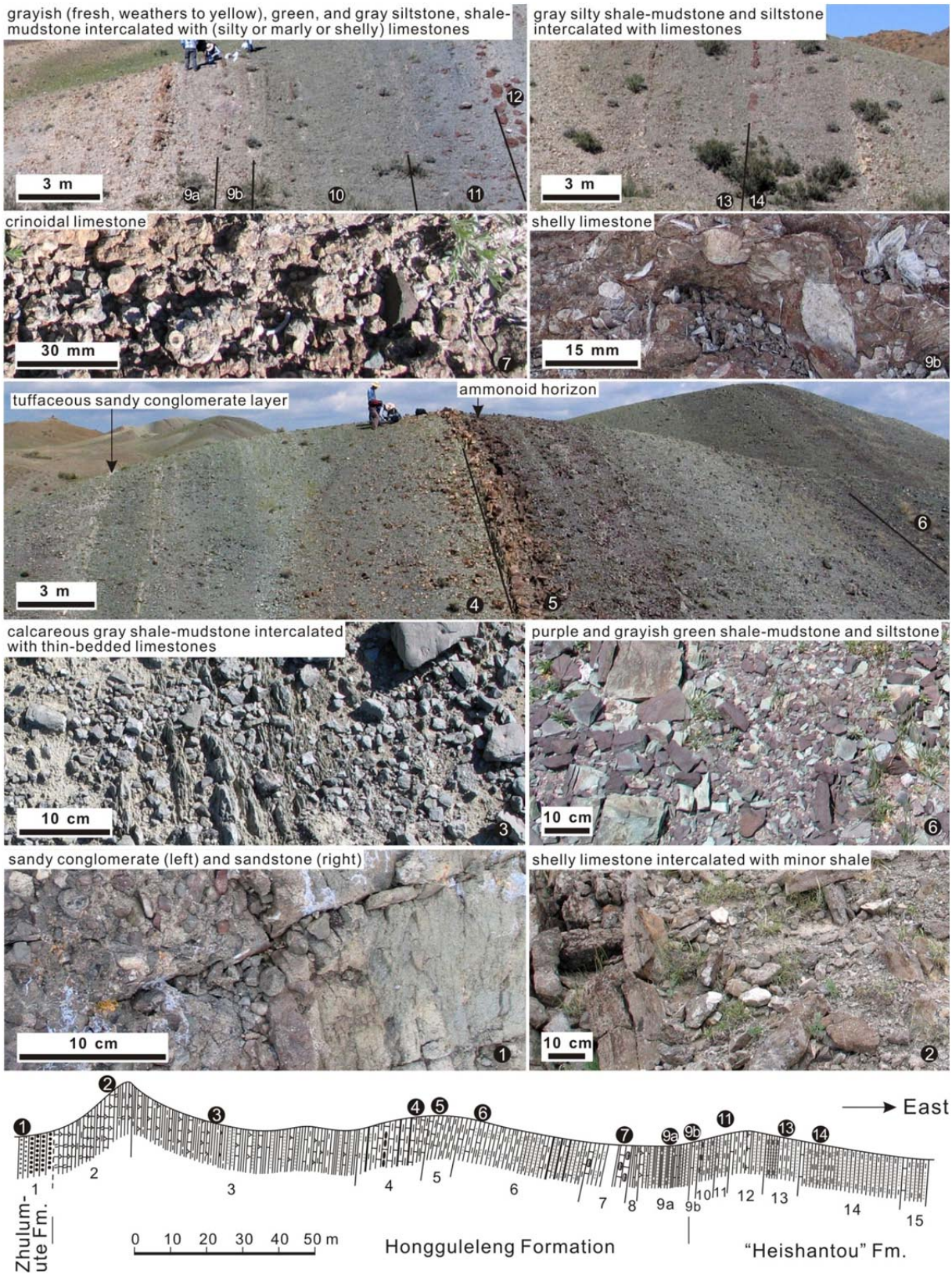


Fig. 2 A profile of the Bulongguoer section and field photos showing characteristic lithologies and sequence. Numbers 1-15 represent bed units and corresponding stratigraphic horizons of the photos taken (black-circled numbers). Same lithologic legend as that of Fig. 3.

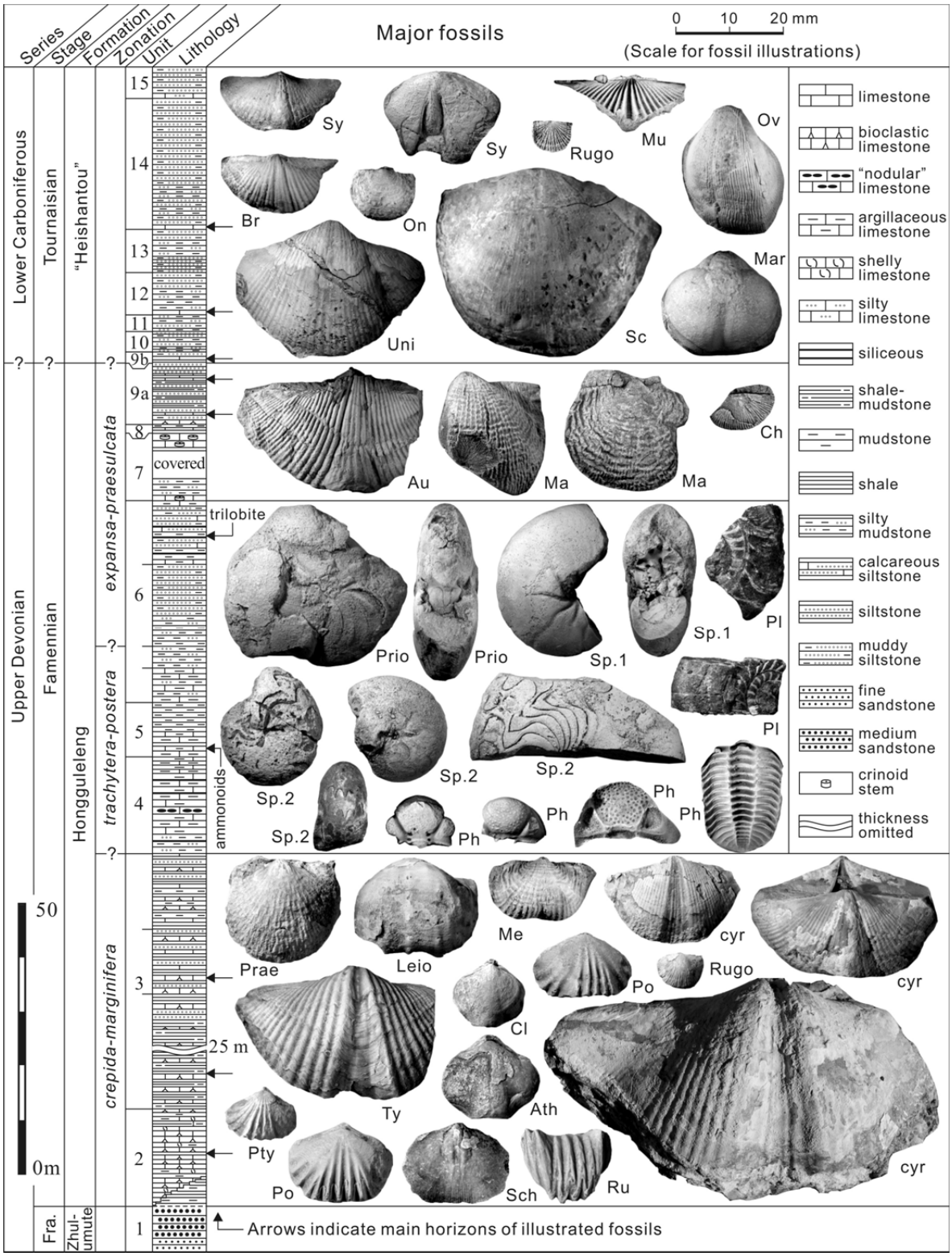


Fig. 3 Columnar section of Famennian and Tournaisian stratigraphy at Bulongguoer and major diagnostic invertebrate fossils in different intervals. Fossil names are abbreviated as follows. Ath: *Athyris* sp.; Au: *Austrospirifer* sp.; Br: *Brachythyrina* sp.; Ch: chonetoid; Cl: *Cleiothyridina* sp.; cyr: cyrtospiriferid; Leio: *Leioproductus* sp.; Ma: *Margaritiproductus* sp.; Mar: *Martinia* sp.; Me: "*Mesoplica*" sp.; Mu: "*Mucrospirifer*".

### 2.2.3 The Upper Member

The upper member (units 7-9a of Figs. 2 and 3: 26.8 m thick) is different from the middle member in its absence of purple and greenish color. It is made up of grayish silty mudstone-shale and crinoidal limestone in the lower part and fresh grayish (weathers to yellow and partly ferruginous) silty shale-mudstone and siltstone intercalated with minor gray limestone in the upper part. The base of this member is characterized by a 60 cm thick crinoidal limestone layer. Cyrtospiriferid brachiopods (tentatively identified as *Austrospirifer* sp.) are present in unit 7 and the lower part of unit 9a (Fig. 3).sp.; On: *Onavia*? sp.; Ov: *Ovatia* sp.; Ph: *Phacops* sp.; Pl: *Platyclymenia* sp.; Po: *Porostictia*? sp.; Prae: *Praewaagenoconcha*? sp.; Prio: *Prionoceras* sp.; Pty: *Ptychomaleotechia* sp.; Ru: *Rugaltarostrum* sp.; Rugo: *Rugossochonetes* sp.; Sc: *Schellwienella* sp.; Sch: *Schizophoria* sp.; Se: *Semiproductus*? sp.; Sp.1: *Sporadoceras*? sp. 1; Sp.2: *Sporadoceras* sp. 2; Sy: *Syringothyris* sp.; Ty: *Tylothyris* sp.; Uni: *Unispirifer* sp. (Ammonoid names are provided by R. T. BECKER)

## 3. The Carboniferous Tournaisian in the Hoxtolgay area

The "Heishantou" Formation is conformable with the underlying Hongguleleng Formation. It mainly consists of greenish and gray shale-mudstone and siltstone with ferruginous marly limestone intercalations (units 9b-15 of Figs. 2 and 3: 52.7 m thick). The base at Bulongguoer is characterized by a ferruginous shelly limestone layer of 0.2 m thick (Fig. 2), yielding a diverse brachiopod fauna including *Syringothyris* sp., *Unispirifer* sp., *Leptagonia* sp., *Rugosochonetes* sp., *Plicochonetes* sp., *Rhipidomella* sp., *Composita* sp., etc. as well as some other brachiopods upwards in association with some simple rugose corals. Overall brachiopod and coral data suggest an Early Carboniferous age (ZONG et al., in preparation).

The age of the brachiopod *Syringothyris* first occurrence in northern Xinjiang is not clear yet. HOU et al. (1993) considered it to be the Early Carboniferous. ZHAO (1986) listed a brachiopod association including *Cyrtospirifer*, *Tenticospirifer, Spirifer, Syringothyris* and others together with conodonts such as *Siphonodella praesulcata* in the Hebukehe section (Third Hill Crest). However, we have not found such a brachiopod association in our field investigation so far. Instead, the succession from a brachiopod fauna (including cyrtospiriferids) to the *Syringothyris* fauna (including *Spirifer, Unispirifer* etc.) can be observed, such as in the Bulongguoer section (Fig. 3) and the Hebukehe section (our data). About 10 km eastwards, the brachiopod *Syringothyris* interval yields the conodonts *Polygnathus communis* and *Siphonodella cooperi* (Emuha section: XU et al., 1990) and the ammonoid *Weyerella angularia* (LIANG and WANG, 1991) (formerly *Gattendorfia angularia*; southwestern flank of Adeerke Hill near Honggulengleng). In conclusion, the occurrence of *Syringothyris* in western Junggar probably signifies entry into the Carboniferous. Further data from conodont- or ammonoid-related studies are needed to clarify the Devonian and Carboniferous boundary, together with detailed stratigraphic description and proper identification of benthic fossils.

**Acknowledgments**

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# FIRST RECORD OF FRASNIAN (UPPER DEVONIAN) SEDIMENTS AND AMMONOIDS FROM MYANMAR

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## Introduction

Devonian sediments and faunas are known from Myanmar since more than 100 years (REED 1908) but currently there is no published record of Upper Devonian deposits or fossils. Upper Devonian ammonoids are so far unknown from all of SE Asia. This preliminary report includes the first documentation of Frasnian sediments and goniatites, which is not only of interest for the regional geology but also for palaeobiogeographic and plate tectonic comparisons and reconstructions.

The Myogyi area (Fig. 1), from where the Upper Devonian ammonoids were recovered, is situated approximately 20 km southeast of Kyaukse town, Mandalay Division. It is located at the triple junction of Kyaukse-Myitha and Ye-ngan townships. The area is bound by Latitude 20˚ 22′ 4″ to 20˚ 29′N, and Longitude 96˚ 15′ 5″ to 96˚ 22′ 5″ E, Myanmar Military grid no. 780 to 930 vertically and 930 to 070 horizontally, in the one-inch topographic map no. 93-C/7, covering about 96 square km of a rugged terrain The Hanmyinbo-Yengan motor road runs across the area from west to east and, hence, the area is readily accessible, more easily in summer and winter. The geology of the Myogyi area was investigated by one of us (KoKo MYINT 1989) in the frame of a M. Sc. study and for the preparation of a detailed geological map of the area. It includes the description of the regional lithostratigraphic units mapped, a description of the geological structure of the area, an interpretation of the depositional environment, and the economic aspects of the area.

## Regional Geology

The Myogyi area lies in the western marginal zone of the eastern High Lands, which includes the Eastern Kachin-Shan-Tanintharyi Highlands. It is also known as the Sino-Burman Ranges (BENDER 1983), which represents the largest tectonic unit in Myanmar that occupies the eastern part of the country. It is mainly composed of Precambrian metamorphic rocks (gneiss), low grade metasedimentary rocks (Chaung Magyi Group), Paleozoic and Mesozoic carbonates, sandstones and shales. Igneous rocks are represented by various generations of acidic and basic intrusions and acidic, intermediate and basic extrusive volcanites.

Structurally the area lies between the Shan Boundary Fault in the West and the Pan Laung Fault in the East, which intersects with the Shan Boundary Fault at an acute angle and appears to join it in the area approximately 220 km to the north of the studied area. GARSON et al. (1976) mentioned that the movement of the Pan Laung Fault commenced in the Jurassic and that it lasted for most of the Tertiary. However, the Myogyi area, located in the immediate vicinity of the Pan Laung Fault, was already tectonically active during the Palaeozoic because two areas with different lithofacies and palaeogeographic development adjoin each other.

The Myogyi area (Fig. 2) is part of a Precambrian to Mesozoic shelf in which the stratigraphic sequence consists of the Precambrian Mogok Gneiss, the Chaung Magyi Group, the Cambrian Ngwe Taung Group, the Ordovician Naung Kangyi Group, the Silurian Nyaungbaw Formation, the Lower Devonian Zebingyi Formation, a new, currently unnamed Upper Devonian unit, the Carboniferous Lebyin Group, and the Permian-Triassic "Plateau Limestone Group". To the East, the Precambrian Mogok Gneiss is faulted against thick Ordovician strata, which were combined by MYINT LWIN THEIN (1973) as the Pindaya Group, which overlies the Molohein Group. Further to the East, the Precambrian Chaung Magyi Group widely forms the inner part of a major anticline (Yechanzin Anticline), located in the North of Ye-U, Ye-ngan township. There, the Lower Paleozoic rocks are

unconformably overlain by the Permian-Triassic sequence of the "Plateau Limestone Group".

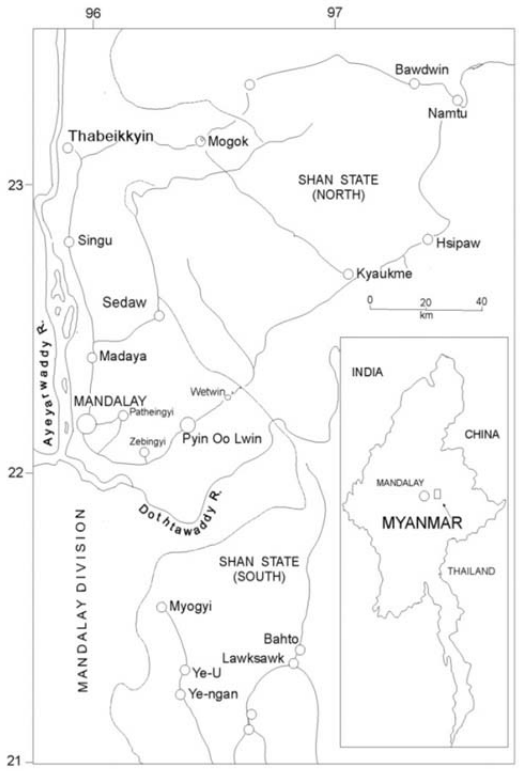


Fig. 1. Geographic position of the Myogi area in the SSE of Mandalay, southern Shan State.

Towards the West, the area is widely covered by Quarternary alluvium, which is cut by the Sagaing Transform Fault (WINSWE 1970, 1972), which was subsequently considered as the Shan Boundary Fault (BENDER 1984, p. 38). Further West, Cenozoic sedimentary rocks widely occur in the areas between the Sagaing Fault and the Central Volcanic Line (CVL) of Myanmar. The rock sequences that mainly occur to the North of the Myogyi area are a southern continuation of the area between Mandalay and Pyin Oo Lwin, except that there are more undifferentiated metamorphics, mainly schists and gneisses as possible equivalents of the Mogok Gneiss. The main components of the Palaeozoic shelf sediments to the North are the same as those found in the Myogyi area.

Towards the South, the sequence becomes more complete by the addition of some granites and other non-basaltic intrusives of unknown age that intruded in rocks of the Carboniferous Lebyin Group and in undifferentiated metamorphics. In addition, some Mesozoic rocks of the "Pan Laung Formation" overly unconformably the Permian-Triassic 'Plateau Limestone Group" in the area west of the Pan Laung overthrust.

**Previous Devonian ammonoids from Myanmar**

Previously, the only record of Devonian ammonoids for the northern Shan States area of Myanmar goes back to REED (1908), who briefly described two goniatites from supposed Eifelian strata of the Padaukpin area as "*Anarcestes* cf. *lateseptatus*" and "*Agoniatites*" sp. Whilst the first species was not illustrated, the second has relative low whorls and a wide umbilicus and might represent an upper Emsian sellanarcestid. The faunule badly needs revision, including a re-assessment of its age and a modern comparison with European-North African faunas (e.g., EBBIGHAUSEN et al. 2010 in press). A single new specimen collected from the same region was not available for this study. The biostromal level at Padaukpin with corals and brachiopods clearly falls in the Eifelian (e.g., ANDERSON et al. 1969, AYE KO AUNG 1995), which was confirmed by one adjacent conodont sample.

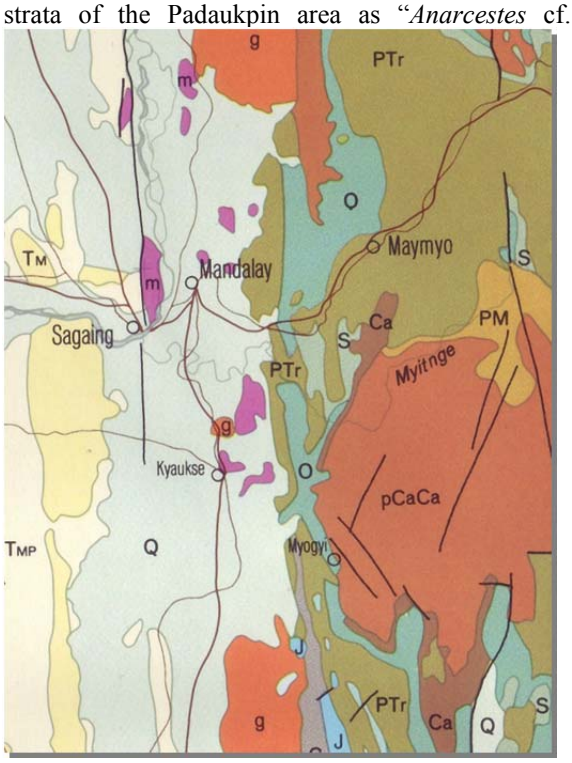


Fig. 2. Geology of the region around Mandalay, Maymyo and Myogyi, showing the position of fault zones (extracted from from Bender et al. 1983, fig. 17a). g = granite of unknown age, m = Mogok Gneiss, pCaCa = Chaung Magyi Group (Precambrian-Cambrian), Ca = Cambrian (Ngwe Taung Group), O = Ordovician (Naung Kangyi Group), S = Silurian (Nyaungbaw Group), PTr = Palaeozoic to Triassic, including the Devonian Zebingyi Formation to PermoTriassic Shan Dolomite Group, PM = undifferentiated Palaeozoic-Mesozoic, J = Jurassic, TM = Miocene, TMP = Miocene to Pleistocene (Irrawaddy Group), Q = Quarternary [for scale see the distance between Mandalay and Myogyi in Fig. 1]

**Locality and Stratigraphy**

The Upper Devonian ammonoids were recovered from a single locality in the western part of the range

running NNW-SSE in direction, about 2 km southwest of Myogyi, a village located at 24 km distance from Hanmyinbo along the Hanmyinbo-Ye-ngan motor road. The area is characteristically rugged terrain very close to the West of the Pan Laung Fault zone. Locally, the Precambrian to Paleozoic rock sequence is fairly thick.

The eastern half of the Myogyi area is covered by the Precambrian Mogok Gneiss and metasedimentary rocks of the Chaung Magyi Group. Overlying in places, there are some Cambrian sandstone, siltstone and orthoquartzite outcrops. The almost complete sequence of the Ordovician, which has been named as the Naung Kangyi Group (BENDER 1983), occurs in the western part of the area. It is composed of fossiliferous yellow or buff-coloured sandy limestone and calcareous fine sandstone, which frequently weather into sandy marl, and of intercalated lenses of of crystalline limestone. Outcrops of the Ordovician units concordantly overlie the Cambrian sandstones and occur in the middle part of the area. They are followed by the Nyaungbaw Limestone (LA TOUCHE 1913; PASCOE 1959), a red brown to blue-grey phacoidal limestone-claystone facies or a mixture of clastic and carbonate facies, which is characterized by a profusion of *Michelinoceras* sp. in the limestone and by a number of species of common graptolites of Early Silurian (Llandovery) age in the shale.

Two Devonian units are recognized in the Myogyi area, the Zebingyi Formation and the conformably overlying unnamed unit. The local lithology of the Zebingyi Formation mostly agrees with that of the type section (AYE KO AUNG 2008), consisting upwards of medium-bedded, bluish grey, nodular argillaceous limestone with calcareous shale intercalations (Khinzo Chaung Limestone Member), alternating, medium-bedded, light grey argillaceous limestone with silt partings, calcareous sandstone and hard, compact, bluish grey micritic limestone with silt partings (In-ni Chaung Limestone Member), and massive, hard and compact, reddish brown orthoquartzite (Doganaing Chaung Orthoquartzite Member).

The unnamed Devonian unit is here proposed as a part of the "Maymyo Formation", which includes the Padaukpin Limestone and Wetwin Shale (AYE KO AUNG 2005). Its age has to be extended to include Middle to Upper Devonian (Eifelian to Frasnian) strata. Previously it was known as the "Maymyo Dolomite Formation" (AMOS 1975) and was regarded as a part of the Shan Dolomite Group (Upper Palaeozoic to Lower Mesozoic, BENDER 1983, p. 67). Typical rock types of the Middle Devonian "Maymyo Formation", thin- to medium-bedded dolomitic limestones with relic shallow-water fossils (mainly tabulate corals and bryozoa), black shaly limestones and dark grey shales, are not found in the Myogyi area. The new Devonian unit consists of alternating purplish-red, unindurated calcareous siltstone and medium-bedded, light grey, argillaceous limestone with some ammonoids, gastropods, nautiloids, and ostracods. This Devonian sequence urgently requires further mapping.

The "Plateau Limestone" covering the western part of the area is divided into two units, the Permo-Carboniferous or anthracolithic section of crystalline limestone (LA TOUCHE 1913), now known as the Thitsipin Limestone Formation, and the Permo-Triassic Nwabangyi Dolomite Formation (GARSON et al. 1976). Both are fairly widely distributed in the western part of the area, where they are faulted against each other. Fossils are rare or absent due to intense dolomitization.

**Ammonoids and Age**

Two species of Frasnian ammonoids have been collected. *Beloceras* is represented by incomplete and partly eroded material (Figs. 4-6) that clearly shows the characteristic, complex sutures. At ca. 4 cm whorl height there are 6-7 ventral and umbilical lobes whilst the umbilicus is moderately wide. The angular tip of some saddles can be seen in Figs. 4 and 5. A very recent revision of German and Australian beloceratids (see EICHHOLT & BECKER 2010) showed that representatives of the genus from the type locality of *Belo. tenuistriatum* (ARCHIAC & DE VERNEUIL, 1842), including the lectotype of *Beloceras sagittarium* SANDBERGER & SANDBERGER, 1850, have slightly more outer umbilical than ventral lobes, as in the supposedly different genus *Idiobeloceras*. This important detail has been overlooked in the recent beloceratid revision of KORN et al. (2011). The oldest available species name for forms with seven ventral and umbilical lobes is *Beloceras shidianensis* YANG, 1984, which was previously (e.g., KORN & KLUG 2002) regarded as a subjective synonym of *Belo. tenuistriatum*. The re-validated name *shidianensis* is here applied to the Myanmar specimens and will have to be used for many other beloceratids from Europe, North Africa, the Urals, and Australia.

An incomplete tornoceratid with closed umbilicus (Fig. 4) shows deeply flexured sutures with a relative wide A-lobe and an ascending ventral saddle that is somewhat lower than the saddle on the inner flank. The different height of the two outer saddles is typical for *Tornoceras contractum* GLENISTER (1958) from the Canning Basin of Australia, which, however, has wider inner flank saddles. Hence, a cf. is added to the species identification.

The entry of *Beloceras* defines the Frasnian *Beloceras* Genozone (UD I-H) but the genus ranges right to the Frasnian-Famennian boundary. The umbilical width, the level of sutural complication, as far as it can be discerned from the available photos, and the comparison with the Canning Basin

*Beloceras* succession (BECKER & HOUSE 2009, EICHHOLT & BECKER 2010) suggests that the material came from the interval near the middle/upper Frasnian boundary (UD I-H/I), which correlates with the MN 10/11 zone interval. It is possible that the Myanmar Frasnian ammonoid occurrence is related to the *semichatovae* Transgression at the base of the Upper Frasnian, which allowed a sudden spread of beloceratids in other regions, such as the Ardennes (e.g., HAUSER 1999), eastern Dra Valley of southern Morocco, (BECKER et al. 2004), and Iran (e.g., YAZDI, 1996). The postulated Prototethys route of migration (BECKER 2000) between Western Australia and South China and the branches to Iran, Siberia, Europe, and North Africa was situated near Myanmar and the "Sibumasu terrain". The types of *Belo. shidianense* are from the Baoshan District of western Yunnan, which is rather close to Myanmar. *T. contractum* is restricted to the lower Frasnian to middle part of the middle Frasnian in the Canning Basin (UD I-B to I-F, BECKER & HOUSE 2009) but ranges to the top of MN Zone 9 in the Timan (BECKER et al. 2000). A related tornoceratid with low ventral saddle that is close to the new Myanmar specimen was described by HOUSE & KIRCHGASSER (2008) from the lower part of the upper Frasnian of New York State as *T.* cf. *typum*. Relatives of *T. contractum* with distinctive growth lirae occur abundantly and together with rare *Beloceras* in the basal Upper Frasnian *Carinoceras* Beds of the Dra Valley of southern Morocco (BECKER et al. 2004). Further precision of the age of the ammonoid level can be expected from future conodont investigations and additional collections.

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Fig. 3. *Beloceras shidianense* YANG, 1984

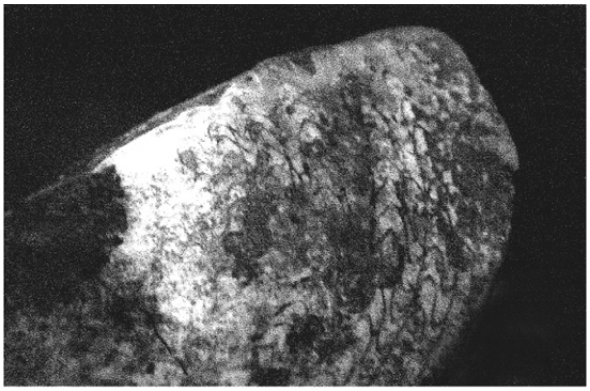
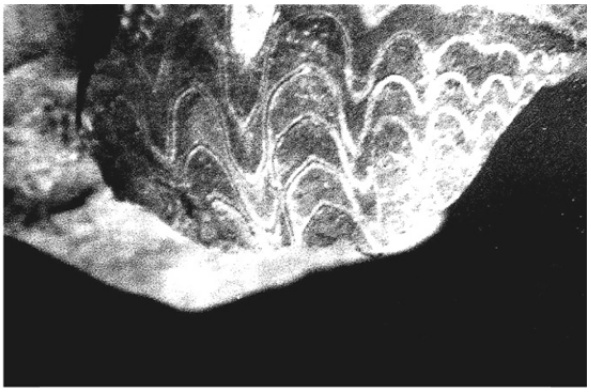


Fig. 4. *Beloceras shidianense* YANG, 1984



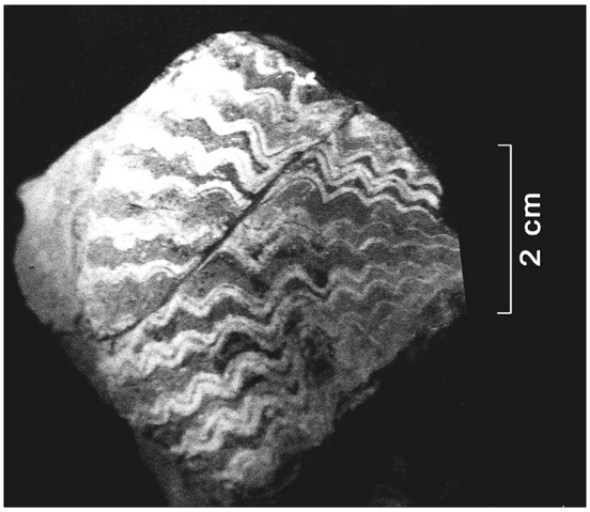



Fig. 4. *Beloceras shidianense* YANG, 1984

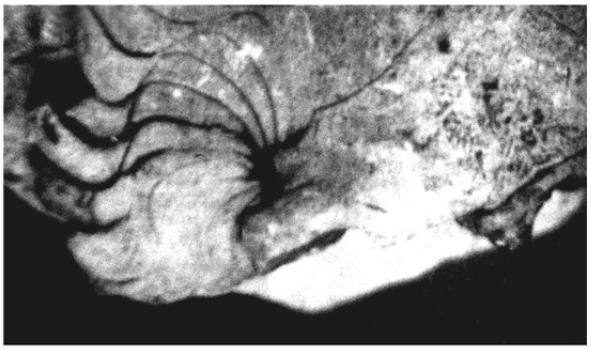


Fig. 5. *Tornoceras* cf. *contractum* GLENISTER, 1958

# THE PRAGIAN–EMSIAN STRATA OF KITAB RESERVE AND BARRANDIAN AREA: THE 2008 SDS RESEARCH TASK ON MAGNETIC SUSCEPTIBILITY LOGS AND THEIR STRATIGRAPHIC CORRELATION BY MEANS OF THE DYNAMIC TIME WARPING TECHNIQUES

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The magnetic susceptibility (MS) sampling from 2008 (SDS meeting in Kitab Reserve) encompassed the entire thickness of the Zinzilban Beds on the left side of the Zinzilban Gorge and continued upwards to the Norbonak Beds. The main goal of the Czech team activity was to compare the new MS data from the Zinzilban and Norbonak beds (see KIM et al. 1978; 2008 for historical and present definitions of these units) with those that have been obtained for the Bohemian Praha and Zlichov formations (relative to units – CHLUPAC 1957; 1981; CHLUPAC et al. 1998). Possibly the most thoroughly studied section in Barrandian area, the Pozar-3 section, was used as an appropriate counterpart for distal correlation of the Zinzilban section (for this Bohemian section, see Slavik et al. 2007; CARLS et al. 2008; KOPTIKOVA et al. 2010a, b; HLADIL et al. 2010).

The MS measurements and processing of data were carried out in the laboratories of the Czech Academy, and the stratigraphic correlation approach applied to this task was based on the dynamic time warping (DTW) alignment techniques (see SAKOE & CHIBA 1978 and/or HLADIL et al. 2010 for the details about the algorithm and conditions). Before computing the best alignments for the best corresponding segments (i.e., vertically and according to their length), the MS data were moderately adjusted in two ways – first, to increase symmetry and thus also adequately expressed resolution between the diamagnetically driven "valleys" and ferri/paramagnetic driven "peaks" and, secondly, also reducing the regional and long-term fluctuating facies bias on the most important records related to n ×1 to n ×10 m (or n ×10 ky to n × 100 ky).

Of course, and in agreement with all recent MS stratigraphic studies (also MS-DTW in HLADIL et al. 2010), the biostratigraphic reasoning was considered to be a necessary step to take in order to roughly pre-define the compared segments. In this point, we used mostly occurrences of dacryoconarids, e.g., the last occurrence data (LODs) of *Nowakia* ex gr. *acuaria* or acme-occurrences of *Guerichina* ex gr. *strangulata*, or an average provided by index of occurrences of graptoloids *Monograptus yukonensis* and *M. aequabilis notoaequabilis*; conodonts can be correlated only indirectly due to large differences in composition of conodont faunas in compared areas (see KIM et al. 2008 vs. CARLS et al. 2008 for the critical analyses and data in the field of related biostratigraphy). However, to the contrary to simple biostratigraphic decision on compared segments (made in many MS stratigraphic papers), we used a novelty routine where the various lengths and various positions of compared segments were used until the best DTW alignment (MS-DTW stratigraphic correlation) was found. In resulting output, the best DTW solution was found for the segments Zinzilban 0 – 150.6 m and Pozar-3 88.9 – 121.6 m (Fig. 1).

The results show a surprisingly great correspondence of MS pattern successions in both sections, even in spite of a great palaeodistance between these two basins and different palaeogeographic/ palaeoclimatic positions. Ultimately, it must be considered that Zinzilban was, most likely, situated on northern hemisphere, at about 10° palaeolatitude whilst the Barrandian was on southern hemisphere, at about 15° (?30°) palaeolatitude, according to palaeomagnetic (?and/or palaeoclimatic) data where the latter is being inferred from presence of prevailing "westerlies" winds – HLADIL & BEK 1999). According to the preliminary designed DTW scheme, in this report, the correlation of the basal Emsian GSSP (Zinzilban) points to 88.9 m mark in the Pozar-3 section, i.e., to the lower part of the Lodenice Limestone (and with lateral facies change across the Devonian "Prague basins" to uppermost part of Koneprusy Limestone). The upper two-thirds of the Praha Formation (~ original Pragian before the GSSP approval) remain now in the Emsian, and it is worth of note that it is a really substantial part of the previously perceived "classical Pragian".

The MS-DTW mid-level for the Bohemian anoxic "graptolite event" (Pozar-3, 113.2 m – see also HLADIL et al. 1996 for the local correlation details) is connected to Zinzilban very close (3 m) below the base of the Norbonak Beds. According to KIM et al. (2008), this base lies at 110-m original metre tagging point. Similarly, many other details in MS pattern successions can be correlated (see Fig. 1 for connection of all points in both sections), and we assume that it is not only an exceptional case of this unique long-distance MS-DTW correlation, but also other Pragian–Emsian sections of the world may, to

certain degree, contain these MS stratigraphic patterns/succession features.

Publication of the announced study:
Currently a detailed original paper on this subject is being prepared to be submitted to the journal.

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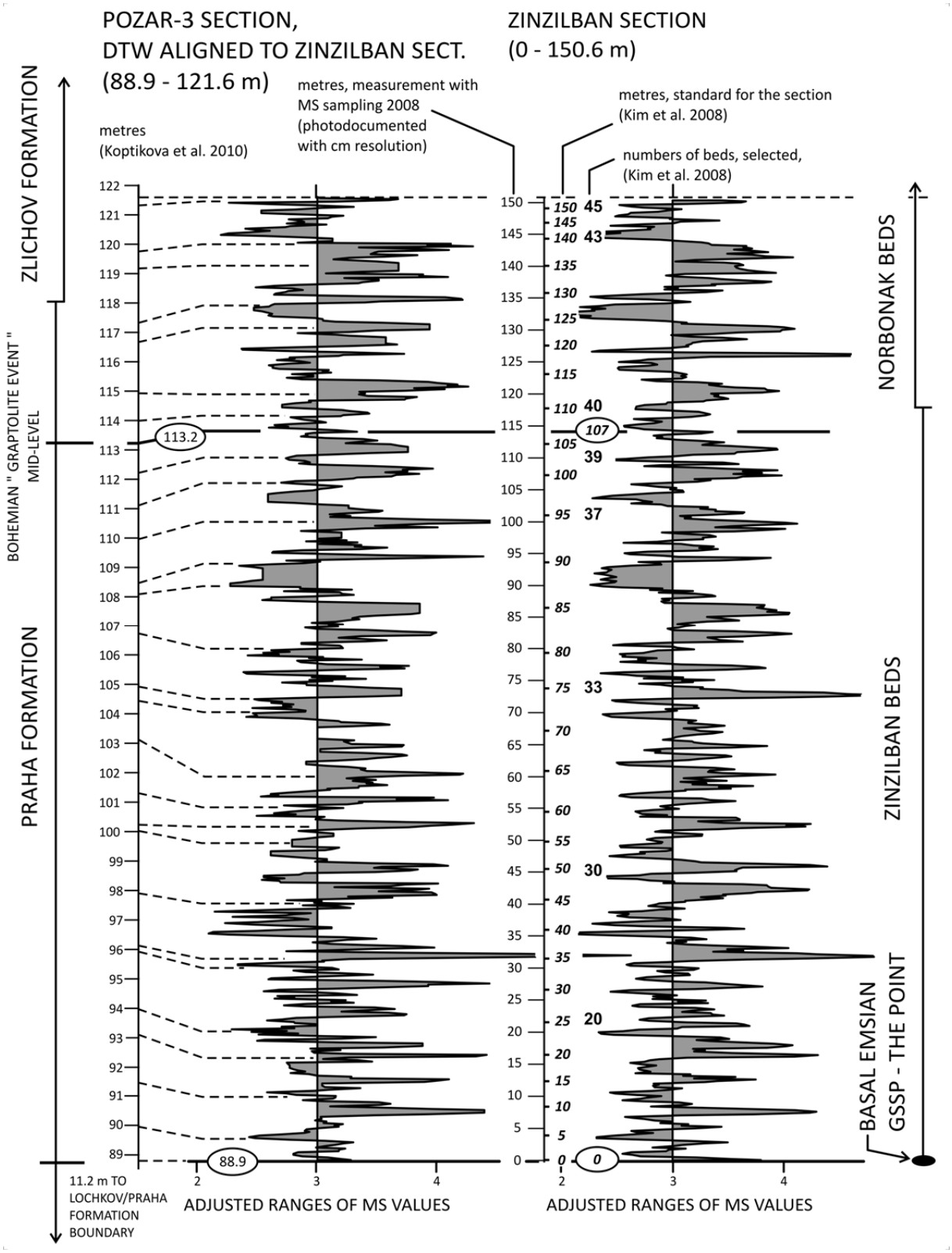
Fig. 1. The DTW alignment (stratigraphic correlation) of MS logs of Zinzilban and Pozar-3 sections, Uzbekistan an Czech republic, respectively. In this figure, the data are shown as curves slightly smoothed by moving average (5, p.t), highlighted using a mid-level of adjusted data, and the positive MS shifts point to right side.



# CONODONT REPORT ON THE ZINZILBAN GORGE EMSIAN GSSP AND UP

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During the past SDS meeting in the Kitab Reserve (Uzbekistan) in 2008, the SDS reached an agreement regarding the redefinition of the base of the Emsian. We need to mention first that in redefining formal boundaries, tradition shall be respected as much as possible. Accordingly, it results that the current *kitabicus* boundary is located at a very low position, within the traditional Pragian (CARLS & VALENZUELA-Ríos, 2007; CARLS *et al*. 2008) and it cannot be tied to the beginning of the Emsian in the German traditional sense. After many contrasting opinions, the following main agreements were reached: 1) To search for a new boundary for the base of the Emsian, which will be located in the Zinzilban Gorge, at a position close to the entry of the *excavatus* group and specially, the entry of a particular taxon within the *excavatus* group; this taxon bears semi-crossed ridges on the tongue and it has been cited at about 114 m above the GSSP in Zinzilban (YOLKIN *et al*., 1994: 148). 2) To maintain the *kitabicus* boundary as a reference marker; it can be a used for subdividing the Pragian. Initially it was thought to be used as the index for a two-fold subdivision of the Pragian (upper and lower) but more work needs to be done.

After this agreement, a sample campaign was scheduled and the three of us, helped by our lovely friend Prof. Peter CARLS, measured and sampled in detail the supposed interval that needed to be investigated in detail; this interval measures about 12 m and comprises from base of Bed 39/1 to base of Bed 41/1 of the Zinzilban Gorge GSSP section (YOLKIN *et al*., 2008). We collected 15 samples from this interval and divided each sample into three parts to be processed and studied at our respective laboratories in Novosibirsk, Valencia and Prague. The results are rather disappointing regarding the find of the potential new index for the base of the Emsian. In fact, only a few *Polygnathus* specimens have been recovered from all of these samples: 1 undetermined juvenile, and a fragment that can be related to *Pol. excavatus* from sample 40/1; 1 *Pol. pannonicus*, 1 *Pol.* cf. *pannonicus* (anterior is broken) and undetermined fragments from Bed 40/10. All other beds didn't yield any *Polygnathus*. Besides *Polygnathus*, all beds, but 40/12, contain specimens of a spathognathodontid genus close to *Criteriognathus* (more than 150 determinable specimens). Coniform elements (*Belodella*, *Panderodus*, *Pseudooneotodus*) are common, but not as much as the Spathognathodontidae. Three beds (39/2; 40/2 and 40/4) also contain a few specimens of *Pandorinellina* including two species, *Pa. exigua* and *Pa. philipi*. It is also noticeable that not any single remain of icriodids has been retrieved from the samples.

*Pol. pannonicus* enters in Zinzilban Gorge section in Bed 12/3 and has a discontinuous range up to Bed 21/7; then, the range is continuous from Bed 26/1 to Bed 40/6 (Yolkin *et al*. 2008). In the same paper, the entry of *Pol. excavatus* is registered in Bed 40/3 and ranges up to Bed 45/17. Consequently, our current records of *Po. pannonicus* would correspond to its upper range and, if confirmed, the record of *Po. excavatus* in Bed 40/1 will lower the entry of the taxon by about 1 m. As the intended (preferred) conodont index for the redefined Emsian GSSP enters about 22 m above Bed 40/3 (= base of Middle *excavatus* Zone, according to YOLKIN *et al*., 1994), we need to continue our detailed sampling up and try to find the morphological sequence leading from *Po. excavatus* with interrupted ridges on the tongue to *Po. excavatus* with semicrossed ridges (= *Po. excavatus* 114 of CARLS & VALENZUELA-Ríos, 2002). Moreover, by means of correlation of different measurements from 1978 to 2008 in Zinzilban Gorge section, this level shall be located around Bed 42/7.

In brief, the sampling carried out in the Zinzilban Gorge section in 2008 shows that this part of the section is not appropriate for placing the new basal Emsian GSSP, and that the redefined boundary shall be located even higher (probably within the set of beds between marker Beds 42 and 43. Therefore, we suggest that in exploring the potential of this interval for relocating the GSSP, a new sampling campaign shall be scheduled in the near future.

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# AMMONOID AND FORAMINIFERAL FAUNAS IN THE FAMENNIAN OF WESTERN KAZAKHSTAN: RESEARCH SUMMARY AND SEDIMENTARY SETTINGS

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**Abstract.** The succession of the Middle-Upper Famennian ammonoid zones (*Cheiloceras, Prolobites-Platyclymenia, Clymenia-Gonioclymenia* and *Kalloclymenia-Wocklumeria*) and four foraminiferal zones *Parathurammina, Eoquasiendothyra, Eoendothyra* and *Quasiendothyra*) and their correlation allowed dating of the Famennian carbonate sedimentation and gave insight into evolutionary pathways in both groups. We were able to date the main stages of the evolution of the ramp that was controlled by eustatic sea-level fluctuations and local tectonics and examined microfacies across the entire area. Three facial bands (inner ramp, mid-ramp, and outer ramp) display features of an idealized carbonate ramp complicated by regional tectonics. Famennian ammonoids are abundant and are found in association with foraminifers in the deep ramp microbioclastic wakestones-packstones, in highly condensed sections. High diversity of ammonoids throughout the Middle-Upper Famennian and the presence of many endemics suggest that this area was a center of their mainly northward distribution along the south-eastern shelf of Baltica, while the relative abundances of foraminifers display a gradual eastward decrease, suggesting depth-controlled distribution.

## 1. Introduction

The Famennian ammonoid and foraminiferal faunas of Western Kazakhstan are restricted to different zones of the meridional band on the eastern margin of the Volga-Ural carbonate platform. Ammonoids are found in the deeper eastern part of this band (outer shelf zone), while most foraminifers are confined to the shallower mid-shelf western zone. Presently, deeper shelf sediments are exposed in the Aktyubinsk Region (southern fringes of the Urals bordering with the Mugodzhary Mountains, Kiya Formation), whereas the shallow marine carbonates with foraminifers lie at depths of 4500-5300 m in the Peri-Caspian Region, where they are known from many deep boreholes drilled for oil and gas exploration (Tengiz, Karachaganak, Pavlovskaya, Baktygaryn, Rozhkovskaya and other oil fields) (Fig. 1). Famennian foraminifers of the Peri-Caspian Basin are very abundant and provide a reliable framework for oil and gas exploration (AKHMETSHINA & GIBSHMAN, 2007). Ammonoids of Western Kazakhstan are very diverse and abundant. These ammonoid faunas were extensively studied taxonomically by KIND (1944), NALIVKINA (1953), BOGOSLOVSKY (1969, 1971, 1981), NIKOLAEVA & BOGOSLOVSKY (2005) and others. Although only few of the foraminifers are also found in the southeastern zones in the ammonoid-bearing sections, they are sufficient for correlation of the foraminiferal and ammonoid zonations. Joint research of a team including ammonoid, foraminiferal, and conodont workers (2001-present) has for the first time allowed the correlation of the two successions. Preliminary correlations were published by AKMETSHINA et al. (2002, 2004).

## 2. Ammonoid zonation

Ammonoid genozones *Cheiloceras*, *Prolobites-Platyclymenia*, *Clymenia-Gonio-*

*clymenia* and *Kalloclymenia-Wocklumeria* are recognized in an uninterrupted succession in the Mugodzhary Mountains (NIKOLAEVA & BOGOSLOVSKY, 2005). The succession of species within these genozones is somewhat similar to that previously recognized in Germany and Morocco (see BECKER, 1993; BECKER & HOUSE, 2000; BECKER et al., 2003 for references) although there are evident regional differences. Like in many cases with Paleozoic ammonoid faunas, the correlation was shown to be the most productive at the supraspecific level, while at the species level the disparity is too high. Ammonoid assemblages are highly diverse throughout the Middle-Upper, suggesting that this area was a center of their mainly northward distribution along the shelf of Baltica, while the relative abundances of foraminifers display a gradual eastward decrease, suggesting depth-controlled distribution.

**2.1. *Cheiloceras* Genozone**

This genozone was identified in Araltobe and a number of other sections. This assemblage is diverse and contains many species of goniatitids (mostly *Cheiloceras* and *Dimeroceras*). The content of this genozone and major localities in Western Kazakhstan are described in detail by BOGOSLOVSKY (1969, 1971).

**2.2. Prolobites-Platyclymenia Genozone**

The horizons with *Pseudoclymenia* constitute the basal part of the *Prolobites-Platyclymenia* Genozone. They are subdivided into two species zones (*dorsatum* and *pseudogoniatites*), initially established in Germany and later in Morocco.

**2.2.1.** The ***"dorsatum"* Zone (III- A)** is recognized along the Bakai and Araltobe rivers and in the Karadzhar Basin (Shily-Sai 1 = section 20, beds 1-2). The assemblage includes *Pernoceras fundiferum, Sporadoceras equale* and other species.

**2.2.2. The *pseudogoniatites* Zone (III-B)** is present along the Bakai and Araltobe Rivers, and in the Shily-Sai 1 (= section 20, Beds 3-14) and Shily-Sai 2 localities (= section 21, Beds 1-7). The assemblage contains *Pseudoclymenia pseudogoniatites, Sporadoceras* sp., *Enkebergoceras clarkei, Maeneceras rotundum, Araneites falcatus, Dimeroceras aktubense, Falcitornoceras bilobatum*, etc. This assemblage is also identified in the Chelyabinsk Region (South Urals) (PERNA, 1914) and is very similar to the assemblage of the *pseudogoniatites* Zone in the Subvariscan region.

**2.2.3.** The ***delphinus* Zone (III-C)** is recognized in the Shily-Sai 2 (Beds 8-12) and Ornektotas-sai (section 22, Beds 1-9) localities and along the Araltobe river. The assemblage is dominated by *Prolobites (P. delphinus, Aurilobites auriformis,* etc.), includes many sporadoceratids (*S. muensteri, Enk. clarkei, Enk. lentiforme*, etc.). Of clymeniids, there are *Rectoclymenia roemeri, Pricella stuckenbergi, P. glabra, P. tuberculata, Genuclymenia angelini, Platyclymenia pompeckii, Cyrtoclymenia frechi*, etc.). On the whole the assemblage is similar to those from Germany and Poland, but different from the Moroccan and Algerian assemblages, where typical *Prolobites* are absent. We were not able to observe the successive appearances of the earliest clymeniids similar to those reported from the Enken-Berg Section, Germany, where *Cyrtoclymenia frechi* (TOKARENKO) and *Pricella stuckenbergi* (TOKARENKO) are the first to appear in the succession followed by *Genuclymenia*, *Stenoclymenia,* and early *Platyclymenia*.

**2.2.4.** The ***annulata* Zone (IV- A)** is recognized in the Karadzhar Basin (Shily-Sai 2, Bed 13), at Ornektotas-Sai (Bed 10), in section Kiya 1 (200 m from the source, Beds 1-3) and in section Kiya 2 (900 m downstream of the Grebeshok rock). The assemblage contains *Prionoceras divisum, Platyclymenia annulata, P. placida, Rectoclymenia semilyrata, "Falciclymenia" uralica, "F." plicata*, *Pleuroclymenia kasachstanica, Uraloclymenia volkovi,* etc. In general, the *annulata* Zone shows the diversification of *Platyclymenia* and *Falciclymenia* and the disappearance of *Genuclymenia* and *Pricella*, while *Prolobites* and *Rectoclymenia* lost their dominance. Among goniatitids, *Prionoceras, Falcitornoceras, Sporadoceras*, and *"Maeneceras"* (possibly *Erfoudites)* are dominant. In the South Urals and Kazakhstan this zone occurs very widely (ammonoid communities of this age lived throughout the western and eastern realms of the Uralian Ocean, from the north to the south). The assemblage of Western Kazakhstan is most similar to that of Germany, but this is just a reflection of a general situation of world-wide likeness of ammonoid faunas of this age noted by many authors. Compared to the assemblages from other regions, *Rectoclymenia* and *"Falciclymenia"* are far more diverse.

**2.2.5.** The ***dunkeri* Zone (IV-B)** is present in the Shily 2 (Bed 14), Kiya 1 and Kizil-Dzhal sections (left bank of the Kiarakty River, Kazakhstan). The assemblage contains most species of the preceding zone supplemented by *Protoxyclymenia dubia*. *P. intermedia* is probably the earliest *Protoxyclymenia* in the Aktyubinsk Region, while *P. rotundata* is the earliest *Protoxyclymenia* in the Orenburg region.

**2.2.6.** The ***serpentina* Zone (IV-C)** is perhaps present in the Kiya 1 section (at least *Protoxyclymenia pseudoserpentina* is recorded from here). Because of its transitional assemblage, the position of this zone in the Famennian scale and its correlation are debatable.

**2.3. *Clymenia-Gonioclymenia* Genozone**

The main feature of this genozone is a change from the platyclymeniid to clymeniid assemblages and a wide distribution of the genus *Clymenia*. It is interesting that the genus *Clymenia* is worldwide represented by only a few species, but its type species *Clymenia laevigata* occurs in great abundance (we observed hundreds shells in Western Kazakhstan). The assemblage contains newly appearing goniatitids, *Imitoceras, Discoclymenia,* and *Alpinites*, while *Sporadoceras* and *Falcitornoceras* continued from the preceding epoch. In the Subvariscan region this genozone contains three species zones: *laevigata*, *ornata*, and *piriformis*. Two of these zones are traced in Western Kazakhstan.

**2.3.1.** The ***laevigata* Zone (V-A)** is recognized in the Kiya 1 section (Beds 4-6) and contains *Clymenia laevigata, Progonioclymenia* aff. *acuticostata, Leviclymenia levis, Pachyclymenia intermedia, Cyrtoclymenia angustiseptata*, *Cymaclymenia striata, Mimitoceras varicosum, Discoclymenia cucullata* (BUCH), etc. This zone in Germany is subdivided into two subzones (*binodosus* and *laevigata* s.s) (BECKER, 1993; BECKER & HOUSE, 2000), which are not recognized as separate units in Western Kazakhstan. The equivalents of this zone in Morocco (BECKER et al. 2002) are recognized as the *Endosiphonites muensteri* and *Gonioclymenia subcarinata* subzones, which are also not recognized as separate units in Western Kazakhstan.

**2.3.2. *ornata* Zone (V-B)** (Kiya 1 - Bed ?6). This zone contains *Ornatoclymenia ornata, Gonioclymenia hoevelensis, Sphenoclymenia maxima, Biloclymenia dubia, Progonioclymenia ventroplana, Protoxyclymenia carinata*, etc. A large assemblage of goniatitids is also present (*Discoclymenia, Posttornoceras, Alpinites, Mimimitoceras*). This zone is characterized by the appearance of coarsely ornamented gonioclymeniids and cymaclymeniids, including *Ornatoclymenia ornata*. This level in some places show the presence of the first species of *Kosmoclymenia* (with smooth, compressed, evolute, typically "clymeniid-like" shells).

**2.3.4. *frechi-corpulenta* Zone (V-C).** This zone is present at Kiya 1, Bed 7, where it contains *Kalloclymenia frechi, K. subarmata, Pachyclymenia sinuconstricta, Kiaclymenia uralica, Gonioclymenia corpulenta,* etc. The zone corresponds to the *Kalloclymenia* Zone and possibly to the *piriformis* Zone (KORN, 1999). This correlation is only provisional because the *piriformis* Zone is recognized only in Germany. The *frechi-corpulenta* Zone in Western Kazakhstan contains *Kalloclymenia frechi*, *Pachyclymenia sinuconstricta*, *Kiaclymenia uralica*, *Kalloclymenia subarmata*, *"K." pachydiscus*, *Otoclymenia* aff. *uhligi*, and *Gonioclymenia corpulenta*.

**2.4. *Kalloclymenia-Wocklumeria* Genozone**

In this genozone clymeniids of the preceding genozone (*Clymenia, Progonioclymenia, Gonioclymenia*) disappear to become replaced by diverse *Kalloclymenia* and *Sellaclymenia*, slightly later supplemented by *Glatziella, Postglatziella, Wocklumeria, Parawocklumeria,* etc. Goniatitids are dominated by *Rectimitoceras* and *Mimimitoceras*, later supplemented by *Acutimitoceras* and other imitoceratids. Certainly, the beds synchronous with the *sublaevis, lens* and *endogona* zones are present in the sequences of Western Kazakhstan, but because sections are very condensed, these zones are still difficult to identify. Therefore we provisionally mark the interval of these three zones as "not recognized".

**2.4.1. *nucleus* Zone (VI-C2).** The *nucleus* Zone is defined by the appearance of *Balvia (Mayeneoceras) nucleus* (SCHMIDT) in the Kiya 1 section (upper part of Bed 9). This zone was originally recognized in Morocco (BECKER et al., 2002) and corresponds to the *paradoxa* Zone, established in the Rhenish Massif (Germany) based on the first entry of *Parawocklumeria paradoxa*. This zone obviously has a wide

geographical distribution (Germany, Morocco, Poland, Great Britain, and Austria; etc. and now in western Kazakhstan).

**2.4.2. *sphaeroides* Zone (VI-D).** The *sphaeroides* Zone in Western Kazakhstan (Kiya 1 section, upper part of Bed 10) contains *Wocklumeria sphaeroides*, *Glatziella glaucopis*, *Synwocklumeria kiensis*, *S. elata*, etc.

**3. Foraminiferal Zonation**

**3.1. *Parathurammina dagmarae* Zone.** The base of the zone is drawn based on the first appearance of the index species (fixed in Karachaganak). In addition the assemblage contains *Parathurammina breviradiosa, P. obnata, P. suleimanovi, P. scitula, Caligella* sp.*, Radiosphaera irregularis, R. basilica, Archaesphaera* spp. The same association is also found at Baktygaryn and in the Shily-Sai 1 (Beds 1-2) and Ornektotas-Sai sections.

**3.2. *Eoquasiendothyra bella* Zone.** The base is drawn based on the first appearance of the index species (Pavlovskaya borehole) or based on the appearance of *Septaglomospiranella* sp. (Karachaganak 15, core 5535-28 m). In addition, the assemblage contains *Septatournayella rauserae*, *Septaglomospiranella compressa*, *S. primaeva, Parathurammina devonica*. The assemblage is also found at Shily-Sai 1 and is probably present at Berchogur. It is missing in the Baktygaryn and Rozhkovskaya sections.

**3.3. *Eoendothyra communis* Zone.** The base is defined by the appearance of the index species (Pavlovskaya, Karachaganak). The species *Eoendothyra turbida, E. venusts, E. regularis, Eoquasiendothyra baidjansaica, Laxoendothyra concavacamerata,* and *Bisphaera malevkensis* appear in succession. *Parathurammina dagmarae* does not continue into this zone. The zone is present at Pavlovskaya, has low diversity at Karachaganak, is possibly present in the Kiya 1 Section and is missing in the Karadzhar, Baktygaryn and Rozhkovskaya sections.

**3.4. *Quasiendothyra kobeitusana* Zone.** The base is defined by the appearance of the index species (Pavlovskaya). Its upper boundary coincides with the D-C boundary, but practically recognized by the disappearance of the genera *Eoquasiendothyra, Eoendothyra* and *Quasiendothyra*. New species *Tournayellina primitiva, Quasiendothyra dentata*, and others appear in a succession within the zone. This zone has a wide geographical distribution and is productive in the Tengiz Oil Field. In the exposed Famennian successions in the east of the region (ammonoid-bearing successions) and at Baktygaryn this zone is not present.

**4. Correlation of the ammonoid and foraminiferal zonations**

The proposed correlation is presented in Tab. 1. The conodonts are identified by L.Z. AKHMETSHINA (AKHMETSHINA et al., 2002). All correlations are based on the co-occurrence of ammonoids and foraminifers in the sections Shily-Sai 1, Shily-Sai 2, Ornektotas-Sai and Kiya 1.

**5. Microfacies and paleogeographical implications**

The Famennian basin of Western Kazakhstan was situated on the shelf that was subjected to a progressive ??decrease in the Famennian due to the collision of the Baltica and Kazakhstania continents and subduction of the Magnitogorsk Island Arc. The complex tectonics of this area resulted in the development of unstable short-lived environments and variable communities influenced by changing depths, the amount and quantity of sedimentary material influx, and volcanism. Ammonoids and foraminifers gradually but consistently declined towards the end of the Famennian. This was unlikely to have been connected solely to global eustatic fluctuations, but rather to the local tectonic events followed by the changes in the sedimentary settings and it was probably related to the general reduction of the shelf due to the progressive collision of Baltica, Kazakhstania and Siberia.

**5.1. Inner lagoon, inner shelf.** Microfacies are represented by algal microbioclastic wackestone/packstone or wackestone with fragments of pelmatozoans and brachiopods, and with the foraminifers *Archaesphaera* and representatives of the Kamaenidae. In general these are settings of low energy, almost complete absence of open sea organisms such as corals, crinoids, and the predominance of small foraminifers and algae and *Solenopora* sp. These settings are found in the northwest of the basin in the boreholes Pavlovskaya, Rozhkovskaya and Koshinskaya - on the very margin of east European epicontinental basin.

**5.2. Outer lagoon, inner shelf.** Microfacies are represented by algal boundstone formed by

Kamaenidae in life position, or by remains of organisms, including *Archaesphaera* and relicts of bioclasts. Many small bioclasts and large peloids are included in the matrix. The lithology suggests the organic buildups formed on the side of the outer lagoon by algal boundstone and *Girvanella* stromatolites, typical of the bioherms of the Urals.

**5. 3. Middle shelf, calcareous dunes facies.** Microfacies include grainstones with carbonate, mostly sparitic cement, bioclasts, and peloids. Bioclasts include foraminifers Bisphaera malevkensis*, Eoquasiendothyra baidjansaica, Eoendothyra communis, Cribrosphaeroides* sp., algae, stromatoporoids, echionoids and other organisms with massive calcareous skeleton. Some bioclasts are covered by thin layer of micrite, while uncovered bioclasts dominate. The peloids are of various sizes and shape, some of them rounded.

**5.4. Middle shelf, biohermal mound/inter-mound facies.** Microfacies are represented by boundstones, with clusters of organic mud with *Archaesphaera* and *Calcisphera*. The cement is radial-fibrous and sparitic (approximately equal proportions). The thin sections show stromatolite-like structures, possibly of bacterial origin. A similar facies is identified by WILSON as calcispheran wackestone. This facies is for the first time found in Karachaganak: Wackestone with *Baituganella* sp. and *Calcisphaera*. The lithology suggests microbial mounds, where abundant sparitic and radial-fibrous cement facilitates the preservation of organic mud and lithification in the high-energy zones of the middle ramp.

**5. 5. Outer shelf, lower slope of the carbonate shelf and transition into basin**. Microfacies are represented by microbioclastic wackestone and packstone with rare *Archaesphaera*, *Vicinesphaera*, relics of re-crystallized pelmatozoans, bioclasts included in heterogeneous micrite. Foraminifers include *Parathurammina* sp., and *Calcisphaera* sp. in association with numerous thin-shelled ostracodes, sponge spicules, relics of pelmatozoans, and algae. The rock contains numerous remains of conodonts and ammonoids. The outer shelf settings are confirmed for Baktygaryn, basins of Karadzhar and Kiya, and for the outcrops of Famennian clayey carbonates of the Kiya Formation.

## 6. Conclusions

**6.1.** Famennian ammonoids and foraminifers of Western Kazakhstan inhabited the epicontinental marginal basin on the south-eastern slope of Baltica, at the edge of the Volga-Ural carbonate platform. From the middle of the *Clymenia-Gonioclymenia* Zone ammonoids began declining. This decline was apparently related to the reduction of the shelf as a result of the progressive collision of Baltica and Kazakhstania and profound changes in the environment.

**6.2.** Three facial zones with different palaeodepths and energies are recognized based on the lithology of the microfacies and fossils: inner shelf/ramp (Pavlovskaya-3, Rozhkovskaya-3, Chinarevskaya-2), median shelf (Tengiz, Karachaganak), and deep shelf to basinal slope (Baktygarin-1, Karadzhar, Kiya). Organic buildups in the middle shelf became vast hydrocarbon reservoirs.

**6.3.** The correlation of the ammonoid and foraminiferal zones allowed dating of the main stages of the ramp evolution.

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**Fig. 1.** Map showing Famennian ammonoid and foraminiferal localities in Western Kazakhstan. Ammonoid localities are in the shaded area and at the eastern termination of the double-sided arrow. Major foraminiferal localities are at the western termination of the double-sided arrow in the Peri-Caspian Region.

| Foraminifera | Conodonta | Ammonoidea | |
|---|---|---|---|
| | | Genozones | Zones |
| *Q. kobeitusana* | | *Kalloclymenia-Wocklumeria* | zones not recognized |
| | | | *sphaeroides* |
| | | | *paradoxa* |
| | *P. expansa* | | zones not recognized |
| *E. communis* | | *Clymenia-Gonioclymenia* | *frechi-corpulenta* |
| | | | *ornata* |
| | | | *laevigata* |
| | | *Prolobites-Platyclymenia* | *serpentina* |
| | *P. postera* | | *dunkeri* |
| | | | *annulata* |
| *Eq. bella* | *P. trachytera* | | *delphinus* |
| | | | *pseudogoniatites* |
| | *P. marginifera* | | *"dorsatum"* |
| *P. dagmarae* | | *Cheiloceras* | |
| | *P. rhomboidea* | | |
| | *P. crepida* | | |

**Fig. 2.** Correlation of ammonoid, foraminiferal, and conodonts zones (AKHMETSHINA et al., 2004).

## MEETINGS

### GSA, NORTHEASTERN (46th ANNUAL) AND NORTH-CENTRAL (45th ANNUAL JOINT MEETING, 20-22nd March 2011,PITTSBURG, PENNSYLVANIA

An overview of important Devonian presentations to be given within different symposia.

15-4 OVER, D.J., SULLIVAN, N., PETEYA, J., MINJIN, C., MYROW, P. & SOJA, C.M.: Conodonts from the Tsagaanhaalga Formation (Emsian?-Eifelian) and the Tentaculite Member of the Govialtai Formation (Eifelian-Givetian), Tsakhir Well Section, Govi Altai Terrane, Southern Mongolia.

29-1 ETTENSOHN, F.R.: Acadian/Neoacadian tectonic framework for Devonian-Mississippian sedimentation in the Appalachian Foreland Basin.

29-3 PASHIN, J.C.: Stratigraphic and depositional framework of Devonian shale in the Black Warrior Basin and Appalachian Thrust Belt of Alabama.

29-4 CECIL, C.B.: Eolian dust and the origin of Devonian chert in Eastern North America.

29-5 WITZKE, B.J.: Estimating magnitudes of sea-level changes associated with Middle and Upper Devonian sequences in the Iowa Area.

29-6 MATTESON, D.K. & EBERT, J.R.: Where does the Devonian begin in the Appalachian standard succession? Recognition of the Silurian – Devonian Boundary Event in the Helderberg Group of New York State.

29-7 BROCKE, R., BERKYOVA, S., FATKA, O., LINDEMANN, R., SCHINDLER, E. & VER STRAETEN, C.A.: The Early Mid-Devonian Choteč Event: Do palynomorphs have the potential for long-distance correlations?

29-8 LINDEMANN, R., VER STRAETEN, C.A. & SCHINDLER, E.: Dacryoconarid faunas of the basal Eifelian to Chotec Bioevent interval in the north and central Appalachian Basin.

29-9 BARTHOLOMEW, A. & SCHRAMM, T.J.: Timing of faunal turnover during the Middle Devonian Kacak Bioevent in the eastern Appalachian Basin.

30-1 BOYLE, J.T., RYAN, M.J., JACKSON, G. & ZELINSKI, D.: New information on *Titanichthys* (Placodermi: Arthrodira) from the Cleveland Shale Member of the Ohio Shale Formation (Famennian) of Ohio, U.S.A.

30-2 DAESCHLER, E.B.: The first Devonian record of a whatcheerid tetrapod (Catskill Formation: Upper Devonian).

30-3 JAMES, J.M., CODER, R.L. & CIAMPAGLIO, C.: Marine vertebrate remains from a Late-Middle Devonian bone bed at the Deleware Limestone/Ohio Shale boundary, Logan County, Ohio and Little Hardwick Creek in Vaughn's Mill, Kentucky.

53-1 ZAMBITO, J.J., JOACHIMSKI, M., BAIRD, G., BRETT, C.E., DAVIS, W. E. & OVER, D. J. : Preliminary analysis of conodont apatite oxygen isotope ratios through the Late Givetian global Taghanic Biocrisis in the Northern Appalachian Basin.

53-2 MINTZ, J.S, DRIESE, S.G., HARLOW, R.H., WRIGHT, T.C. & ATCHLEY, S.: Middle Devonian landscapes, climates and the correlation of continental strata in the northern Appalachian Basin.

53-3 WILSON, R.D. & SCHIEBER, J.: The significance of erosional features found in the Middle Devonian Geneseo Shale.

53-4 ROSSBACH, T.: Paleoenvironmental signals relating to recognition of the Late Devonian Frasnian-Famennian stage boundary in the Foreknobs Formation of Virginia and West Virginia.

53-5 BREZINSKI, D.K.: Evidence for fluvial incision near the Frasnian-Famennian Contact (Late Devonian) in the central Appalachian Basin of Maryland.

53-6 WILCOX, E. & BOYER, D.: How anoxic is the Kellwasser Event in New York State? Evidence from paleontological and geochemical proxies.

53-7 BUSH, A.M, DIRENZO, G.V., CHRISTIE, M. & TUITE, M.L. jr.: A stratigraphic study of benthic paleoecology from the Frasnian Famennian Transition (Late Devonian) in New York

53-8 ETTENSOHN, F.R., LIERMAN, R.T., MASON, C.E. & CLAYTON, G.: Possible relationships between Late Devonian alpine glaciation and black shales.

63-1 CRAMER, B.D., DAY, J. E., SALTZMAN, M.R. & WITZKE, B.J.: The Uppermost Famennian Hangenberg Excursion in North America and the search for the base of the Carboniferous System.

63-2 DAY, J., WITZKE, B.J., & ROWE, H.: Development of an epeiric subtropical paleoclimate record from western Euramerica: Late Frasnian - Earliest Tournasian stable carbon isotope record from the Yellow Spring - New Albany Groups of the Northwestern Illinois Basin.

63-3 LIERMAN, R.T., CLAYTON, G., ETTENSOHN, F.R, MASON, C. & ANDERSON, E.D.: Evidence for late Devonian (Fammenian) alpine glaciation in the Appalachian Basin: A granitic lonestone from Upper Devonian black shales in Northeastern Kentucky.

63-4 AVKHIMOVICH, V.I., RICHARDSON, J.B. & WOODROW, D. L.: Spore zonation through the Late Devonian (Strunian) Cattaraugus and Oswayo Formations of New York and the Huntley Mountain Formation of Pennsylvania: A basis for paleoclimatic interpretation.

63-5 BAIRD, G.C., HANNIBAL, J.T., CARR, R.K., MCKENZIE, S.C. & RALPH, M.J.: End-Devonian successions in Northwest Pennsylvania and Northern Ohio compared: Review of potential unit relationships to the Hangenberg Bioevent.

63-6 SALLAN, L., KAMMER, T.W. , AUSICH, W., COOK, L.A.: The impact of successive Devonian extinctions on crinoid and vertebrate trophic interactions and diversity.

63-7 RETALLACK, G.J.: Devonian trees of New York and Pennsylvania: Causes or consequences of black shales and biotic crises?

63-8 ELLWOOD, B., TOMKIN, J., HASSANI, A., BULTYNCK; P. & WEDDIGE, K.: A climate-driven model and development of a floating point time scale for the entire Middle Devonian Eifelian stage using magnetostratigraphy susceptibility as a climate proxy.

63-9 GOUWY, S. & MACLEOD, K.G.: Middle Devonian conodont biostratigraphy and stable oxygen isotopes around the Eifelian-Givetian Boundary of the Col des Tribes section (Montagne Noire, France).

63-10 NAGEL-MYERS, J. & DIETL, G.: Introducing a „community module“ approach to test the stability of ecological interactions in the Middle Devonian Hamilton Fauna.

63-11 TUITE, M.L. jr & MACKO, S.: The paradox of $pO_2$ in the Middle and Late Devonian.

68-1 VAN STAAL: C. R., BARR, S.M., WHALEN, J.B. & WHITE, C.E.: Constraints on the tectonic setting of Devonian magmatism and orogenesis.

68-2 WALSH, G.J., ALEINIKOFF, J.N., WINTSCH, R. & AYUSO, R.A.: Origin of the Quinebaug-Marlboro Belt in Southeastern New England.

68-3 WINTSCH, R., YI, K. & DORAN, M.J.: Evidence for a Late Acadian Arrival of the extreme Western Margin of Avalon Terrane.

68-4 PROCTOR, B. MCALEER, R.J., KUNK, M.J. & WINTSCH, R.P.: New structural findings and $^{40}Ar/^{39}Ar$ white mica ages in the classic Barrovian Sequence in Southeastern New York.

68-5 HATCHER R.D., Jr., MERSCHAT, A.J. & HUEBNER, M.T.: Confirmation of the Acadian-Neoacadian Orogeny driven by Mid-Paleozoic Accretion of the Carolina Superterrane in the southern-central Appalachians.

68-6 PILOTE, J.L., BARR, S. & GIBSON, D.: A cross-border geochronological compilation for Late Silurarian-Devonian granitoid rocks in Maine (USA) and New Brunswick (Canada) Magmatic pulses or a continuum?

68-7 MURPHY, J.B.: COUSENS, B.L., BRAID, J.A., STRACHAN, R., DOSTAL, J., KEPPIE, J.D. NANCE, R.D.: Highly depleted oceanic lithosphere in the Rheic Ocean: Implications for Paleozoic Plate reconstructions.

68-8 THOMPSON, M.G., BARR, S.M., MORTENSEN, J.K., WHITE, C.E. & HERMES, O.D.: Tectonic Setting(s) of Devonian magmatic rocks in SE New England and the Gulf of Maine.

68-10 LOAN, M.E, HEPBURN, J., KUIPER Y. & TUBRETT, M.N. Age constraints on the depostion and provenance of meta-sedimentary units of the Nashoba Terrane.

68-13 KARABINOS, P. & ALEINIKOFF J.N.: An Emsian Age for the Goshen Formation in the Connecticut Valley – Gaspe Trough in Massachusetts.

68-14 VER STRAETEN, C.A.: Northern Appalachian Basin Sedimentation and the timing of Acadian orogenic events

71-23 PARISH, A., DAY J., MYERS, R., TAPANILA L. & BECKER, R.T.: *Comiotechia* and *Xinshaoella*? (Rhynchonellida-Ladogiidae) from the Middle? and Late Frasnian of the Euramerican Tropics (North America and Germany): First known occurrences outside of the Russian Platform and South China.

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**Conference**

The technical sessions will be held in Novosibirsk (IPGG SB RAS) on 27-28-29 (morning) July 2011.
Oral presentations are scheduled for 20 minutes, each including time for discussion (15 + 5). The conference room will be equipped with a computer and projector for Microsoft PowerPoint presentations. Poster presentations are welcomed.

**Languages - official languages of the Conference are English and Russian (oral presentations preferable shall be given in English, synchronous translations are possible).**

General schedule

| | |
|---|---|
| 20.07.11 | Arrival in Ufa, hotel, registration |
| 21.07.11 – 25.07.11 | Pre-Conference Field Trip to the South Urals |
| 25.07.11 (in the evening) – 27.07.11 | Route: Ufa –Novosibirsk by train |
| 27.07.11 | Arrival in Novosibirsk, hotel, registration for the conference |
| 27.07.11 – 29.07.11 | Conference session and SDS meetings in the IPGG, Conference dinner |
| 29.07.11 – 09.08.11 | Post-Conference Field Trip to the Salair and Kuznetsk Basin |
| 10.08.11 | Departure from Novosibirsk |

Indoor sessions

| | |
|---|---|
| 27.07.11 | Opening |
| | Oral presentations |
| | Poster presentations |
| 28-29.07.11 | Oral presentations |
| | SDS Business meetings |
| | Conference dinner |

Abstracts

Abstracts should be submitted before the ***15th April 2011*** in English or Russian. They should not exceed two A4 pages, including line drawing illustrations and references. Text should be written using 10p Times New Roman font (office address and references - 9p Times New Roman font), single-spaced; the margins should be 2 cm at the top and right, 2.7 cm at the bottom and 2.5 cm to the left. Abstracts should be sent by e-mail as attachment files: text in RTF format, illustrations in TIFF, JPG or CDR (CORELDRAW.12) formats. The abstract volume will be available at the meeting. It is planned to publish a Proceedings Volume in honor of Evgeny A. YOLKIN.

Abstract example:

**DEVONIAN EVENTS, CLIMATIC STRATIGRAPHY AND TIME IN THE DEVONIAN ORCADIAN BASIN, SCOTLAND**

**J.E.A. Marshall[1], J.F. Brown[2], T.R. Astin[3]**

*1 School of Ocean and Earth Science, University of Southampton, National Oceanography Centre, Southampton, European Way, Southampton, SO14 3ZH, UK; jeam@noc.soton.ac.uk*

*2 The Park, Hillside Road, Stromness, Orkney, KW16 3AH*

*3 School of Human and Environmental Science, The University of Reading, Whiteknights, PO Box 217, Reading, RG6 6AH, UK*

The Devonian contains a number of distinct events that represent combinations of biotic, palaeoceanographic and climatic perturbations to the earth system. These are now well established in the marine record and recognised from many different areas. What is less understood are how these events are expressed in the continental record and this is particularly important as such sequences can contain long climatic records. The Devonian Orcadian Basin contains such a long sequences that is generally developed in lacustrine sediments. The climatic record is a direct representation of times when the lake alternated between deep and permanent or shallow and ephemeral conditions. These lakes cycles are also bundled up into longer intervals of time where the climate was generally more arid or humid.

**References**

Mark-Kurik, E. 2000. The Middle Devonian fishes of the Baltic States (Estonia, Latvia) and Belarus. *Cour. Forsch.—Inst. Senckenberg*, **223**: 309-324.

Valiukevicius, J. 2000. Acanthodian biostratigraphy and interregional correlation of the Devonian of the Baltic States, Belarus, Ukraine and Russia. *Cour. Forsch.—Inst. Senckenberg*, **223**: 271-289.

**Pre-conference field excursion**

The field excursion will be held in the South of Urals, from 20th to 25th July 2011, for an examination of the complete Middle – Upper Devonian and Lower Carboniferous sequences in marine terrigeneous, carbonate and volcanic facies with fauna (conodonts, ammonoids, brachiopods).

**Guides:** Drs. Olga V. ARTYUSHKOVA, Elena I. KULAGINA, and Rustam R. YAKUPOV

**Accomodation during excursion** in the hotels of Ufa and Sterlitamak.

**Post-conference field excursion**

The field excursion will be held in the Salair and Kuznetsk Basin, from 29th July to 9th August 2011, for an examination of the Middle–Upper Devonian and Lower Carboniferous sequences in terrigeneous, bedded/reef carbonate and volcanic facies with fauna.

**Guides:** Drs. Nikolay K. BAKHAREV, Nadezhda G. IZOKH, and Olga T. OBUT

**Accomodation during excursion** in the field camp and hotels of Prokopievsk and Anzhero-Sudzhensk.

**Transport and food**

For transportation of participants within Ufa and Novosibirsk cars and buses will be used. In the field there will be the following vehicles: bus, 4WD tracks and jeeps.

**Accommodation**

In Novosibirsk (Akademgorodok) - Zolotaya Dolina Hotel, located within a 7-10 min. walk from the venue of the conference (IPGG SB RAS). During the post-conference trip, participants will be provided with sleeping bags and shared tents.

**Costs (in Euros)**
Registration and field excursion fees to be paid by cash on arrival.

Registration fee
Professional delegates **150 Euro**
Student delegates **80 Euro**

It will cover the following:
Attendance at all scientific sessions
Abstract volume
Coffee or tea breaks twice a day
The Conference dinner

Accommodation in Zolotaya Dolina Hotel, Novosibirsk
Price for one person/night (tentative prices):
Deluxe – 50 Euro
Single room – 40 Euro
Shared room – 30 Euro

Meals (in Akademgorodok) : 30 – 50 Euro (per day)

**Pre-conference field excursion 220 Euro** (4 days)
The fee does not include accommodation (with breakfast) in the hotels and dinner costs. The train fare from Ufa to Novosibirsk will have to be paid by the participants themselves. Hotel rooms and train tickets will be booked by the Organizers.

Accommodation at Sterlitamak (tentative prices)
Grand-Hotel Vostok, price for one person/night:
Deluxe – 150 Euro
Single room – 60-120 Euro
Shared room – 47 Euro
Hotel Ashkadar, price for one person/night:
Economy – 20-25 Euro
Single room – 45-55 Euro
Shared room – 35 Euro

Accommodation at Ufa (tentative prices)
Single room – 40-95 Euro
Shared room – 50-130 Euro

Train ticket Ufa-Novosibirsk: 100 Euro per person

Meals (in Ufa, Sterlitamak): 30 – 50 Euro (per day)

**Post-conference field excursion**
Professional delegates **550 Euro** (12 days)
Student delegates **300 Euro** (12 days)
Accommodation in field camps includes:
Field meals
Transportation
Guide book
2-3 nights in the hotel
The fee does not include accommodation on the day of arrival in Novosibirsk on the day of return from the field on August, 9

**Medical Care**

The participants should have health insurance for the journey. All foreign participants are required to bring with them health insurance contracts, for the time of the trip, from an insurance company that provides international insurance policy program. Travel companies should give specific information. There will be first aid in Ufa, Novosibirsk, then Prokop'evsk, Gur'evsk, Anzhero-Sudzhensk, Kemerovo. You should take along necessary medicine.

**Climate**
Novosibirsk is situated in the southern part of West Siberia E89 N55. Typical temperatures for the end of July – beginning of August are 15-25 C (day) and 10-15 C (night). Rain is rare. In the South Urals typical temperatures are 15-25 C (day) and 10-18 C (night). Rain is usual.

**Clothing and field facilities**
You are advised to bring your field boots (rubber boots could be useful in South Urals excursion), warm sweaters, raincoats, swimming suit, caps, hammer and others.

**Travel and visa information**
The Organizing Committee requires about 1,5 month for the preparation of the formal invitation, a letter in order to obtain a VISA, and time for posting it by surface mail. Thus, the participants are asked to send by Fax until ***1th March 2011*** their personal data, a copy of passport pages with full name, date and place of birth, passport number, place of issue and expiry date, nationality, as well as, by E-mail, information on the country and permanent region of residence, full home and office addresses, place of employment and position details, science degree, and on previous visits to Russia.

**Cultural program**
During conference/arrival/departure days we shall try to organize visits to the Central Siberian Geological Museum and tourist route around Akademgorodok (Novosibirsk) and Ufa city.

**Deadlines**
Registration (form included here) – ***15th February 2011***
Personal data for the Invitation Letter – ***1st March 2011***
Abstract submission **– *15th April 2011*** (devon@ipgg.nsc.ru)

**Correspondence**
All correspondence and questions to be addressed to the Symposium Secretariat:
Dr. Olga OBUT (devon@ipgg.nsc.ru)
Dr. Rustem YAKUPOV (stpal@anrb.ru)

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Institute of Geology, Ufa Research Center
Russian Academy of Sciences
K. Marx Street. 16/2 Ufa, Russia
Tel.: +7 (347) 272 8256,
Fax: +7 (347) 273 0368

Conference information is available on *Websites*:
Trofimuk Institute of Petroleum Geology and Geophysics SB RAS (IPGG) http://biostratigraphy.ipgg.nsc.ru
Institute of Geology, Ufa Research Center Russian Academy of Sciences
http://ig.ufaras.ru/?part_id=437&conference_id=11

REGISTRATION FORM

**International Conference**
**"BIOSTRATIGRAPHY, PALEOGEOGRAPHY AND EVENTS IN DEVONIAN AND LOWER CARBONIFEROUS"**

with pre- and post-conference excursions

**"MIDDLE-UPPER DEVONIAN AND LOWER CARBONIFEROUS BIOSTRATIGRAPHY OF SOUTH URALS AND KUZNETSK BASIN"**

*(SDS joint field meeting)*
**Ufa - Novosibirsk, Russia, July 20 - August 10, 2011**

*Please complete and return by 15th February, 2011 by E-Mail:*
E-mail: Olga OBUT (devon@ipgg.nsc.ru), Rustem YAKUPOV (stpal@anrb.ru)

First name: …… Family Name: …..…..…….……
Sex: (M/F) …….. …….
Institution: ……..…
Address: ……..…….. City: ……..…..
State/Province: …… Country: …… Postal code ……...
Phone: …….. Fax:……. E-mail: …….

**Please indicate your participation:**

*in conference*

| possibly | | probably | | certainly | |
|---|---|---|---|---|---|

*In Pre-conference field excursion*

| possibly | | probably | | certainly | |
|---|---|---|---|---|---|

*In Post-conference field excursion*

| possibly | | probably | | certainly | |
|---|---|---|---|---|---|

**I will submit:**

| *Oral presentation* | | *Poster* | |
|---|---|---|---|

Author(s) and title(s): …….....
……

**I intend to be accompanied:**

| yes | | no | |
|---|---|---|---|

Date

**Accommodation, your preference:**

*Price for one person/night in Hotels of Ufa (pre-conference excursion)*

| Room | Price for one person/night (tentative prices) | Please indicate preferable price |
|---|---|---|
| Single room | 40-95 Euro | |
| Shared-room | 50-130 Euro | |

*Price for one person/night in the* Grand-Hotel Vostok, *Sterlitamak (pre-conference excursion)*

| Room | Price for one person/night (tentative prices) | Please tick |
|---|---|---|

| | | |
|---|---|---|
| Deluxe | 150 Euro | |
| Single room | 60 Euro | |
| Shared-room | 47 Euro | |

*Price for one person/night in the Hotel Ashkadar, Sterlitamak (pre-conference excursion)*

| Room | Price for one person/night (tentative prices) | Please tick |
|---|---|---|
| Economy | 20-25 Euro | |
| Single room | 45-55 Euro | |
| Shared-room | 35 Euro | |

*Price for one person/night in the Hotel "Golden Valley" of Akademgorodok (Novosibirsk)*

| Room | Price for one person/night (tentative prices) | Please tick |
|---|---|---|
| Deluxe double room | 50 Euro | |
| Single room | 40 Euro | |
| Shared-room | 30 Euro | |

2011 ANNUAL GSA MEETING
POST MEETING FIELD TRIP

# EVENT HISTORY AND SEQUENCE ARCHITECTURE OF THE MIDDLE-UPPER DEVONIAN EPEIRIC CARBONATE PLATFORM OF THE IOWA BASIN

The Iowa Basin Middle and Upper Devonian carbonate platform is one of most intensively studied subtropical Middle Paleozoic epeiric systems serving as the primary reference succession for central North America. Investigations since the mid-1980s have documented and integrated the brachiopod and conodont biostratigraphic records, biogeographic and extinction bioevent records, sea level event records, and paleoclimatic and paleoceanographic geochemical and magnetostratigrphic proxy records for the southern hemisphere subtropical epeiric ocean of western Euramerica. Modern stratigraphic syntheses of the Devonian of the Iowa basin have played a key role in conformation and refinement of the Middle and Upper Devonian eustatic sea level curve, and development of the Middle and Early Late Devonian Sea surface temperature and paleoclimate records for large parts of the Givetian and Frasnian ages. This system met its demise during the Late Devonian through combined sea level lowstand-platform emergence and stepped subtropical SST cooling events and associated Kellwasser extinction bioevents in the late Part of the Frasnian. This three day trip will showcase the current understanding of the processes and events controlling carbonate ramp development of the Wapsipinicon and Cedar Valley groups and Lime Creek Formation in well-studied quarries, road-cuts and cores in north-central Iowa. Guidebook contributions and trip stops highlight current understanding of epeiric records of global sea level change, paleoclimate, and bioevents based on integrated sequence stratigraphy, stable isotope chemostratigraphy, biostratigraphic-biotic signatures of 3rd and 4th order cyclic packages in the Iowa Basin Middle-Late Devonian (Late Eifelian-Late Frasnian) epeiric carbonate platform system.

**Preliminary Itinerary**

Leave Minneapolis GSA Convention Center 4 PM Wednesday, October 13th, arrive 7 PM for overnight in Decorah, IA

Day 1 (Thursday, October 14th) - Late Eifelian to Late Givetian platform facies and faunas of the Middle Devonian (Eifelian-Late Givetian) Wapsipinicon and lower Cedar Valley Group, overnight in Cedar Falls, IA

Day 2 (Friday, October 15th) – Late Givetian-Middle Frasnian carbonate platform facies and faunas of the Cedar Valley Group, north-central, Iowa

Day 3 (Saturday, October 16th) - Middle Frasnian carbonate platform (patch reef tract) facies and faunas of the Shell Rock Formation (upper Cedar Valley Group), and Late Frasnian Lime Creek platform and platform extinction. Leave last stop at 4 PM, arrive in downtown Minneapolis at 6 PM, demob downtown.

**PRIMARY TRIP LEADER - GUIDEBOOK EDITOR**

Dr. James (Jed) DAY-Professor of Geology
Department of Geography & Geology
Campus Box 4400
Illinois State University
Normal, IL 61790-4400

Phone: 309-438-8678
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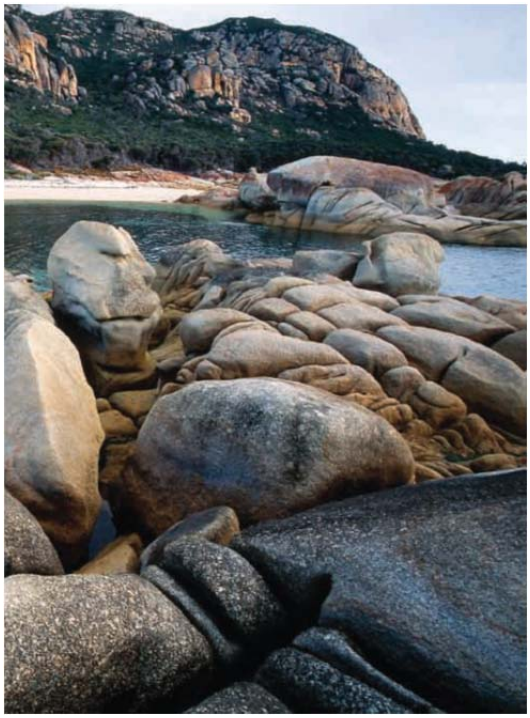
Geological Society of America – Geobiology & Geomicrobiology Division
International Subcommission on Devonian Stratigraphy (SDS)

***Oceania invites you to the***
**34th International Geological Congress (IGC): AUSTRALIA 2012**



**Brisbane Convention and Exhibition Centre**
**Queensland**
5 - 10 August, 2012 **www.34igc.org**

## 34TH IGC CIRCULARS

General distribution of this and subsequent Circulars for the 34th IGC is by email.
Please feel free to forward it to others who may be interested. If necessary, hard copies can be supplied in limited numbers on request through the website:

**www.34igc.org** or
by contacting Carillon Conference Management Pty Ltd. by email: info@34igc.org,
or by post: PO Box 177, Red Hill, 4059, Queensland, Australia.

The Second Circular is scheduled for electronic distribution in April 2011.

**Congress Participation and Visa Requirements**
All members of the global geoscience community are welcome to participate in the Congress and are warmly invited to attend. Membership of a national geoscience society or association is not necessary, but will attract a discounted registration.

All delegates are required to complete a delegate registration form and pay the appropriatecongress registration fee. Note that registrations will not be confirmed until after payment hasbeen made and cleared. Delegates from all countries will need to obtain a visa to enter Australia. The only exceptions are citizens of Australia and New Zealand travelling on passports issued by these countries. Official letters of invitation will be provided to delegates by the congress **only** after clearance of registration fee payment. Information on visa requirements is available from the Australian Department of Immigration:

www.immi.gov.au/visitors/event-organisers-participants/iecn.htm

Congress fees will be payable in Australian Dollars (AUD). Payments cannot be accepted in any other currency. Secure on-line credit card payment facilities will be available.

**Important Dates**
Please note that the Congress will be organised in accordance with the following dates:

**April 2011**
Abstract submission opens.

**August 2011**
Early registrations open (available until 30 April, 2012).

**17 February 2012**
Abstract submissions close.

**30 March 2012**
Formal notification to authors of the success or otherwise of their abstract submissions.

**30 April 2012**
Presenters of papers (oral and poster) accepted for the 34th IGC must pay for their registration for the congress by this date or be automatically deleted from the Congress Program.

Close of Early registration. The more expensive Standard registration fee will
automatically apply for all registrations received 1 May – 1 July 2012.

**1 July 2012** Standard registrations close. The more expensive Late registration fee will apply to all registrations received after this date. An additional on-site processing fee will apply to all registrations received on or after 1 August 2012.

**Proposed Overall Structure of 34th International Geological Congress**
Pre-Congress Field Trips 28 July – 5 August 2012
Young Earth-Scientist Field Trip and Reception 4 August 2012
Registration opens, Exhibition set up, some business meetings 5 August 2012
34th IGC Welcome Reception Evening, 5 August 2012
Opening Ceremony First session, 6 August 2012
Scientific Program 6-10 August 2012
Business Meetings Evenings, 6-10 August
Congress Dinner 8 August 2012
Closing Ceremony Last session, 10 August 2012
Post Congress Field Trips 11-17 August 2012

**Registration**
Congress registration fees will be announced in August 2011. As a general indication only, the full Early registration fee is likely to be roughly AUD1,000 for members of a geoscience society or professional institute. Registration fees for students and retired geoscientists will be lower.
Early registration will be available until 30 April 2012, after which the registration fees will be progressively increased. Registration fees will cover lunches, morning and afternoon refreshments, a ticket (1 person) to the welcome reception and congress materials including detailed congress program and abstracts.
It is hoped to provide the program and abstracts on an electronic tablet reader which will also have Wifi access.

## SDS has proposed a special symposium on the Devonian of Asia and Australia.

## PUBLICATIONS

### SDS MIDDLE DEVONIAN VOLUME

Palaeogeography,
Palaeoclimatology,Palaeocology

C.E. BRETT, E. SCHINDLER & P. KÖNIGSHOF, Eds.

CONTENT:

*Z. Sarah ABOUSSALAM, R. Thomas BECKER*
The global Taghanic Biocrisis (Givetian) in the eastern Anti-Atlas, Morocco
*Available online 20 October 2010*

*Carlton E. BRETT, Gordon C. BAIRD, Alexander J. BARTHOLOMEW, Michael K. DESANTIS, Charles A. VER STRAETEN*
Sequence stratigraphy and a revised sea-level curve for the Middle Devonian of eastern North America.
*Available online 16 October 2010*

*John E.A. MARSHALL, John F. BROWN, Timothy R. ASTIN*
Recognising the Taghanic Crisis in the Devonian terrestrial environment and its implications for understanding land–sea interactions.
*Available online 16 October 2010*

*Leona KOPTÍKOVÁ*
Precise position of the Basal Choteč event and evolution of sedimentary environments near the Lower–Middle Devonian boundary: The magnetic susceptibility, gamma-ray spectrometric, lithological, and geochemical record of the Prague Synform (Czech Republic).
*Available online 16 October 2010*

*Eberhard SCHINDLER, Achim WEHRMANN*
Genesis and internal architecture of the Middle to Upper Devonian Gwirat Al Hyssan reef-mound (Western Sahara).
*Available online 16 October 2010*

*Brooks B. ELLWOOD, Jonathan H. TOMKIN, Ahmed EL HASSANI, Pierre BULTYNCK, Carlton E. BRETT, Eberhard SCHINDLER, Raimund FEIST, Alexander J. BARTHOLOMEW*
A climate-driven model and development of a floating point time scale for the entire Middle Devonian Givetian Stage: A test using magnetostratigraphy susceptibility as a climate proxy.
*Available online 16 October 2010*

*Brooks B. ELLWOOD, Thomas J. ALGEO, Ahmed EL HASSANI, Jonathan H. TOMKIN, Harry D. ROWE*
Defining the timing and duration of the Kačák Interval within the Eifelian/Givetian boundary GSSP, Mech Irdane, Morocco, using geochemical and magnetic susceptibility patterns.
*Available online 16 October 2010*

*Charles A. VER STRAETEN, Carlton E. BRETT, Bradley B. SAGEMAN*
Mudrock sequence stratigraphy: A multi-proxy (sedimentological, paleobiological and geochemical) approach, Devonian Appalachian Basin.
*Available online 16 October 2010*

*Michael K. DESANTIS, Carlton E. BRETT*
Late Eifelian (Middle Devonian) biocrises: Timing and signature of the pre-Kačák Bakoven and Stony Hollow Events in eastern North America.
*Available online 16 October 2010*

*Ian TROTH, John E.A. MARSHALL, Andrew RACEY, R. Thomas BECKER*
Devonian sea-level change in Bolivia: A high palaeolatitude biostratigraphical calibration of the global sea-level curve.
*Available online 16 October 2010*

# THE GLOBAL *ANNULATA* EVENTS AND THE DASBERG CRISIS (FAMENNIAN, UPPER DEVONIAN) OF EUROPE AND NORTH AFRICA – HIGH RESOLUTION CONODONT STRATIGRAPHY, CARBONATE MICROFACIES, PALAEOECOLOGY, AND PALAEODIVERSITY

Sven HARTENFELS

Münstersche Forschungen zur Geologie und Paläontologie, **105**: ca. 360 pp., ca. 85 figs., 18 tabs., 71 pls., Münster, date of publication: Spring 2011.

**Abstract**

The poorly investigated *Annulata* and Dasberg Events have not yet received the attention they deserve in order to understand all significant short-termed global environmental hazards of the past. Based on lithological and faunal changes, carbonate microfacies, and high resolution conodont biostratigraphy, palaeoecological developments are analyzed and interpreted in an interval ranging from the *Palmatolepis rugosa trachytera* Zone (= Lower *trachytera* Zone) to the *Bispathodus aculeatus aculeatus* Zone (= Middle *expansa* Zone).

A total of 18 sections from Germany (Rhenish Massif: Beringhauser Tunnel, Effenberg, Oese, Riescheid; Saxothuringia: Gositzfelsen, Kahlleite East, Grünau), Poland (Holy Cross Mountains: Kowala), and Southeast Morocco (Maider: Mrakib; Tafilalt: Bine Jebilet, El Atrous East, Hassi Nebech, Jebel Erfoud, Jebel Ouaoufilal, Jebel Ouaoufilal Pass, Ouidane Chebbi Northwest, Oum el Jerane, Takhbtit West) have been measured and sampled bed-by-bed around and between the event intervals. Regionally, these successions cover different environments. The strata from the Rhenish Massif, Saxothuringia, and the Holy Cross Mountains were deposited on hemipelagic carbonate slopes and in shaly basins. The Southeast Moroccan sections represent the faintly inclined hemipelagic Tafilalt Platform as well as the more argillaceous Tafilalt, Rheris, and Maider Basins.

Overall 350 conodont and additional facies samples have been taken. An isolated conodont sample from Malpasso (Carnic Alps) has been used for comparison. A total of 80.460 platform elements are assigned to 20 genera, 131 species, subspecies, and well defined morphotypes. As common in high resolution stratigraphy studies, only the Pa element taxonomy is used. Many Famennian multielement reconstructions are still doubtful. Three new species (*Clydagnathus tragelehni* n. sp., *Polygnathus pseudotenellus* n. sp., *Po. spiculiferus* n. sp.) and four new subspecies (*Alternognathus regularis continuus* n. ssp., *B. stabilis zizensis* n. ssp., *Pa. gracilis carnicus* n. ssp., *Pa. gracilis semisigmoidalis* n. ssp.) are established. In addition, six new morphotypes are defined within *B. spinulicostatus*, *Pa. gracilis expansa*, *Pa. perlobata postera*, *Po. spiculiferus* n. sp., and *Pseudopolygnathus micropunctatus*. Further thirteen taxa (*B.* aff. *costatus*, *Caenodontus* sp., "*Pandorinellina*" n. sp., *Po.* cf. *experplexus*, *Po.* cf. *granulosus*, *Po.* cf. *perplexus*, *Po.* cf. *rhabdotus*, *Po.* aff. *semicostatus*, *Po.* aff. *subirregularis*, *Polylophodonta* cf. *concentrica*, *Ps.* aff. *granulosus*, *Ps.* cf. *granulosus*, ?N. Gen. et sp.) remain in open nomenclature. *Po. dissimilis* is re-assigned to the genus *Bizignathus*, *Branmehla gediki* is considered as a subspecies of *Br. bohlenana*. Various conodont taxa are reported for the first time from the investigated areas, particularly from the Wildenfelser Zwischengebirge and the southeastern Anti Atlas. In both regions middle/upper Famennian conodont faunas have been studied for the first time in detail.

The conodont biostratigraphy is revised and a new zonation is introduced (Fig. 1). This zonation represents a synthesis of the new data with the former "standard zonations" sensu ZIEGLER (1962a) and ZIEGLER & SANDBERG (1984), replacing some rather unreliable biostratigraphic markers, such as *Pa. perlobata postera* and *Pa. gracilis expansa*. The new zonal concept is based on the comparison of detailed regional zonal schemes and comprises seven international zones. They are strictly named after the name-giving species/subspecies: *Scaphignathus velifer velifer* Zone (= Uppermost *marginifera* Zone), *Pa. rugosa trachytera* Zone (= Lower *trachytera* Zone), *Ps. granulosus* Zone (= Upper *trachytera* Zone: including a higher *Pa. gracilis sigmoidalis* Subzone and the subsequent *trachytera-styriacus*-Interregnum in the Rhenish Massif, Saxothuringia, and Holy Cross Mountains, and a higher *Pa. gracilis sigmoidalis* Subzone in the Tafilalt), *Po. styriacus* Zone (= Lower *postera* Zone), *Pa gracilis manca* Zone (= Upper *postera* Zone: including a higher *Pa. rugosa rugosa* Subzone in the Rhenish Massif), *B. stabilis stabilis* Zone (= *stabilis* Morphotype 2, = approx. Lower *expansa* Zone: including a higher *styriacus-aculeatus*-Interregnum in the Rhenish Massif and Saxothuringia), *B. aculeatus aculeatus* Zone (= Middle *expansa* Zone: including a higher *B. costatus* Subzone in the Rhenish Massif, Saxothuringia, and Holy Cross Mountains).

The supraregional and regional ranges of some, partly important taxa, such as *B. stabilis*

*bituberculatus* (= *stabilis* Morphotype 3), *Br. ampla*, *Br. werneri*, *Pa. glabra lepta* late morphotype, *Pa. minuta minuta*, *Pa. rugosa trachytera*, *Ps. granulosus*, and *Sc. velifer velifer* are specified.

The base of the regional *trachytera-styriacus*-Interregnum is marked by the extinction of *Pa. rugosa trachytera* between the Lower and Upper *Annulata* Events (*Annulata* Intralimestones). Thus, both *Annulata*-Events belong to the upper part of the *Ps. granulosus* Zone. The European Dasberg Event belongs to the upper part of the *B. stabilis stabilis* Zone, whereas the event level of Southeast Morocco falls in the basal part of the next younger *B. aculeatus aculeatus* Zone. Therefore, the period encompassing both heterochronous event layers is named as Dasberg Crisis.

Using the nomenclature of DUNHAM (1962), 19 modified microfacies types (incl. subtypes) are defined. These types are assigned to two significant facies series (MF-A: facies zone below storm-wave base; MF-B: facies zone influenced by storm-waves). They are used for the reconstruction of different sedimentary environments. In the Amessoui Syncline (Tafilalt) a previously unknown $C_{org}$-rich high-energy carbonate event facies (*Annulata* and Dasberg Events) is detected.

In the Rhenish Massif (Effenberg, Oese), the *Annulata* and Dasberg Events are developed similarly. Furthermore, there are analogies with the Hangenberg Event. A cyclic succession of nodular limestones and intercalated shales/marls is interrupted by black shales rich in $C_{org}$. These black shales indicate an increased deposition of fine clay and a time of high primary production during transgressions. However, the specific primary producers are so far regionally unknown. The facies change between the cyclic sedimentation and the event layers is short but gradual. Characteristic blooms of specific opportunistic clymeniids (e.g. *Platyclymenia*) or the bivalve *Guerichia* intercalated between poorly fossiliferous beds confirm short termed peak episodes of eutrophication. Such phases varied locally and vertically in intensity, which resulted in differences of the $C_{org}$ abundance, ventilation (general living conditions for benthos), and pelagic fauna of the event beds. Food resources for the ammonoids and guerichids remain unclear. Anoxic maxima are indicated by unfossiliferous black shales and pyrite layers. In contrast to the Lower *Annulata* Event, the Upper *Annulata* Shale probably has been accumulated under stronger oxygen depletion, indicated by a reduced content of macrofossils within the event facies. Faunal blooms subsequent to the Upper *Annulata* Shale may be explained by sustained nutrient recycling (silty to fine-sandy, marly, greenish Wagnerbank equivalent at Oese; middle to dark greyish marl at Effenberg). At Oese, local *Guerichia* blooms between the Upper *Annulata* and Dasberg Black Shales provide evidence that the requirements for similar eutrophication periods existed for a long interval.

At the Beringhauser Tunnel section (drowned volcanic seamount), the Lower *Annulata* Event is developed in a different, slightly dark grey, condensed carbonate facies. The absence of *Guerichia* blooms and restricted ammonoid faunas argue for a reduced nutrient input in contrast to the deeper slope deposits of Oese and Effenberg.

In Saxothuringia, the events are more poorly developed and preserved. Whereas in the Saalfeld area the *Annulata* Event shows only a single black shale layer, two thin horizons occur in the region of the Bergaer Anticline (Kahlleite East). A post-*Annulata* regression is recognizable by the micritic, very fossiliferous Wagnerbank and its equivalents. In spite of a change to aerobic conditions, sudden mass occurrences of prinoceratids indicate a continuing nutrient input.

The event layers and facies shifts in the Holy Cross Mountains (Kowala) are consistent with those of the Rhenish Massif. *Cyrtoclymenia* blooms are a distinctive feature of the Dasberg Black Shale at Kowala.

In the southeastern Anti Atlas, the *Annulata* and Dasberg Events are prominently developed. However, time-equivalents of the European Dasberg Event are missing in a hiatus. All event beds show regionally only evidence of ammonoid blooms, whilst an exaerobic *Guerichia* facies is not developed. Even though, *Guerichia* occurs occasionally. Obviously their food resources, which were common in Europe, were regionally restricted, perhaps controlled by the higher palaeolatitude.

At Mrakib (Maider), ammonoid blooms are characteristic for both the Lower *Annulata* Shale and the *Endosiphonites* Shale of the Dasberg Cisis. Due to the absence of benthos, the substrate was anoxic. The three-fold Wagnerbank Equivalent subsequent to the Upper *Annulata* Shale documents a very fossiliferous *Prionoceras*-*Platyclymenia* fauna and an abnormal, unique maximum of the normally rare conodont genus *Caenodontus*. The latter is unknown in other regions and represents a new conodont biofacies of a eutrophic basin. Between the Upper *Annulata* Event and the Dasberg Crisis Interval, three successive marker horizons (*Procymaclymenia pudica*, *Sporadoceras orbiculare*, and

*Protoxyclymenia wendti* beds) keep records of different ammonoid blooms and, therefore, of the ecological complexity of the basinal facies. Furthermore, two additional anoxic black shales (rich in pyrite) are locally intercalated.

On the central southern Tafilalt Platform, only the Lower *Annulata* Event is developed. The event bed represents a shallow, high-energetic, eutrophic carbonate facies above a hiatus. Likewise, following a hiatus, the Dasberg Crisis occurs in a comparable carbonate facies (*Endosiphonites* Limestone of Oum el Jerane) or as dark, pyritic, very fossiliferous shales with a high content of $C_{org}$ (Jebel Ouaoufilal). On the northern Tafilalt-Platform the *Annulata* Event beds are lacking, supposedly in a hiatus. In this area, the Moroccan Dasberg Event is developed as a thick, hypoxic shale that is comparatively poor in macrofossils.

In the Tafilalt Basin, the marly *Annulata* Events have abundant ammonoids and contain specialized benthos. Whereas the irregular bivalve *Loxopteria* is common, guerichids are absent. The local event facies was dysaerobic, but not ex- or anaerobic. Similarities exist with the *Annulata* Event beds of the Rheris Basin. The regional Dasberg Event is developed as a eutrophic *Endosiphonites* Shale and resembles the Maider.

Associated with the *Annulata* Events, there is a gradual loss of seven partly important conodont species/subspecies high in the *Ps. granulosus* Zone: *Pa. perlobata grossi* (second massive carbonate bed below the Lower *Annulata* Black Shale), *Sc. velifer velifer* (Lower *Annulata* Event), *Pa. rugosa trachytera* and *Pa. glabra lepta* late morphotype (Lower *Annulata* Intralimestone), *Pa. minuta minuta* (Upper *Annulata* Intralimestone), as well as *Po. duolingshanensis* and *Po. padovanii* (Wagnerbank equivalent). Supposedly, these minor extinctions depend on the stronger anoxia of the Upper *Annulata* Event. Changes in the ammonoid fauna were much more dramatic between the UD III and IV (at species level locally up to 100 %). Within the beds slightly below the Lower *Annulata* Event, a general ammonoid decline documents a gradual extinction before the onset of black shale sedimentation. The *Annulata* Events permitted the well-known sudden radiation of ammonoids in the basal UD IV, both for goniatites and clymeniids. Likewise, the Dasberg Crisis shows no significant effect on conodont populations. But a dramatic break within the ammonoids led to the replacement of the global *Prionoceras-Platyclymenia* fauna by the first faunal complex of the *Clymenia-Gonioclymenia* Stufe (UD V-$A_1$). Youngest *Prionoceras* of the *Endosiphonites* Zone indicate that the change was also more gradual than formerly known.

The faunal change in Southeast Morocco appears to be comparatively dramatic due to a hiatus at the top of UD IV. In contrast, the European beds slightly below the Dasberg Crisis Interval are poor in macrofauna (similar to the Lower *Annulata* Event) and, therefore, the faunal change is indistinctive. New data verify the significant radiation of clymeniids and goniatites within the UD V-$A_1$.

The differences between conodonts and ammonoids illustrate the ecological independence of both groups within identical outer shelf regions. Clearly, their evolution was not linked.

The new data agree with the former model of black shale genesis introduced by BECKER (1992) and BECKER et al. (2004) for the *Annulata* Events. Phases of eutrophication with different intensities and supposedly controlled by climatic processes caused either a discrete or repeatedly an increased primary production during transgressive intervals in various regions. The primary producers are still unknown. As a consequence, blooms of different opportunistic mollusks (specific ammonoids and/or bivalves adapted to eutrophic conditions) and locally varying hypoxia occurred; respective to the bathymetric position either dark $C_{org}$-rich shales or carbonates were deposited. There is no evidence for a predominantly terrestrial control of the *Annulata* Events and the Dasberg Crisis.

Future field work in other regions as well as geochemical and palynological studies have to further improve our knowledge of Famennian events and crises.

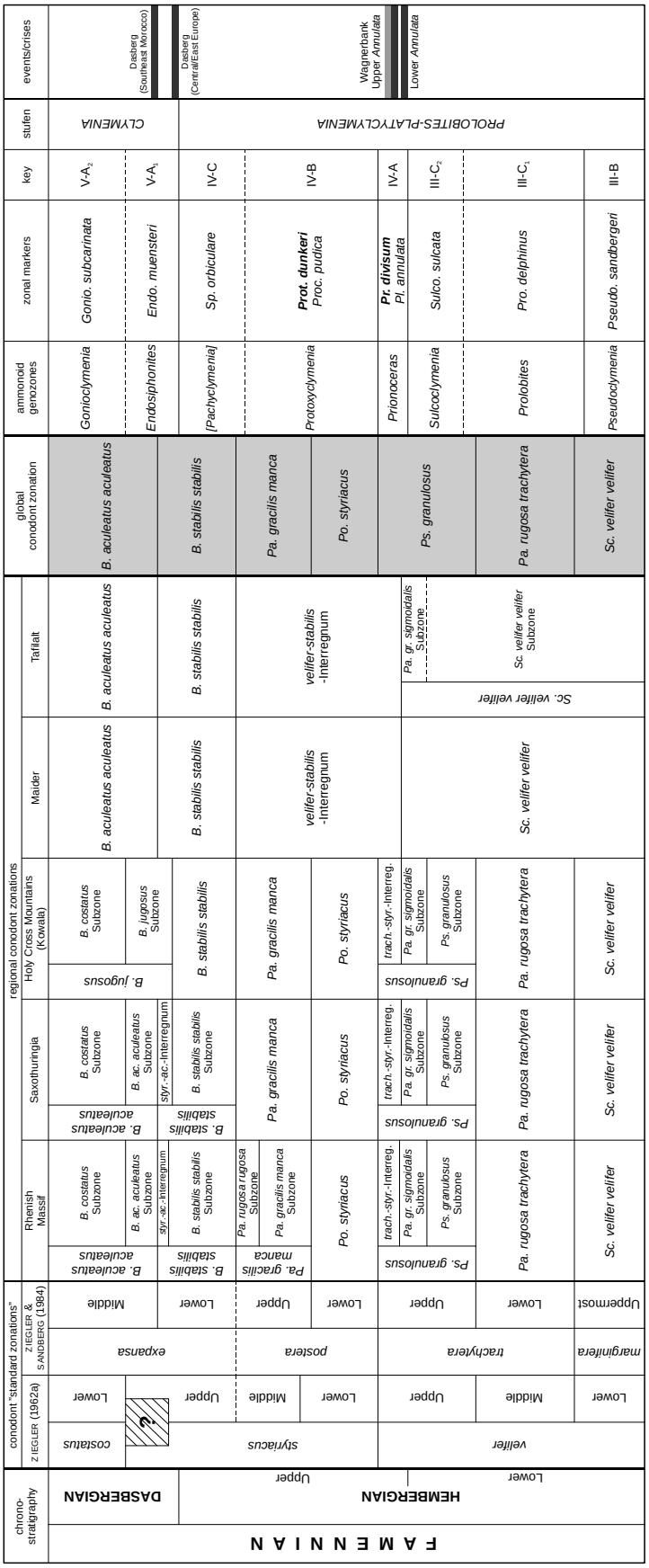



**Fig. 1:** Stratigraphic position of the global *Annulata* Events and Dasberg Crisis in relationship to the chronostratigraphy and the conodont and ammonoid zonations. Correlation of the former conodont „standard zonation“ with the new regional zonations and the revised global zonation (marked in grey).

# ASSOCIATION OF AUSTRALASIAN PALAEONTOLOGISTS, MEMOIR 39

## "SILURO-DEVONIAN STUDIES 1"

**Content**

## REGIONAL DEVONIAN WORKSHOP PRAGUE & GRAZ: PRAGUE, 25-27TH MAY 2009

Berichte der Geologischen Bundesanstalt, **79**, Wien., 124 S., 2009.
SUTTNER, Thomas J. , BERKYOVA, Stanislava, HUBMANN, Bernhard, KOPTIKOVA, Leona, SLAVIK, Ladislav (Eds)


(pdfs available free on the Bundesanstalt homepage)

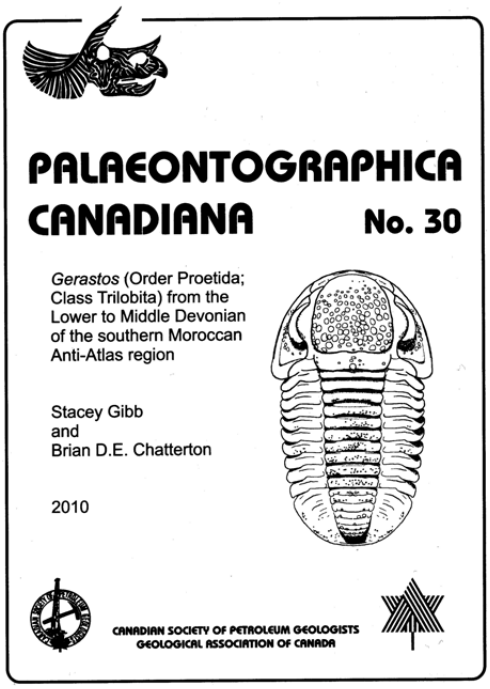
**CONTENT**

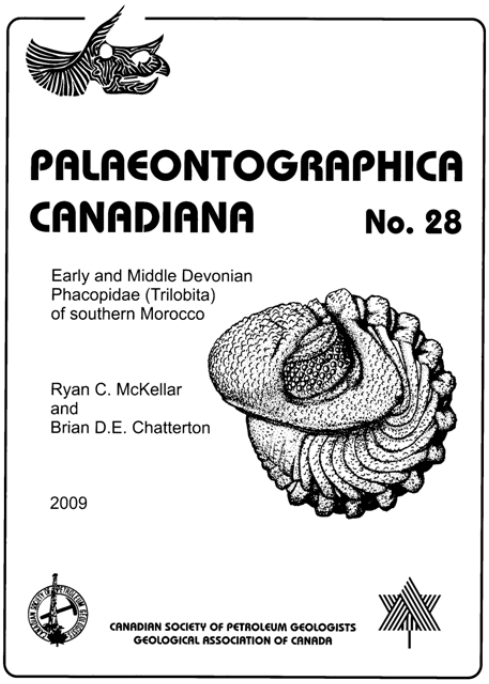
## *PALEOZOIC SEAS SYMPOSIUM* GRAZ, 14-18TH SEPTEMBER 2009

Berichte des Institutes für Erdwissenschaften, Karl-Franzenz-Universität Graz, Band **14**, Graz 2009 (ISSN 1608-8166)

**Content:**
(Abstracts – Devonian contributions emphasized)

**NEW IMPORTANT DEVONIAN TRILOBITE PUBLICATIONS:**




BASSE, M. (2009). Proetoidea HAWLE & CORDA, 1847 and other Trilobita from Lower Devonian (Zlichovian, Dalejan) Hercynian Limestones of the western Harzgerode Imbrication Zone southwestern Harz Mts, Rhenohercynian Zone): General part and Proetinae HAWLE & CORDA, 1847. – Freiberger Forschungshefte, **C532**: 1-55 [with the new genus *Luetkeproetus*].

BASSE, M. (2009). Neue und wenig bekannte Taxa der Scutelluinae, Proetinae und Otarioninae (Trilobita) aus dem Mitteldevon der Blankenheim-, Hillesheim- und Prüm-Mulde (Eifel). – Dortmunder Beiträge zur Landeskunde, mathematisch-maturwissenschaftliche Mitteilungen, **42**: 75-119 [with the new genus *Chamaeleonaspis*].

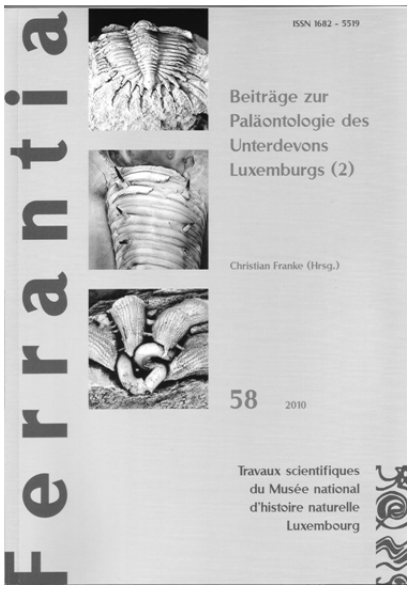
BASSE, M. (2010). Proetoidea HAWLE & CORDA, 1847 und andere Trilobita aus unterdevonischen Herzynkalken der westlichen Harzgeröder Faltenzone (Zlichovium, Dalejum; südwestlicher Harz, Rhenoherzynikum): Cornuproetinae RICHTER, RICHTER & STRUVE in MOORE, 1959 und Eremiproetinae ALBERTI, 1967b (1). - Freiberger Forschungshefte, C **536**: 1-67 [with the new genera *Montanproetus* and *Taciproetus*].

MCNAMARA, K.J., FEIST, R. & EBACH, M.C. (2009). Patterns of Evolution and Extinction in the last harpetid trilobites during the Late Devonian (Frasnian). – Palaeontology, 52 (1): 11-33 [with the new genera *Eskoharpes* and *Globoharpes*].

VAN VIERSEN, A.P. & PRESCHER, H. (2010). Taxonomy and biostratigraphy of some proetid trilobites in the Middle Devonian of the Ardennes and Eifel (Rhenohercynian Zone). – Bulletin de l´Institut royal des sciences naturelles de Belgique, Sciences de la Terre, 80: 5-45 [with 11 new species].

VAN VIERSEN, A.P. & BIGNON, A. (2011). Late Devonian (Frasnian) asteropygine trilobites from the Frasnes area, southern border of Dinant Synclinorium, Belgium. – Geologica Belgica, **14** (3/4): 109-128 [with two new species].

## NEW VOLUME ON THE DEVONIAN OF LUXEMBURG:




**FRANKE, C. (Ed., 2010).**
**Beiträge zur Paläontologie des Unterdevons Luxemburgs (2). – Ferrantia, 58, 80 pp.**

**Content**:



## FUTURE DEVONIAN VOLUMES „Palaeogeography, Palaeoclimatology, Palaeoecology“

During the 3rd International Palaeontological Congress in London in summer 2010, Devonian papers were presented in two different symposia. Contributions to Symposium 26 on “Time-specific facies. the colour and texture of biotic events” will be assembled in an issue of “Palaeo x 3”, with Annalisa FERRETI as main editor. The end of February 2011 was set as manuscript deadline. After the successful electronic publication of our Middle Devonian volume in the same journal, negotiations are currently under way to publish contributions to our extensive SDS Symposium on “Devonian Bioevents: timing, palaeoecological and evolutionary patterns” in a similar way. R.T. BECKER and C.E. BRETT would act as main editors. The response by symposium authors to submit manuscripts was very positive and the given deadline, end of this year, is still valid. The volume would be open to manuscripts that fit the topic, which have not been presented at the London symposium. More details can be expected at our SDS Annual Business Meeting and notices will be sent by email to all authors that expressed their interest at IPC3.

# MAGNETIC SUSCEPTIBILITY, CORRELATIONS AND PALAEOZOIC ENVIRONMENTS

Geologica Belgica, **13** (4)

**Contributions to the first Meeting of IGCP 580 on "Application of magnetic susceptibility as a palaeoclimatic proxy on Paleozoic sedimentary rocks and characterization of the magnetic signal"**

**Content**

## MEMBERSHIP NEWS

### CM Gordon C. BAIRD

For three years, I have been reexamining the end-Devonian succession in the northern Appalachian Basin, both, to refine correlations in this region, and to search for the signature of the global Hangenberg Biocrisis in this succession. Last year, was devoted to extending stratigraphic mapping activity westward from northwest Pennsylvania into northern Ohio in an attempt to reexamine these strata in the Cleveland-Lorain and compare them to the Pennsylvania succession. Currently, I am working closely with Jeff OVER at SUNY Geneseo (conodont biostratigraphy), Bob CARR of the University of Ohio: Athens (microvertebrates, paleoichthyology), Scott MCKENZIE of Mercyhurst College, Erie, PA (macroinvertebrates), and Joe HANNIBAL of the Cleveland Museum of Natural History (macroinvertebrates, stratigraphy, facies analysis). A total of 77 sections were examined and written up during this 12 month period.

During June and July, I worked also with a student (Matt RALPH) on coarse, paleovalley-fill, marine lowstand, deposits of the Cussewago Sandstone in northeast Ohio. As this unit is believed to correlate with diamictite deposits in eastern Pennsylvania and Maryland, recently interpreted to be of glacial origin by David BREZINSKI and colleagues, we were looking for clues that this fluvial-to-estuarine unit actually connected to these inferred icehouse events. The presence of a significant amount of immature basement clasts as well as the pervasive presence of greenish clay between grains within the basal Cussewago in northeast Ohio, suggest that it accumulated during a time of accelerated erosion in hinterland areas and may contain outwash products. Fossiliferous, basal deposits of the latest Famennian, gray, Bedford Shale above the black Cleveland Shale, probably correlative to some level within the Hangenberg Biocisis time-slice, were mapped across the Cleveland metropolitan area. West of Cleveland, the base-Bedford contact appears to be only a minor diastem. However, crossing Cleveland towards the southeast, this contact becomes a major erosional disconformity such that nearly the entire Cleveland Shale is overstepped by base-Bedford erosion in its southernmost exposures south of Cleveland. Additional work is ongoing to deconvolute complex stratigraphy along the Devonian-Mississippian contact between Cleveland and Meadville, Pennsylvania.

Currently, Jay ZAMBITO, Carl BRETT (University of Cincinnati), and I are studying the relationships of anomalous lithofacies (massive micrites and ooidal chamosite) to patterns of faunal incursions and outages within the type Taghanic interval in New York State and central Pennsylvania to establish temporal connections to inferred paleoclimatic changes.

I am co-organizer of a an upcoming symposium on Devonian Stratigraphy, Paleoecology, and Paleoclimatology (with David BREZINSKI and Jeff OVER) to be held at the Northeastern/North-Central sections meeting of the Geological Society of America on March 20-22, 2011; during November and December, 2010, we sent out 56 invitations for paper submissions and have received 29 abstracts for this session. This will assure three complete half-day sessions of presentations at the meeting and great promise for the dissemination of new ideas. Moreover, another parallel symposium on the Devonian Marcellus Shale will also be held at this meeting, and a pre-meeting two-day field trip to examine the gas-rich Marcellus and Genesee Shales will also take place.

Papers (see Carlton BRETT citations for published collaborations with Baird).

## CM I. BARDASHEV

LIST OF PUBLICATIONS (2007-2010):


BARDASHEV, I. A., BARDASHEVA, N. P. (2006b): The stratigraphy and conodonts of Altyntopkan type sections in the Devonian-Carboniferous carbonate deposits of the Beltau-Kurama structure-faciale zone. - Proceedings of the Institut of Geology, **5**: 47-60, 1 tabl. Donish, Dushanbe. (in Russian)

BARDASHEV, I. A., BARDASHEVA, N. P. (2007): The stratigraphy and conodonts of Baraktyntau type sections in the Devonian carbonate deposits of the Beltau-Kurama structure-faciale zone. - Proceedings of the Institut of Geology, **6**: 3-17, 1 tabl. Donish, Dushanbe. (in Russian)

BARDASHEV, I.A. 2008. Devonian Stratigraphy of Turkestan-Zeravshan facies zone of South Tien Shan. - Bull. MOIP, otd. geol. **83** (6): 27-52, 2 pl., 5tabl., 4 text-fig. (in Russian)

BARDASHEV, I. A., BARDASHEVA, N. P. (2008a): The stratigraphy and conodonts of Silurian-Devonian section in Turkparida stream valley. - Materials of a Republican conference (15.03.2008), 134-142. Anjumani Devashtich, Dusnanbe. (in Russian)

BARDASHEV, I. A., BARDASHEVA, N. P. (2008b): The stratigraphy and conodonts of Kumarg type of the Devonian-Carboniferous of the Zeravshan-Hissar zone. - Materials of a Republican conference (22.10.2008), 97-106. Anjumani Devashtich, Dusnanbe. (in Russian)

BARDASHEV, I. A., BARDASHEVA, N. P. (2008c). Kalaktash type of Devonian of Central Pamir zone. - Dokl. AN Resp. Tajikistan. **51** (8): 626-630. (in Russian)

BARDASHEV, I. A., BARDASHEVA, N. P. (2008d). Section of Devonian-Carboniferous in Pushnevat pass area in Hissar range. - Izv. AN RT, Otd. fiz.-mat., him., geol. i tekhn. nauk, **3** (132): 65-71. (in Russian)

BARDASHEV, I. A., BARDASHEVA, N. P. (2008e). The stratigraphy of Aktash type of Upper Silurian-Carboniferous of Turkestan-Alai zone - Proceedings of the Unstitut of Geology, **7**: 18-32. Donish, Dushanbe. (in Russian)

BARDASHEV, I.A. (2009). New Frasnian conodonts of the genus Palmatolepis from the Central Tajikistan - Paleontol. J., **3**: 61-66, 1 pl., 2 text-fig. (in Russian)

BARDASHEV, I. A., BARDASHEVA, N. P. (2009a). The stratigraphy and conodonts of Silurian-Devonian of Rangkul Carbonate Massive of Central Pamir zone. -/ Materials of a Republican conference. 24-35. TNU, Dusnanbe. (in Russian)

BARDASHEV, I. A., BARDASHEVA, N. P. (2009b). Turkparida type of Devonian sections of of the Zeravshan-Hissar structure-faciale zone. - Proceedings of the Institut of Geology, **8**: 42-55. Donish, Dushanbe. (in Russian)

BARDASHEV, I. A., BARDASHEVA, N. P., SABIROV, A.A. (2010a). Stratigraphy, fauna and flora of the Devonian-Carboniferous deposits of Akbaital faciale type of sections in The Central Pamir. - Proceedings of the Institut of Geology, **9**: 11-29. Donish, Dushanbe. (in Russian)

BarDASHEV, I. A., BARDASHEVA, N. P., SABIROV, A.A. (2010b). On Buzinova (Novchomok) Formation of the Devonian-Carboniferous in the Zeravshan-Hissar. - Proceedings of the Institut of Geology, **9**: 30-47. Donish, Dushanbe. (in Russian


## TM R. Thomas BECKER and the Münster Group

The last year saw the continuation of old research projects, the initiation of new ones, and many Devonian contributions to various meetings. Moroccan Field work in spring was conducted jointly with S. HARTENFELS, V. EBBIGHAUSEN AND J. BOCKWINKEL. It concentrated on new samples from the Lower Emsian of J. Ihrs in the western Tafilalt (see Document by BECKER & ABOUSSALAM in this Newsletter), on the less hypoxic development of the Chotec Event in the northern Tafilalt (Rheris Basin, section El Gara), on the *Pharciceras* Stufe to Famennian of Rich Haroun (central Tafilalt), and on the Amessoui Syncline of the southern Tafilalt, where an unique rhynchonellid coquina bed was discovered in the Famennian of Tizi Nersas. The rhynchonellids were given to Paul SARTENAER; their conodont age is not yet clear. A macrofossil-poor, Givetian-Frasnian section in debris flow facies at El Kachla (NE margin of Bou Maiz Syncline) proved to have very nice Frasnian conodonts below its thick Kellwasser succession. The military, unfortunately, did not allow us to re-sample Emsian-Eifelian strata of the Oued Kseir area of the easternmost Tafilalt (Tafilalt Basin), right at the border to Algeria.

The re-sampling of the important new D-C boundary section Lalla Mimouna North (northern Maider) yielded good new conodont faunas (not yet fully identified), some new Lower Tournaisian goniatites of the *Gattendorfia* Zone (LC I-$A_2$, see Fig. 1), and numerous brachiopods from a thin sandstone interval within the deeply weathered shales between the two pre-Hangenberg and post-Hangenberg crinoidal limestones. This brachiopod fauna (given to D. BRICE) comes from the regressive peak of the Hangenberg Event and will allow a correlation with the much thicker sections of the Tafilalt and southern Maider, with their thick

equivalents of the Hangenberg Shale and Sandstone. The significance of the new section lies in its conodonts from just below the Hangenberg Extinction and from just above the regressive phase, below the onset of *Gattendorfia*. Preliminary results were presented at the London D/C Boundary Workshop. The important joint paper on all the other Moroccan D/C boundary sections (KAISER et al.), unfortunately, is still in preparation (but close to final submission to "Palaeo x 3").

Another highlight of last year´s Moroccan trip were investigations at the contact between the Anti-Atlas Devonian (stable Gondwana margin) and allochthonous units within the southern High Atlas fault system (margin of Variscan or Hercynian Morocco). Good autochthonous Emsian to Givetian successions, with a nice development of the Kacak Event, occur in the Tinejdad area (N of the Maider), whilst Visean olistolites and tectonic mélanges include a wide array of Devonian lithologies close to Tinerhir in the West (Todrha Valley region). We plan a detailed investigation of these outcrops. Fortunately, the DFG has just given its OK for our long planned joint project (with TM EL HASSANI and colleagues) on the comparison of the southern and northern margin of the Prototethys in the Middle Devonian to Tournaisian. It will run for three years and include a Ph.D. study on the detailed comparison of Moroccan and German Devonian reefs.

Together with Jürgen BOCKWINKEL and Volker EBBIGHAUSEN, the description and revision of Moroccan pharciceratid faunas continues. There has been considerable progress with a long manuscript on the famous, very rich Hassi Nebech faunas, which will include a range of new species and genera. The extensive joint paper on the Emsian and Eifelian goniatites of Oufrane (eastern Dra Valley) should be out very soon in the Neues Jahrbuch für Geologie und Paläontologie. Its electronic version (pre-print) has already been quoted by others. As much as time allows, it shall be followed soon by a revision of the widely misunderstood, supposed marker genus *Latanarcestes*. A manuscript on the last Givetian ammonoid faunas of the Tafilalt, jointly with Sarah ABOUSSALAM, is ca. half written. Another long Moroccan paper (HAHN et al. in press, Geologica et Palaeontologica) deals with the Carboniferous trilobites of the Anti Atlas. It includes from Kheneg Lakahal, S of Assa (western Dra Valley), a pre-Hangenberg Event species, *Pseudowaribole (Ps.) conifer*, in direct association with supposed basal Carboniferous brachiopods. The implications of this single specimen for the brachiopod stratigraphy at the D/C boundary could be far-reaching.

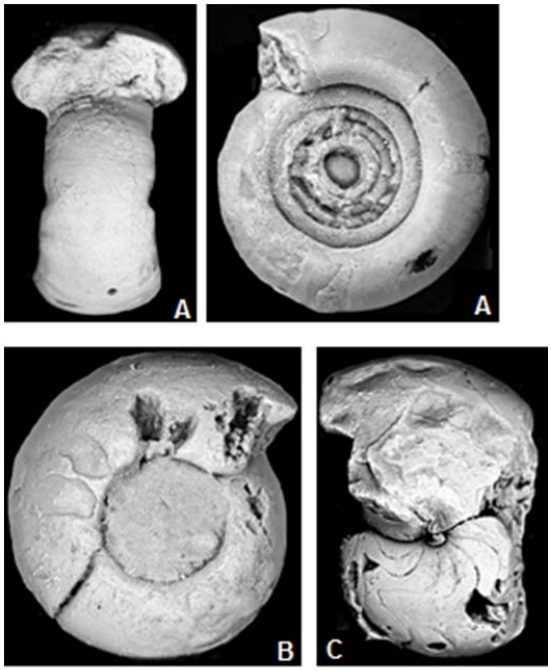



Fig. 1. Goniatites from the basal Tournaisian of Lalla Mimouna North. A. *Gattendorfia* aff. *jacquelinae*, B. *Gattendorfia* n. sp., C. *Imitoceras* sp.

Work in the Rhenish Massif continued, too. During student trips, we completed conodont re-sampling of the Givetian to Lower Frasnian at the famous Blauer Bruch (Kellerwald) and Giebringhausen (W of Adorf) sections. A new co-operation has started with the Rheinkalk company, the biggest national lime producer. Thanks to very good relationships with M. OEHMEN, we have access to their huge Devonian reef quarries and can study and sample (for microfacies and conodonts) cores that penetrate the reefs but that start in post-reefal, conodont-rich cephalopod limestones. The main aim of various B.Sc. and M.Sc. studies, partly in co-operation with M. PIECHA, is to retrieve precise ages of the reefs and compare their palaeoecological trends and cycles. We now can demonstrate that last biostromes in the core of the Hagen-Balve Reef are overlain by nodular limestones of the MN 10 Zone (with dominant *Palmatolepis plana*). But in the Hagen area, the main reef growth ceased at the top of the Middle Givetian whilst in the Wülfrath area, to the West, the whole reef could be Frasnian. These first results leave much to do.

Smaller international side projects include the first Frasnian ammonoids of Myanmar (see Document in this Newsletter by AUNG et al.), new Devonian ammonoids from Victoria (with Clem EARP), the *Annulata* Shale of Bulgaria, goniatites from around the Eifelian-Givetian boundary of New York (material sent by Alex BARTHOLOMEW and Thomas SCHRAMM), and the identification of additional specimens from Bolivia, sent by John MARSHALL. They look like tornoceratids but probably belong to the Eifelian homoemorphic group around *"T." bolivianum* that is discussed in TROTH et al. (2010). Jed DAY and collaborators are currently dealing with the interesting brachiopods from right around the F-F boundary of Beringhauser Tunnel (see abstract of March GSA-NE Meeting).

**Sarah ABOUSSALAM** has completed all identifications of our new Montagne Noire conodonts from around the Middle-Upper Devonian boundary but the manuscript is not yet finished. New sampling at Giebringhausen extended the data base for contemporaneous faunas of the Rhenish Massiv and resulted in small revisions of the stratigraphy that was already presented at some meetings. The new samples kept producing strange, partly pathological (Fig. 2) specimens and new taxa. The new Blauer Bruch material will enable a detailed comparison of the eastern Sauerland and Kellerwald areas. The mentioned "western Prototethys" project will give Sarah a job for the next three years, with a concentration of conodont and carbon isotope stratigraphy work on the Moroccan Meseta. Supposed Frasnian conodont samples brought from Myanmar to Münster by AUNG Aye-Ko turned out to be of Triassic age. Therefore, Sarah will make a short joint excursion into the Smithian-Spathian conodont world.

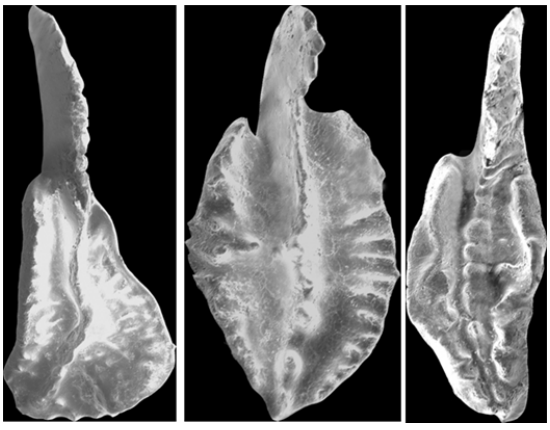


Fig. 2. Enigmatic, possibly pathological conodonts from the latest Givetian of Giebringhausen.

**Sven HARTENFELS** successfully completed and defended his Ph.D. in summer 2010. He is currently editing his voluminous monograph on microfacies and conodonts around the *Annulata* and Dasberg Events. It should be out still this spring/early summer and will have dozens of nice thin section and conodont plates (see abstract under Devonian Publications). He has started to sample additional Famennian sections of the Tafilalt (El Gara) and Sauerland, extending work to the Lower and Uppermost Famennian. A major future task will be to establish the precise number of sedimentary cycles within clearly fixed Famennian conodont zones of distant regions. Joint efforts with Harald TRAGELEHN concerning a voluminous monograph on microfacies and conodonts of Franconia (especially of the Köstenhof = Schübelhammer section) are continuing.

**Claudia DOJEN** was working in the last year mostly for the Geomuseum Münster. Her research focused on Devonian ostracodes (Emsian to basal Givetian) of the Western Dra Valley (Morocco) and their palaeoecological, biogeographical and event stratigraphical interpretation. First results, with a focus on events, have been presented at the IPC3 in London. A joint paper with Helga GROSS-UFFENORDE on Moroccan ostracodes is in progress; the results will be presented at the 7th European Ostracodologist´s Meeting 2011 in Graz (Austria). From May 2011 on, Claudia will start a new position at the Landesmuseum Kärnten (Austria). The Münster Devonian Group is both sad to lose an important team member and glad that Claudia eventually found a permanent job. We hope that her new duties will leave some time for ostracode studies.

Several **B.Sc.** and **M.Sc. students** worked on Devonian topics. Marlene NOVAK investigated in her B.Sc. thesis the microfacies and palaeoecology of the youngest biostromal limestones at the famous Beul just E of the Hönne Valley (core of the Remscheid-Altena Anticline, Nordsauerland). Conodonts (only polygnathids), identified by Sarah, prove a topmost Givetian to early Middle Frasnian age for coral-bearing limestones. Sören STICHLING investigated in his B.Sc. the upper reefal to post-reefal interval in an adjacent, cored well. Conodonts confirmed the Middle Frasnian range of reefs. Above black Kellwasser limestones and the F-F boundary were located. The B.Sc. thesis of Tobias FISCHER dealt with the palaeopathology of Uppermost Famennian ammonoids of the Tafilalt and Maider Basins. The comparison with a previous Lower Tournaisian study of the same region enables

to clarify the impact of the Hangenberg Mass Extinction on the predation on ammonoids. Current new B.Sc. projects include a revision of the famous Ballberg section near Hövel (Famennian) and a study on the first Middle Givetian chaetetid sponges of southern Morocco.

Stephan EICHHOLT is about to complete his one year M.Sc. on the ontogenetic morphometry, taxonomy, and phylogeny of beloceratids of the Canning Basin. The surprisingly complex results were presented at the Annual Meeting of the Paläontologische Gesellschaft in Munich. Stephan HELLING will soon finish his M.Sc. on various rare trilobites (mostly proetids and phacopids) of the Dra Valley. He also presented results at Munich and will give a talk at the 2nd German meeting of trilobite researchers, in mid-February at the Senckenberg Museum, Frankfurt. The lower Eifelian of the Assa region (Bou Tserfine) appears to contain a new proetid genus. Hendrik NOWAK started a M.Sc. on the palaeoecology and stratigraphy of the Wülfrath Reef. First he examined cores, which will be compared in summer with quarry examinations. Jointly with Hans KERP, as the main M.Sc. supervisor, Stephan HÖTZEL compared the microfacies and palynofacies patterns in the Middle Devonian of the Sötenich Syncline (Eifel Mts.).

## Publications 2010

ABOUSSALAM, Z.S. & BECKER, R.T. (2010): The global Taghanic Biocrisis (Givetian) in the eastern Anti-Atlas, Morocco. - Palaeogeography, Palaeoclimatology, Palaeoecology, 29 pp., doi:10.1016/j.palaeo.2010.10.015.

BECKER, R. T. & MAPES, R. H. (2010). Latest Devonian ammonoids from Oklahoma and their biogeographic significance. - Acta Geologica Polonica, **60** (2): 139-163.

BECKER, R.T., DE BAETS, K. & NIKOLAEVA, S. (2010): New Ammonoid Records From The Lower Emsian Of The Kitab Reserve (Uzbekistan) – Preliminary Results. – SDS Newsletter, **25**: 20-28.

DOJEN, C., ABOUSSALAM, S.Z. BECKER, R.T. (2010): Palaeoecological and biogeographical interpretation of Devonian ostracodes (Emsian to basal Givetian) of the Western Dra Valley, Morocco (sections Bou Tserfine, Rich Tamelougou and Hassi Mouf). - SDS Newsletter, **25**: 37-39.

TROTH, I., MARSHALL, J. E. A., RACEY, A. R. & BECKER, R. T. (2010): Mid Devonian sea-level change at high palaeolatitude: testing the global sea-level curve. – doi:10.1016/j.palaeo.2010.10.008, Palaeogeography, Palaeoclimatology, Palaeoecology, 18 pp.

### Publications 2011 and in press

AUNG, A.K., BECKER, R.T. & GYI, K.K. (2011): First record of Frasnian (Upper Devonian) sediments and ammonoids from Myanmar. – SDS Newsletter, **26**.

BECKER, R.T. & ABOUSSALAM, Z.S. (2011**).** Emsian chronostratigraphy – preliminary new data and a review of the Tafilalt (SE Morocco). – SDS Newsletter, **26**.

EBBIGHAUSEN, V., BECKER, R.T. & BOCKWINKEL, J. (2011): Emsian and Eifelian Ammonoids from Oufrane, eastern Dra Valley (Anti-Atlas, Morocco) – Taxonomy, Stratigraphy and Correlation. – Neues Jahrbuch für Geologie und Paläontologie. **259** (3): 313-379, doi**:** 10.1127/0077-7749/2011/0121.

HAHN, G., MÜLLER, P. & BECKER, R.T. (2011): Unterkarbonische Trilobiten aus dem Anti-Atlas (Marokko). – Geologica et Palaeontologica, **43**.

KAISER, S.I., BECKER, R.T., STEUBER, T. & ABOUSSALAM, Z.S. (2011 in press): Climate-controlled mass extinctions, facies, and sea-level changes around the Devonian-Carboniferous boundary in the eastern Anti-Atlas (SE Morocco). - Palaeogeography, Palaeoclimatology, Palaeoecology.

### Abstracts 2010

ABOUSSALAM, Z.S. & BECKER, R.T. (2010): Middle/Upper Devonian boundary conodont faunas from Giebringhausen (Rhenish Massif, Germany). – International Palaeontological Congress, London 2010, June 28 – July 3, p. 61.

BECKER, R.T. (2010): The chance of evolutionary success – the case of the oldest (Tournaisian) ceratitoid ammonoids (Prodromitidae, Tornoceratina). – 8th International Symposium, Cephalopods – Present and Past, August 30 – September 3, 2010, University of Burgundy & CNRS, Dijon – France, Abstract Volume: 25-26.

BECKER, R.T. & HARTENFELS, S. (2010): Der Faunenwechsel bei Ammonoideen des mittleren Fameniums (Oberdevon III/IV) – Folge einer globalen trophischen Krise in Außenschelfen? - Zitteliana, Reihe B, **29**: 20-21.

BECKER, R.T., ABOUSSALAM, Z.S., HARTENFELS, S. & EL HASSANI, A. (2010): An update of Middle/Upper Devonian global events in southern Morocco. - International Palaeontological Congress, London 2010, June 28 – July 3, p. 85.

DOJEN, C., ABOUSSALAM, Z.S. & BECKER, R.T. (2010): Effects of Lower/Middle Devonian events on ostracodes from Morocco. - International Palaeontological Congress, London 2010, June 28 – July 3, p. 149.

EICHHOLT, S. & BECKER, R.T. (2010): Phyletischer Gradualismus bei Beloceratiden (Agoniatitida, Gephuroceratacea) des tiefen Oberdevon? - Zitteliana, Reihe B, **29**: 31.

HELLING, S., HÜBERS, M. & BECKER, R.T. (2010): Neue, seltene *Gerastos*-Funde (Trilobita, Proetida) aus dem Unter- und Mittel-Devon Süd-Marokkos. - Zitteliana, Reihe B, **29**: 46.

HÜBERS, M. & BECKER, R.T. (2010): Empirical relationships between shell expansion and septal spacing in Devonian ammonoids. - 8th International Symposium, Cephalopods – Present and Past, August 30 – September 3, 2010, University of Burgundy & CNRS, Dijon – France, Abstract Volume: 48.

HUMBERG, B. & BECKER, R.T. (2010): Morphometry and palaeopathology of Orthoceratida from the Middle and Upper Devonian of the Dra Valley (SW Morocco). - 8th International Symposium, Cephalopods – Present and Past, August 30 – September 3, 2010, University of Burgundy & CNRS, Dijon – France, Abstract Volume: 128.

KIRCHGASSER, W.T., BAIRD, G.C., OVER, J.D., BRETT, C.E. & BECKER, R.T. (2010): Konzentrat Lagerstätte of the goniatite *Naplesites* marking a global transgression event (Upper Devonian *Mesobeloceras* Genozone) in the Rhinestreet Shale, Western New York. - International Palaeontological Congress, London 2010, June 28 – July 3, p. 231.

## TM Alain BLIECK

**Devonian activities:**

Pursuing studies on Early and Middle Palaeozoic vertebrates, based upn three main subjects:

1. Origin of vertebrates (conodonts are not vertebrates);
2. Taxonomy, biostratigraphy, palaeobiogeography and palaeoenvironments of Early Devonian agnathans (pteraspidomrophs);
3. Transition from fish to tetrapod (biostratigraphy and palaeoenvironments).

**Papers published:**

THIRION, F. & BLIECK, A. (2009). New pteraspidiform heterostracans (Vertebrata) from the Lower Devonian of La Gileppe and Nonceveux, Belgium. - Geologica Belgica, **12** (1-2): 31-43, 7 fig., 2 pl.; Bruxelles [http://popups.ulg.ac.be:80/Geol/document.php?id=2651].

DUPRET, V. & BLIECK, A. (2009). The Lochkovian-Pragian boundary in Podolia (Lower Devonian, Ukraine) based upon placoderm vertebrates. - C. R. Geoscience, **341** (1): 63-70, 4 fig., 1 appendix; Elsevier, Amsterdam & Acad. Sci. Paris [: [http://dx.doi.org/10.1016/j.crte.2008.09.007].

BLIECK, A. (2009). Le Nord – Pas-de-Calais depuis 450 millions d'années — Un passé agité. - In : ROBASZYNSKI, F. & GUYÉTANT, G. (coord..), Des roches aux paysages dans le Nord – Pas-de-Calais — Richesse de notre patrimoine géologique (dans le cadre de l'Inventaire National du Patrimoine Géologique et de l'Année Internationale de la Planète Terre); Conserv. Sites Natur. Nord - Pas-de-Calais & Soc. Géol. Nord édit.: 20-29, 9 fig. [In French]

BLIECK, A. (2009). Pernes en Artois – Les roches les plus vieilles du Nord – Pas-de-Calais. - In: ROBASZYNSKI, F. & GUYÉTANT, G. (coord.), Des roches aux paysages dans le Nord – Pas-de-Calais — Richesse de notre patrimoine géologique (dans le cadre de l'Inventaire National du Patrimoine Géologique et de l'Année Internationale de la Planète Terre); Conserv. Sites Natur. Nord - Pas-de-Calais & Soc. Géol. Nord édit.: 86-87, 3 fig. [In French]

BLIECK, A. (2009). Biodiversité, environnements et évolution au Paléozoïque: le cas des vertébrés du Cambrien au Dévonien. - Ann. Soc. Géol. Nord, 2e série, **16**: 19-33, 11 fig.; Villeneuve d'Ascq. [In French, with English abstract]

LÓPEZ-ARBARELLO, A. & BLIECK, A. (2010). Neuer Vertreter der Psammosteiformes (Heterostraci, kieferlose Fische) aus dem Unterdevon des Bergischen Landes [New representative of the Psammosteiformes (Heterostraci, agnathan fishes) from the Lower Devonian of Bergisches Land]. - Freunde der Bayerischen Staatssammlung für Paläontologie und Historische Geologie München, Jahresbericht 2009 und Mitteilungen **38**: 33-39, 3 fig.; Verlag Dr. Friedrich Pfeil, München [In German].

BLIECK, A., CLÉMENT, G. & STREEL, M. (2010). The biostratigraphical distribution of earliest tetrapods (Late Devonian) – a revised version with comments on biodiversification. - In: VECOLI, M., CLÉMENT, G. & MEYER-BERTHAUD, B. (eds), The Terrestrialization Process : Modelling Complex Interactions at the Biosphere-Geosphere Interface. Geol. Soc. London, Spec. Publ. **339**: 129-138, 2 fig.; doi:10.1144/SP339.11

ELLIOTT, D.K. & BLIECK, A.R.M. (2010). A new ctenaspid (Agnatha, Heterostraci) from the Early Devonian of Nevada, with comments on taxonomy, paleobiology and paleobiogeography. - In: ELLIOTT, D.K., MAISEY, J.G., YU Xiaobo & MIAO Desui (eds.), Morphology, Phylogeny and Paleobiogeography of Fossil Fishes – Honoring Meemann CHANG : 25-38, 1 tabl., 3 fig.; Verlag Dr. Friedrich PFEIL, München.

TURNER, S., BURROW, C.J., SCHULTZE, H.-P., BLIECK, A., REIF, W.-E.†, REXROAD, C.B., BULTYNCK, P. & NOWLAN, G.S. (2010).- False teeth : conodont-vertebrate phylogenetic relationships revisited.- Geodiversitas, **32** (4): 545-594 or 595, 4 fig.; Paris

## CM Margaret BRADSHAW

Devonian work progresses on the Baton Formation, New Zealand, on the event stratigraphy of the lower Taylor Group, Antarctica and on the the bivalve fauna of the MT Ida Formation, Australia.

**Publications 2010**

BRADSHAW, M. A., 2010. Devonian trace fossils of the Horlick Formation, Ohio Range, Antarctica:

Systematic description and palaeoenvironmental interpretation. Ichnos, **17**: 58-114.

## TM C.E. BRETT

Devonian activities in 2010 were primarily focused on the IPC, based in London. We all very much enjoyed John MARSHALL'S marvelous trip in northern Scotland and the Orkney. The many spectacular localities served to emphasize the intriguing paleoclimatic events recorded in the Old Red Sandstone Orcadian Basin and we could relate some of these events to the changes associated with the Middle Devonian Kačák and Taghanic crises. Some magnificent fossil fish were found (most notably the remarkable *Thursius* specimen found by CM Alex BARTHOLOMEW at Mey Beach). This trip, coupled with the very interesting sessions on Devonian bioevents at the IPC, made June a Devonian extravaganza.

The Devonian bioevents symposium will result in an edited volume, as will a symposium I co-chaired on time-specific facies- the interesting concept promoted by Otto WALLISER. Annalisa Ferretti, Kathleen Histon, Pat McLaughlin and I are working on an edited volume for Palaeo-3, which will feature several papers on time-specific facies in the Devonian.

I spent some time in mid-July examining Givetian and Frasnian successions in the Holy Cross Mountains of Poland with Michał GRUSZCZINSKY (Kielce University) including the Zachełmie quarry from which, earlier in 2010, footprints of what appear to be the world's oldest land dwelling tetrapod animal were reported in *Nature*. We saw some of the crude tracks that were still preserved there (others are in a museum) in Eifelian peritidal limestones and, even more interesting, an angular unconformity to rival HUTTON'S Siccar Point, between the Devonian beds and overlying Triassic redbeds (but no Alex to play bagpipes in Poland!). Michał also showed me the Mogiłki quarry of Frasnian limestones and shales that look so strikingly like the anachronistic black shale/stromatolitic limestone facies of the Silurian McKenzie Shale in Pennsylvania that we will make a comparative facies/paleoecological study of these two areas. We are also collaborating with Michał's PhD student, Adrian KIN on fossilized migratory queues (rows) of the blind Famennian phacopid *Trimerocephalus* n. sp., from the famed Kowala Quarry.

Much of the rest of July was spent at the Senckenberg Museum where Eberhard SCHINDLER, Peter KÖNIGSHOF, and I worked on final editing for 11 papers for the special volume on Middle Devonian cycles and bioevents; the entire volume is now published electronically and should be out in hard copy in *Palaeogeography, Palaeoclimatology, Palaeoecology* early in 2011. I am now turning attention to getting the guidebooks from last year's NAPC field trips edited and re-formatted for publication as a Cincinnati Museum special volume. I am also working on a manuscript on comparative facies rhythmic trilobite beds from the Emsian of SW Morocco and elsewhere, based on work initiated in 2007 on a National Geographic grant.

My notes from 2009 somehow did not make it to last year's newsletter so here they are again for old time's sake:

In the first half of 2009 much of my time was devoted to the North American Paleontological Convention (NAPC), held here on the University of Cincinnati campus and in the field. (And, yes, I got to play Charles Darwin and disperse copies of his great book for the opening ceremonies!). I was in charge of organizing the 10 associated field trips and was involved in leading pre-, mid- and post-meeting trips on Ordovician, Silurian and Devonian (respectively). A mid-meeting trip on June 24, with Patrick MCLAUGHLIN (CM of Silurian Subcommission) and Mike DESANTIS and input from Juergen SCHIEBER (Indiana University) examined the Silurian and Devonian of the Falls of the Ohio area in northern Kentucky and Indiana. Despite sweltering heat, we were able to visit all intended sections, including Middle Devonian sections at the Falls of the Ohio and Sellersburg Quarry, and Middle-Upper Devonian New Albany Shale south of Louisville, Kentucky.

The post-meeting field trip for SDS, "Middle and Upper Devonian Sequences, Sea-Level, Climatic and Biotic Events in East-Central Laurentia: Kentucky, Ohio, and Michigan", held June 27 to July 2, 2009, provided an overview of Middle and Upper Devonian sequence stratigraphy, paleoenvironments and paleoecology in Kentucky, Ohio, Indiana and Michigan. The trip co-led by Alex BARTHOLOMEW (State University of NY New Paltz; CM of SDS), Gordon BAIRD (State University

of NY at Fredonia; CM, SDS), Mike DESANTIS and James ZAMBITO (University of Cincinnati), and myself, commenced with Middle-Upper Devonian of Kentucky and proceeded to the Devonian of central and northern Ohio. This was followed by three days in the Middle Devonian Traverse Group of the Alpena, Michigan area. The trip concluded with the Upper Devonian of the Cleveland area in northeastern Ohio where we were joined by Bob CARR (Ohio University) and Joe HANNIBAL (Cleveland Museum). Several interesting discoveries were made at the stops and the trip provided a cross-section of mid-western Devonian geology, including most of the better outcrops that exist between central Kentucky and northern Michigan. Not surprisingly, we had to spend some time traveling. I trust that participants understood that we were not trying to simply run a marathon, but attempting to show a broad diversity of things in the short time we had together; that's the way the outcrops are. It was wonderful to have so many good friends and colleagues from all over the world here in Cincinnati and out looking at outcrops with us. We learned a great deal from them and greatly appreciated their patience, enthusiasm, and expertise. We intend to publish the articles and guides related to the fieldtrips as a book through Cincinnati Museum Center; a companion to our book on the Ordovician of the Cincinnati Arch that came out in 2008.

In early August, 2009, I ran two field workshops on the Devonian of the Ithaca, Cayuga Lake area in central New York: one for an NSF Workshop on Teaching Paleontology; and a second for the Paleontological Research Institution Annual Reunion. In the process of running these trips, I discovered a newly exposed Devonian fish bone bed at the top of the Onondaga Limestone near Seneca Falls, NY. This bed was subsequently excavated by Bob CARR of Ohio University, with help from some of our students; a number of well-preserved onychodid teeth (including symphyseal whorl), placoderm plates, and shark spines were recovered and donated to the Cincinnati Museum Center.

Research on the sequence stratigraphy and paleoecology of the Middle-Upper Devonian Genesee Formation and its eastern equivalents was extended into the area of Oneonta in eastern New York by PhD student James ZAMBITO.

## Publications

BRETT, C. E., ALLISON, P.A., & HENDY, A.J.W., 2011. Comparative taphonomy and sedimentology of small-scale mixed carbonate/siliciclastic cycles: Synopsis of Phanerozoic examples. - In ALLISON, P.A. and BOTTJER, D.J., eds., Taphonomy: Process and Bias through Time. Springer Verlag, Topics in Geobiology, **32**: 107-198

BRETT, C.E. & DESANTIS, M. 2010. Geology and paleontology of the Columbus and Delaware formations in southern Delaware County, Ohio. - In Albert de la CHAPELLE, ed., History, Archeology, and Geology of the Harter Run Site. The Ohio State University Press.

BRETT, C.E., IVANY, L.C., BARTHOLOMEW, A.J., DESANTIS, M.D. K. & BAIRD, G.C. 2009. Devonian ecological-evolutionary subunits in the Appalachian Basin: a revision and a test of persistence and discreteness. Geological Society of London, Special Publications, **314**: 7-36.

BRETT, C.E., SCHINDLER, E. & KÖNIGSHOF, P., 2010. Sea-level and climatic cyclicity and bioevents in Middle Devonian marine and terrestrial environments: an overview. - Palaeogeography, Palaeoclimatology, Palaeoecology.

IVANY, L, BRETT, C.E., BAUGH, H.L. & WALL, P., 2009. Coordinated stasis revisited: Taxonomic and ecologic stability in the Devonian of New York. – Paleobiology, **35**: 499-524.

NAGEL-MYERS, J., DIETL, G., BRETT, C.E. 2009. First report of sublethal breakage-induced predation on Devonian bivalves. - Palaios **24**: 460-465.

SUMRALL, C. D., BRETT, C.E., DEXTER, T. & BARTHOLOMEW, A.J. 2009. An enigmatic blastozoan echinoderm fauna from the Middle Devonian of central Kentucky. - Journal of Paleontology, **83** (5): 739-749.

ZAMBITO, J. BAIRD, G.C., BRETT, C.E. & BARTHOLOMEW, A. J. 2009. Stratigraphic sequences and paleontology of the Middle-Upper Devonian transition (Genesee Group) at Ithaca, NY: A revised lithostratigraphy for the northern Appalachian Basin.. - In OVER, D. J., ed., Studies in Devonian Stratigraphy, Palaeontographica Americana, **63**: 49-69.

## Guidebook Articles:

BAIRD, G.C., CARR, R., HANNIBAL, J., BRETT, C.E. & BRETT, B.L. 2009. Upper Devonian (Famennian) Stratigraphy of the Cleveland Area, Northeastern Ohio. - In BRETT, C.E., BARTHOLOMEW, A.J. & BAIRD, G.C., eds., Middle and Upper Devonian Sequences, Sea-Level, Climatic and Biotic Events in East-Central Laurentia: Kentucky, Ohio, and Michigan. North American Paleontological Convention-2009; Guidebook, Fieldtrip 10, pp. 155-170, University of Cincinnati, Cincinnati, Ohio.

BARTHOLOMEW, A.J., BRETT, C.E. & DESANTIS, M.K., 2009. Middle Devonian (upper Eifelian to uppermost Givetian) Biostratigraphy Sequences and Bioevents of the Michigan Basin. pp. 105-122. - In BRETT, C.E., BARTHOLOMEW, A.J. & BAIRD, G.C., eds., Middle and Upper Devonian Sequences, Sea-Level, Climatic and Biotic Events in East-Central Laurentia: Kentucky, Ohio, and Michigan. North American Paleontological Convention-2009;

Guidebook, Fieldtrip 10, 186 pp. University of Cincinnati, Cincinnati, Ohio.

BARTHOLOMEW, A.J., BRETT, C.E. & DESANTIS, M.K., 2009. Middle Devonian of the southern Michigan, northwestern Ohio. - In BRETT, C.E., BARTHOLOMEW, A.J. & BAIRD, G.C., eds., Middle and Upper Devonian Sequences, Sea-Level, Climatic and Biotic Events in East-Central Laurentia: Kentucky, Ohio, and Michigan. North American Paleontological Convention-2009; Guidebook, Fieldtrip 10, pp. 89-104., University of Cincinnati, Cincinnati, Ohio.

BRETT, C.E., BARTHOLOMEW, A.J. & DESANTIS, M.K., 2009. Middle Devonian of the East Findlay rch Basin: Sandusky Area of North Central Ohio. - In BRETT, C.E., BARTHOLOMEW, A.J. & BAIRD, G.C., eds., Middle and Upper Devonian Sequences, Sea-Level, Climatic and Biotic Events in East-Central Laurentia: Kentucky, Ohio, and Michigan. North American Paleontological Convention-2009; Guidebook, Fieldtrip 10, pp. 147-154, University of Cincinnati, Cincinnati, Ohio.

BRETT, C.E., BARTHOLOMEW, A.J., DESANTIS, M.K. & BAIRD, G.C. 2009. Middle Devonian of the Southern Michigan Basin: Sylvania Area, Northwestern Ohio. - In BRETT, C.E., BARTHOLOMEW, A.J. & BAIRD, G.C., eds., Middle and Upper Devonian Sequences, Sea-Level, Climatic and Biotic Events in East-Central Laurentia: Kentucky, Ohio, and Michigan. North American Paleontological Convention-2009; Guidebook, Fieldtrip 10, 186 pp. University of Cincinnati, Cincinnati, Ohio.

BRETT, C.E., MCLAUGHLIN, P.I. & DESANTIS, M.K., 2009. Middle Paleozoic Sequence Stratigraphy and Paleontology of the Western Flank of the Cincinnati Arch. - North American Paleontological Convention-2009; Guidebook, Fieldtrip 6, 58 pp. University of Cincinnati, Cincinnati, Ohio.

DESANTIS, M.K., BRETT, C.E., BARTHOLOMEW, A.J. & OVER, D. J. 2009. Depositional Sequences, Biostratigraphy, and Bioevents in the Middle and Upper Devonian (upper Eifelian to Famennian), Southern Delaware County, Ohio. p. 67-86. - In BRETT, C.E., BARTHOLOMEW, A.J. & BAIRD, G.C., eds., Middle and Upper Devonian Sequences, Sea-Level, Climatic and Biotic Events in East-Central Laurentia: Kentucky, Ohio, and Michigan. North American Paleontological Convention-2009; Guidebook, Fieldtrip 10, 186 pp. University of Cincinnati, Cincinnati, Ohio.

## CM Rainer BROCKE

In 2010 research activities, partly in conjunction with field work, were concentrated on three projects: "Lower Devonian plants, spores and paleosoils from marin-terrestrial-transitions in the Rheinisches Schiefergebirge" (together with S. SCHULTKA, Humboldt University, Berlin), the "Phytoplankton bloom (prasinophytes) during the basal Choteč Event" (in cooperation mainly with colleagues from the Czech Republic and USA), and the "Devonian of the Central and Southern Taurides of Turkey" (with colleagues from Turkey and Senckenberg). New results of these studies were presented in Darmstadt (GeoDarmstadt 2010, Germany), in London (IPC 3), and in Adana (7th International Symposium on Eastern Mediterranean Geology). Furthermore, work continued on material from the Lower Devonian siliciclastic sections of the Rheinisches Schiefergebirge (Germany) including the Hunsrück Shale (together with. W. RIEGEL, Göttingen and V. KNEIDL, Bad Kreuznach). The Kellwasser sequence at its type locality has been revisited. First palynological results of an ongoing project from the Devonian of the Western Desert in Egypt (in cooperation with A. HOSNY, Al-Azhar Univ., Assiut, Egypt) has been presented in Adana.

### Selected publications and abstracts 2010

BROCKE, R., BERKYOVÁ, S., BUDIL, P., FATKA, O., FRÝDA, J., SCHINDLER, E. (2010). The early Middle Devonian Choteč Event in the Barrandian area (Czech Republic): new insight from a phytoplankton bloom. International Palaeontological Congress (28.06.-03.07.2010), London, Great Britain, 103.

BROCKE, R., ERTUG, K., WEHRMANN, A., YILMAZ, I., BOZDOĞAN, N., YALÇIN, M.N. (2010). Do palynofacies and mineralogical signatures reflect hinterland processes? Implications from Devonian sequences in the Central and Eastern Taurides, Turkey. 7th International Symposium on Eastern Mediterranean Geology, (18.-22.10.2010), University of Çukurova, Adana, Turkey, 57.

HOSNY, A., BROCKE, R. (2010). Palynology of Palaeozoic sequences in the Western Desert of Egypt: Preliminary results from the Devonian of the Sifa-1 borehole. 7th International Symposium on Eastern Mediterranean Geology, (18.-22.10.2010), University of Çukurova, Adana, Turkey, 150.

LUPPOLD, F.W., SCHINDLER, E., BROCKE, R., STOPPEL, D. (2010). Typlokalität der Kellwasser-Horizonte erweitert. Gmit, **39**, 25-26.

SCHULTKA, S., BROCKE, R. (2010). Vegetation horizons in marine-terrestrial transitions: palaeobotanical and palynological implications from Lower Devonian successions in the Rheinisches Schiefergebirge, Germany. GeoDarmstadt2010 (10.-13.10.2010), SDGG, **68**: 500.

WEHRMANN, A., WILDE, V., SCHINDLER, E., BROCKE, R., SCHULTKA, S. (2010). High-resolution facies analysis of a Lower Devonian deltaic marine-terrestrial transition (Nellenköpfchen Formation, Rheinisches Schiefergebirge, Germany): implications for small-scale fluctuations of coastal environments. Neues

Jahrbuch für Geologie und Paläontologie, Abhandlungen, **256**/3, 317-334.

WEHRMANN, A., YILMAZ, I., YALÇIN, M.N., WILDE, V., SCHINDLER, E., WEDDIGE, K., SAYDAM DEMIRTAS, G., ÖZKAN, R., NAZIK, A., NALCIOĞLU, G., KOZLU, H., KARSLIOĞLU, Ö., JANSEN, U., ERTUĞ, K., BROCKE, R., BOZDOĞAN, N. (2010). Devonian shallow-water sequences from the North Gondwana coastal margin (Central and Eastern Taurides, Turkey): Sedimentology, facies and global events. Gondwana Research, **17** (2010), 546-560

## CM Pierre BULTYNCK

During 2010 my research (in collaboration with O.H. **WALLISER** and K. WEDDIGE) mainly focused on extinctions, innovations and survival of conodont species during the late Eifelian and earliest Givetian events (Kacak Episode). The precise position of the events in conodont zonations is still not precisely documented. The stratigraphic position of the Kacak Episode is different from one author(s) to another: e.g. CHLUPAC 1995, CHLUPAC et al. 2000 (Bohemia); WALLISER 1995, 2000 (global); BECKER and HOUSE 1994 (Tafilalt, N America); GARCIA ALCALDE 1998 (Spain). This is also the case for the correlation of the Kacack Episode with the sea-level curve of Johnson, Klapper and Sandberg 1985: TR cycle I-e and or I-f.

The conodont faunas from the Givetian GSSP at Jebel Mech Irdane are rich and several conodont species show a large variability allowing to recognize different morphotypes or new species. The study of the Mech Irdane conodonts is combined with the revision of previouslydescribed conodont faunas from the same time interval in the southern Moroccan Bou Tchrafine and Ou Driss sections and from the Blauer Bruch locality in the E Rhenish Schiefergebirge.

### Published Papers

Narkiewicz, K. and Bultynck, P., 2010. The Upper Givetian (Middle Devonian) *subterminus* conodont zone in North America, Europe and North Africa. Journal of Paleontology, **84** (4): 588-625.

Weyant, M.+, Bultynck, P., Plusquellec, Y. and Racheboeuf, P.R., 2010. Reassessment of Lochkovian – Pragian conodont faunas from the Rade de Brest and the Presqu' île de Crozon (Massif Armoricain, W France. Neues Jahrbuch Geologie und Paläontologie, Abhandlungen **258** (1): 73 – 88.

Wright, A.J., Coen-Aubert, M., Bultynck, P. and Van Viersen, A.P., 2010. New data on occurrences of the Devonian rugose coral *Calceola* in Belgium. Memoirs of the Association of Australasian Palaeontologists, **39**: 121 – 129.

## CM Carole BURROW

(Brisbane, Australia) continues collaborating with Mike NEWMAN (Wales), Bob DAVIDSON (Scotland) and Jan den Blaauwen (the Netherlands) on Scottish Early-Middle Devonian acanthodians and new revelations on their biogeographical distribution, with Sue TURNER (Brisbane) and John MAISEY (New York) on Canadian Early Devonian acanthodians and sharks, with John LONG (previously Melbourne, now Los Angeles) and Kate TRINAJSTIC (Perth) on the rare Gogo shark and acanthodians, and on other bits and pieces with Gavin YOUNG and Tim SENDEN (Canberra), making use of the latter's 3D scanning facility. She is a CI with Gavin, Kate, and Tim on an ARC Discovery project (mid2010-2013) on the "Origin of jaws - the greatest unsolved mystery of early vertebrate evolution". Her investigations on Canadian mid-Palaeozoic spiny fishes were enhanced by a visit to the New Brunswick Museum in August 2010, aided by a G.F. MATTHEW grant. She continues to work on the histology and morphology of Devonian microvertebrate assemblages from New South Wales, as well as on Mike MURPHY's collection of Late Silurian-Early Devonian acanthodians of the western USA, work that will extend the stratigraphic value of acanthodian scales through this interval. She is also working with Pavel BEZNOSOV (Syktyvkar, Russia), Vachik HAIRAPETIAN (Esfahan, Iran), Gavin HANKE (Victoria, Canada) on sorting out the taxonomy and distribution of ischnacanthiform dentigerous jaw bones from Iran, Russia and north America. Publication-wise, 2010 was a productive year, with contributions to two thematic volumes on fossil vertebrates: the IGCP491 final volume and a volume honouring Meeman Chang. The long term collaborative work denying a vertebrate relationship for conodonts is also finally published. She participated in the Scottish SDS field trip and subsequent IPC3 (including the SDS session) in London in June-July 2010.

### SDS-related Publications 2010

### Refereed papers

BLIECK A, TURNER S, BURROW CJ, SCHULTZE H-P, REXROAD CB, BULTYNCK P, NOWLAN GS (2010). Fossils, histology, and phylogeny: Why conodonts are not vertebrates. *Episodes* **33**: 234-241

BURROW CJ, TURNER S, YOUNG GC (2010). Middle Palaeozoic microvertebrate assemblages and biogeography of East Gondwana (Australasia, Antarctica). *Palaeoworld* **19**: 37-54

BURROW CJ, IVANOV A, RODINA O (2010). Emsian vertebrate microremains from the Zinzilban section, Uzbekistan. *Palaeoworld* **19**: 75-86

TURNER S, BURROW CJ, SCHULTZE H-P, BLIECK A, REIF W-E, REXROAD CB, BULTYNCK P, NOWLAN GS (2010).

False teeth: conodont-vertebrate phylogenetic relationships revisited. *Geodiversitas* **32**: 545-594

YOUNG GC, BURROW CJ, LONG JA, TURNER S, CHOO B (2010). Devonian macrovertebrate assemblages and biogeography of East Gondwana (Australasia, Antarctica). *Palaeoworld* **19**: 55-74

BURROW CJ, DAVIDSON RG, NEWMAN MJ, DEN BLAAUWEN JL (2010). Sclerotic plates or circumorbital bones in early jawed fishes? *Palaeontology*. doi: 10.1111/j.1475-983.2010.01003.x

**Book chapters**

BURROW CJ, DESBIENS S, EKRT B, SUDKAMP WH (2010) A new look at *Machaeracanthus*. pp. 59-84. In: ELLIOTT DK, MAISEY JG, YU X, MIAO D (eds), Morphology, Phylogeny and Paleobiogeography of Fossil Fishes - Honoring Meemann CHANG. Verlag Dr. Friedrich Pfeil, München

BURROW CJ, TURNER S (2010) Reassessment of "*Protodus*" *scoticus* from the Early Devonian of Scotland. pp. 123-144. In: ELLIOTT DK, Maisey JG, YU X, MIAO D (eds) Morphology, Phylogeny and Paleobiogeography of Fossil Fishes - Honoring Meemann Chang. Verlag Dr. Friedrich Pfeil, München

**Papers submitted and in preparation**

MARK-KURIK E, BLIECK A, BURROW C, TURNER S (in prep.) Early Devonian fishes from the coastal area of the Long Strait, Central Chukotka, Russia. Geodiversitas.

NEWMAN MJ, DAVIDSON RG, DEN BLAAUWEN JL, BURROW CJ (subm.) THE EARLY Devonian acanthodian Uraniacanthus curtus from the Midland Valley of Scotland. Geodiversitas.

NEWMAN MJ, DAVIDSON RG, DEN BLAAUWEN JL, BURROW CJ (SUBM.) The Early Devonian acanthodian *Euthacanthus gracilis* from the Midland Valley of Scotland. Scottish Journal of Geology.

## TM Jean-Georges CASIER

During 2010, and in collaboration with A. Préat (University of Brussels), X. DEVLEESCHOUWER, E. PETITCLERC and G. CAMBIER of my Institute, I have published a paper on ostracods, rock facies and magnetic susceptibility (MS) of the Trois-Fontaines Fm / Terre d'Haurs Fm transition (Early Givetian) in the Rancennes quarry at the Mont d'Haurs (Givet, France). An other paper on the Hanonet Fm / Trois-Fontaines Fm transition also at the Mont d'Haurs has been submitted for the next issue of the Bulletin of my institute. Finally, the study of ostracods, microfacies and MS of the Terres d'Haurs Fm and Mont d'Haurs Fm always at the Mont d'Haurs, and of the Fromelennes Fm in the Sourd d'Ave section in Belgium, is in progress. Up to now, among 12,000 ostracods have been extracted by the hot acetolysis method at the Mont d'Haurs, and a general good correlation is observed between the results obtained by the ostracod study, the sedimentological analysis and the MS. For example, in the Trois-Fontaines Fm, there is a correspondence between the highest MS values, the restricted environments displayed by the sedimentological analysis and the presence of Leperditicopida. But the most important problem remains that, despite important progress, the conodont biostratigraphy can not fixed with enough precision the stage boundaries in the type locality of the Givetian (CASIER & PRÉAT, 2010).

**Devonian related publications and abstracts 2010**

CASIER, J.-G. & PREAT, A., 2010.Comments on Devonian GSSPs and the Devonian / Carboniferous boundary. Abstracts 4th French Congress on Stratigraphy "Strati 2010", Paris (France), August 30 - September 2: 52-55 .http://www.univ.brest.fr/geosciences/conference/ocs/index.php/CFS/STRATI2010/paper/view/97

CASIER, J.-G., CAMBIER, G., DEVLEESCHOUWER, X., PETITCLERC, E. & PREAT, A., 2010. Ostracods, rock facies and magnetic susceptibility of the Trois-Fontaines and Terres d'Haurs Formations (Early Givetian) in the Rancennes quarry at Mont d'Haurs (Givet, France). Bulletin de l'Institut royal des Sciences naturelles de Belgique, Sciences de la Terre, **80**: 85-114.http://www.naturalsciences.be/pdf/bulletin/

CASIER, J.-G., CAMBIER, G., DEVLEESCHOUWER, X., PETITCLERC, E. & PREAT, A., 2010. Ostracodes, sédimentologie et susceptibilité magnétique au passage des Formations de Trois-Fontaines et des Terres d'Haurs (Givétien) dans la carrière de Rancennes (Mont d'Haurs, Givet, France). 23ièmè Réunion des ostracodologistes de langue française, Tunis (Tunisia), May 6-8: 25-26.

CASIER, J.-G., DEVLEESCHOUWER, X., MOREAU, J., PETITCLERC, E. & PREAT, A., 2010. Ostracodes, microfacies and magnetic susceptibility of the Lower Givetian in the type-locality. Abstracts with Programs Geological Society of America Annual Meeting & Exposition, Denver, Colorado, October 31 - November 3, 42 (5): 1 p. + pdf, 3 pp. http://gsa.confex.com/gsa/2010AM/finalprogram/abstract_178667.htm

CASIER, J.-G., DEVLEESCHOUWER, X., PETITCLERC, E. & PREAT, A., 2010. Ostracods, microfacies and magnetic susceptibility of the lower part of the Givetian in the type-locality. Abstracts 4th French Congress on Stratigraphy "Strati 2010", Paris (France), August 30 - September 2: 49-52. http://www.univ-brest.fr/geosciences/conference/ocs/index.php/CFS/STRATI2010/paper/view/96

CASIER, J.-G., DEVLEESCHOUWER, X., PETITCLERC, E. & PREAT, A., 2011. Ostracods, rock facies and magnetic susceptibility of the Hanonet Formation and Trois-Fontaines Formation transition (Early Givetian) at the Mont d'Haurs (Givet, France). Bulletin de l'Institut royal des Sciences naturelles de Belgique, Sciences de la Terre, 81 (in rev.).

CASIER, J.-G., EL HASSANI, A. & PREAT, A., 2010. Ostracodes du Dévonien moyen et supérieur du Tafilalt (Maroc). Revue de Micropaléontologie,

53 29-51. http://www.em-consulte.com/en/article/240681

PETITCLERC, E., SPASSOV, S., CASIER, J.-G., PREAT, A. & DEVLEESCHOUWER, X., 2010. Hanonet/Trois-Fontaines Formations boundary (base of the Givetian) in Belgium and France: is magnetic susceptibility correlation possible? Abstracts 12th Castle Meeting on paleo, rock and environmental magnetism 2010, Castle of Nove Hadry, Czech Rezpublic, August 29 - September 4: 2 pp.

YATSU, S., KAIHO, K., OBA, M., CHEN, Z.-Q., CASIER, J.-G. & WRIGHT, J., 2010. Euxinic ocean during the Late Devonian mass extinction inferred from organic compounds. International Geobiolgy Conference, June 3-6, Wuhan, Hubei (China): 2 pp.

## CM Carlo CORRADINI

My research is mainly devoted to conodont biostratigraphy in Sardinia, the Carnic Alps and other North Gondwana regions, specially on time intervals across the Silurian/Devonian and the Devonian/Carboniferous boundaries.

In Sardinia several upper Silurian and lowermost Devonian outcrops and sections were restudied in order to update the stratigraphical information on the basis of recent taxonomical novelties (with M.G. CORRIGA). A couple of sections of the same time span have been sampled in the Spanish Pyrenees (with J.I. VALENZUELA-RIOS, M.G. CORRIGA and J.C. LIAO).

A project with the goal to achieve a formal lithostratigraphic subdivision of the pre-Variscan sequence of the Carnic Alps is in progress: in fact, the different parts of this sequence are mainly denominated with informal names, that derivate either from facies or historical terms. Furthermore, being the region across the state border between Italy and Austria, different terminologies have been adopted on both sides of the mountain chain, which result in a high number of names indicating similar - if not the same - lithological units. Almost none has been formalized according to the ICS rules. The goal is to achieve a common but unified terminology, subdividing the lithostratigraphic column in possible formal units by well defined stratotypes and names of the pre-Variscan sequence of the entire region. The project, coordinated by T. Suttner (Graz) and me, involves several colleagues from various countries and is open to everybody can give a contribution. Within this project, several sections from late Silurian to Lower Devonian are in study in varous areas of the Carnic Alps (with L. Simonetto, M. PONDRELLI, M.G. CORRIGA, T. SUTTNER, E. KIDO and P. SERVENTI).

Researches on Late Devonian and Early Carboniferous are related with the redefinition of the Devonian/Carboniferous Boundary. The International working Group (led by M. ARETZ, Toulouse) met in London in connection with the IPC 3, where a few possible criteria for the new definition of the boundary were presented and preliminarily discussed. In this respect a paper on taxonomic problems of early siphonodellids (with S. Kaiser) is in press and a manuscript on genus *Protognathodus* (with S.I. KAISER, M.C. PERRI and C. SPALLETTA) have been submitted. Also a very interesting fauna from central Iran is in study (with A. Bahrami, Isfahan) as well as a few new sections in Sardinia.

Maria G. CORRIGA has almost finished on a PhD project on conodont taxonomy and biostratigraphy across the S/D boundary in Sardinia and the Carnic Alps.

Ali BAHRAMI, PhD student from Isfahan University (Iran), is spending a six months period in Cagliari, to work on Late Devonian and Early Carboniferous conodonts from several sections of central Iran (Tabas and Kerman areas).

**Published papers and abstracts related to Devonian (2009/2010)**

CORRADINI C., KAISER S.I., PERRI M.C. & SPALLETTA C., 2010. Conodont genus *Protognathodus* as a possible tool for recognizing the Devonian/Carboniferous boundary. IPC3 Abstract, 131.

CORRADINI C. & CORRIGA M.G., Silurian and lowermost Devonian conodonts from the Passo Volaia area (Carnic Alps, Italy). *Bollettino della Società Paleontologica Italiana*, **49** (3), 237-253.

## TM Ulrich JANSSEN

Studies on Devonian brachiopod systematics, stratigraphy, palaeoecology and palaeobiogeography were continued in 2010. Regionally the focus was put on materials from Germany (Rhenish Massif) and from other European countries. A monograph of Pridolian to Eifelian taxa is still in preparation. New brachiopod data on Devonian sections in the central and eastern Taurides (Turkey) were contributed to a summarizing publication of our Turkish-German research group (WEHRMANN et al. 2010). The Hunsrueck Slate and Fossil Brachiopod collections (largely Devonian) of my section in the Senckenberg Institute have been the subject of a curatorial upgrade (German Research Foundation Grant, DFG-LIS), including electronic cataloguing and imaging in the web-based Senckenberg Collection Management System, SeSam (JANSEN & TÜRKAY 2010). The following publications document my recent activities:

**PUBLICATIONS**

JANSEN, U. (2010). Brachiopod stratigraphy of the Rhenish Lower Devonian (Germany), 6th International Brachiopod Congress (01.-05.02.2010), Melbourne, Australia. Geological Society of Australia, Abstracts 95, addendum.

JANSEN, U. (2010). Revision of the Pragian/Emsian GSSP from the Rhenish perspective. GeoDarmstadt 2010 (10.-13.10.2010), Darmstadt, Deutschland.

JANSEN, U. (2010). Biohistory of Pridolian through Eifelian brachiopods. GAFOS 2010 Meeting of the Alexander von Humboldt Foundation 2010 (2.-05.06.2010), Abstracts; Potsdam, Deutschland.

JANSEN, U. (2010). Biohistory of Pridolian through Eifelian brachiopods. International Palaeontological Congress, IPC 3, London (28.06.-03.07.2010), Programme and Abstracts; London, Great Britain.

JANSEN, U. (2010). The Hunsrueck Slate and Brachiopod collections of the Senckenberg Museum: new initiatives. International Palaeontological Congress, IPC 3, London (2.-05.06.2010), Programme and Abstracts; London, Great Britain.

JANSEN, U. & TÜRKAY, M. (2010): Palaeontological collections oft he Senckenberg Museum (Frankfurt am Main, Germany): new initiatives. The Geological Curator **9** (4): 255-260.

SCHINDLER, E., YILMAZ, I., YALCIN, N., WILDE, V., WEHRMANN, A., WEDDIGE, K., SAYDAM DEMIRAY, G., ÖZKAN, R., NAZIK, A., NALCIOGLU, G., KOZLU, H., KARSIOGLU, Ö., JANSEN, U., ERTUG, K., BROCKE, R., BOZDOGAN, N. (2010). Stratigraphy, facies development and global events in Devonian sequences of the central and eastern Taurides (Turkey). 7th International Symposium on Eastern Mediterranean Geology (18.-22.10. 2010), Abstract Book, 56; Adana, Turkey.

WEHRMANN, A., YILMAZ, I., YALCIN, N., WILDE, V., SCHINDLER, E., WEDDIGE, K., SAYDAM DEMIRTAS, G., ÖZKAN, R., NAZIK, A., NALCIOGLU, G., KOZLU, H., KARSIOGLU, Ö., JANSEN, U., ERTUG, K., BROCKE, R., BOZDOGAN, N. (2010). Devonian shallow-water sequences from the North Gondwana coastal margin (Central and Eastern Taurides, Turkey): sedimentology, facies and global events. Gondwana Research **17**, 546-560.

## CM Elga Mark-Kurik

The most exciting event in 2010 was the IPC3 pre-conference field trip (23rd-28th June) to Scotland. It was a unique possibility to visit famous Old Red Sandstone exposures and fish localities, particularly these on the Orkney Islands. The trip included classical fish localities, such as Achanarras Quarry, Cromarty and others. Participants could collect fish and plant fossils, and also study collections in Burray Fish and Heritage Centre, Orkney, and briefly these of the National Museum in Edinburgh at the end of the trip. For correlation of the Scottish and Baltic Middle Devonian it was of special interest to visit localities of two key levels: Achanarras and Sandwick Fish Bed (Eifelian), and Eday (Givetian). The excursion was perfectly organized by John MARSHALL (Southampton), John BROWN (Stromness, Orkney), Mike NEWMAN and Bob DAVIDSON (Aberdeen). And in addition to a profound field trip guide we were supplied with very informative and richly illustrated reviews on the Early and Middle Devonian fishes. The latter (by Mike NEWMAN) is quite original, as it shows how restorations of fossil fishes have changed in the course of time. Cordial thanks to above colleagues!

At the beginning of August Ivars ZUPIŅŠ (Latvian Museum of Natural Museum) and I had a short field trip to South Estonia, collecting in two fish localities: Kallaste, a cliff at the Peipsi Lake (lower Givetian Aruküla Fm) and Kalmetumägi on the Piusa River (upper Givetian Gauja Fm). Kalmetumägi is one of the prototetrapod *Livonian multidentata* locality. We found a lot of fossils but nothing seemed to belong to this interesting creature.

A review on the Devonian in Setomaa, SE Estonia, is submitted to the editors of the fundamental nature volume of the county. Illustrations of the paper include the geological map of the Middle-Upper Devonian of this area.

The Devonian stratigraphical scheme of Estonia (autors: E. M.-K. & A. PÕLDVERE) is ready to submit for publication in Estonian Journal of Earth Sciences. The paper will be also with a web version. Series and stage boundaries have been of special interest, particularly that of the Middle/Upper Devonian boundary in the Baltic and adjacent areas: Belarus and NW of Russia.

The paper on the Early Devonian fishes from coastal Long Strait, Siberian Arctic (Russia) is unfortunately still in preparation, except C. Burrow's part on acanthodians. Many thanks to Carole! It is a special case with fish fossils from a very distant region of the Eurasian continent. A rather limited number of microremains, all from the Lochkovian, were obtained from rock pieces, left after preparation of brachiopods. Fish workers were lucky as late Dr. Svetlana CHERKESOVA (VNII Oceangeologia, St. Peterburg) preserved the valuable part of rock and it could be later treated with diluted acetic acid..

### References

MARK-KURIK, E. (2010). *Dolganosteus*, a new Early Devonian rhenanid (Placodermi) from the northern Siberia. In: ELLIOTT, D.K., MAISEY J.G., YU Xiaobo, MIAO Desui (eds.) Morphology, Phylogeny and Paleobiogeography of Fossil Fishes. Verlag Dr. F. Pfeil, München, Germany. 101-106.

PUURA, I., LANG, L., UIBOPUU, E., NEMLIHER, J., MARK-KURIK, E. (2010). Apatite varieties in living and fossil skeletons. Programme and Abstracts, International

Palaeontological Congress, London 2010, June 28-July 3. The Palaeontological Association, London. 321.

MARK-KURIK, E. BEDROCKS. Devonian. (submitted). In: Aun, M. & Palo, K. (eds.) Setomaa county. Tartu. Estonian National Museum. [in Estonian, English and Russian Summaries].

MARK-KURIK, E. & PÕLDVERE, A. (in prep.). Devonian stratigraphical scheme of Estonia. Estonian Journal of Earth Sciences.

MARK-KURIK, E., BLIECK, A., TURNER, S. & BURROW, C. J. (in prep.). Early Devonian fishes from coastal Long Strait, Siberian Arctic, Russia. Geodiversitas.

## CM Hanna MATYJA

During past year I have continued with a Devonian/Carboniferous project in NW Poland and in Tien-Shan. A proximal objective of this work is to establish high-resolution biostratigraphy as well as geochemistry using carbon and oxygen isotopes. A longer-term goal is to identify the respective signatures of the global Hangenberg Event. Two project are in various stages:

Studies with M. STEMPIEN-SALEK, K. SOBIEN and K. MALKOWSKI focused on the transition from the uppermost Famennian to the lower Tournaisian within a complete and condensed offshore shale and carbonate succession in the Chmielno 1 borehole section (Western Pomerania, NW Poland), using the high-resolution biostratigraphic study, based on miospores and some conodont data, sedimentology, magnetic susceptibility and geochemistry. Seven miospore zones/assemblages were recognized within this succession: two local Famennian zones/assemblages (*Tummulispora rarituberculata* = Ra Zone of TURNAU (1978) and assemblage *A* = LL Zone of STREEL), three Famennian/Tournaisian zones of STREEL (*Retispora lepidophyta-Indotriradites explanatus* (LE), *R. lepidophyta-Verrucosisporites nitidus* (LN) and *Vallatisporites vallatus-Tetusotriletes incohatus* (VI), and one local Tournaisian zone (*Convolutispora major* = Ma Zone of TURNAU (1978) with two assemblages

Ma 0 and Ma 1 = uppermost part of VI and HD zones of STREEL). The start of the positive carbon isotope (δ13 C) excursion roughly corresponds to the top of the marly shale horizon A (late *Tummulispora rarituberculata* = LL of STREEL) which coincides with a decrease of the oxygen isotope (δ18 O) value and the magnetic susceptibility signal. The start of the negative carbon isotope (δ13 C) excursion falls within the marly shale horizon D (early *Convolutispora major* = early HD of STREEL) which coincides with an increase of the oxygen isotope (δ18 O) value and the magnetic susceptibility signal. The marly shale horizon (A) is identified as an equivalent to the Rhenish Hangenberg Black Shales, whereas carbonates (B and C) can be correlated with the Hangenberg Sandstones and Shales. They are equivalent to the multiphase Hangenberg Event.

In late August 2008 I took part in the IGCP 499/Subcommission on Devonian Stratigraphy joint field meeting in Uzbekistan with excellent fieldtrip to South Tien-Shan. The Kule section, situated along the Kule Gorge, was earlier a subject of conodont study by M.V. ERINA (OAO "Regionalgeologiya"). Five conodont zones, from Famennian *expansa* to Tournaisian *crenulata*, were recognized in the topmost, condensed, part of the section (dark limestones of the Novchomok Formation). Thomas BECKER (Münster) and I re-examined a carbonate succession around the D/C boundary and collected additional samples in hope to document the entry of oldest siphonodellids or protognathids, as well as some signatures of the global Hangenberg Event. Sandra KAISER (Bonn) and Hanna MATYJA (Warsaw) are presently engaged on conodont study. One of the surprises was a discovery of the *Siphonodella duplicata and Siphonodella sulcata*, as well as other Tournaisian conodont species much below the appointed Devonian/Carboniferous boundary. We should continue sampling as we have not yet found in this section the equivalent level of the *praesulcata* Zone.

In late May-early June I participated in the ICS Workshop *The GSSP Concept* in Prague. This meeting was followed (late June-early July) by the 3rd International Palaeontological Congress in London. During the session *Devonian bioevents: timing, palaeoecological and evolutionary patterns* I gave the presentation *Devonian-Carboniferous boundary in Poland: conodont and miospore succession and event stratigraphy* (co-authors Krzysztof MALKOWSKI, Katarzyna SOBIEN and Marzena STEMPIEN-SALEK)

### Devonian related publications and abstracts 2009-2010

MATYA H. 2009a. Depositional history of the Devonian succession in the Pomeranian Basin, NW Poland. Geological Quarterly **53** (1): 63-92.

MATYA H. 2009b. Shallow-water conodonts of the Uppermost *marginifera* – Middle *expansa* zones in Poland. In: CH.M. HENDERSON & CH.McLEAN (Eds.), *International Conodont Symposium (ICOS) 2009*, Abstracts. Permophiles, International Commision on Stratigraphy, International Union of Geological Sciences. Newsletter of the Subcommision on Permian Stratigraphy, **53**: 29-30.

MATYA H., TOMAS A. 2009. Integrated analysis of conodonts and foraminifera: a tool for recognition of Mid Famennian Event in Western Pomerania. In: PERYT D. & KAMINSKI M. (Eds.), Seventh Micropalaeontological Workshop MIKRO-2009,

Abstracts and Excursion Guide, Św. Katarzyna, Poland, September 28-30, 2009. Grzybowski Foundation Special Publication No. **15**: 48.

GRABOWSKI J., MATYJA H., NARKIEWICZ M., NAWROCKI J., SOBIEŃ K. 2009. Devonian magnetic susceptibility studies in Poland: current state of knowledge and future studies. In: First IGCP 580 Meeting *Magnetic susceptibility, correlations and paleoenvironments*, Liege, Belgium, 2-6 December 2009: 31.

MATYJA H.**,** MAŁKOWSKI K., SOBIEŃ K., STEMPIEŃ-SAŁEK M. 2010. Devonian-Carboniferous boundary in Poland: conodont and miospore successions and event stratigraphy. In: Programme & Abstracts, International Palaeontological Congress 3, London 2010, June 28 – July 3: 268.

SOBIEŃ K., MATYJA H., STEMPIEŃ-SAŁEK M., MAŁKOWSKI K. 2010. Petromagnetic indications of environmental changes in the Devonian-Carboniferous boundary section in Poland (Pomerania region). In: 2010 IGCP 580 Meeting *Applications of Magnetic Susceptibility on Paleozoic Rocks*, 28th November-4th December 2010, Guilin, China. Meeting Programme and Abstracts: 6-7.

## TM J. OVER

Investigation of conodont faunas and magnetic susceptibility in the Marcellus Subgroup across the Eifelian-Givetian continues in cooperation with Chuck VER STRAETEN (New York Geological Survey) and David BREZINSKI (Maryland Geological Survey). This summer several sections in Maryland, New York, Pennsylvania, and West Virginia were collected, in addition to drill core material.

Woodford Shale conodonts – high Frasnian, Famennian, and lower Carboniferous from drill cores in Texas and Oklahoma are currently being described and illustrated, in cooperation with Steve Ruppel (Texas Bureau of Economic Geology).
Middle Devonian icriodid and polygnathid conodonts from Mongolia are in the works.

Uppermost Devonian conodonts from the shale and sandstones of northeastern Pennsylvania, in cooperation with Gordon BAIRD and others, are under investigation in revision of the stratigraphy and understanding of Late Devonian events in the Hangenberg interval.

At the Northcentral-Northeastern Geological Society of America Annual Meeting in Pittsburgh, Pennsylvania, 20-22 March 2011, Gordon BAIRD and David BREZINSKI have organized a multiday Devonian climate and basin analysis symposium, which is also going to coincide with several theme sessions on the Marcellus Shale (Middle Devonian).

## TM Grzegorz RACKI

The well-known Kowala basin succession in the Holy Cross Mountains is still intensively explored by Silesian University research group, and three most recent publications on the late Famennian global anoxic events (*Annulata*, Dasberg and Hangenberg) are abstracted below. In addition, scleriobionts on late Famennian cephalopods, including crinoids (represented by their holdfasts, about 57% of the post-mortem encrusters), problematic worm tubes, bryozoans, microconchids, possible cornulitids and organisms of uncertain affinities, are presented by M. RAKOCIŃSKI in paper in press in Palaeobiodiversity and Palaeoenvironments;
DOI: 10.1007/s12549-010-0045-x (Open Access).

### Abstracts

RACKA, M., MARYNOWSKI, L., FILIPIAK, P., SOBSTEL, M., PISARZOWSKA, A., BOND, D.P.G. 2010. **Anoxic *Annulata* Events in the Late Famennian of the Holy Cross Mountains (Southern Poland): Geochemical and palaeontological record.** - Palaeogeography, Palaeoclimatology, Palaeoecology **297** (3-4), pp. 549-575.

The Upper Famennian *Annulata* Black Shales are exposed in the deep-shelf successions of the famous Kowala Quarry and the Ściegnia outcrop in the Holy Cross Mountains, Southern Poland. At Kowala, the twin *Annulata* anoxic events are manifest as two organic-rich (TOC up to 23. wt.%), finely laminated, fossiliferous black shales, each up to 0.6. m thick, separated by marl and massive or nodular limestone layers. The bituminous interval is condensed in the Ściegnia outcrop to a single 10. cm thick horizon. In both sections, the ABS levels date to the upper part of the Upper *Palmatolepis trachytera* conodont Zone, corresponding to the *Diducites versabilis*-. *Grandispora famenensis* miospore Zone. The *Annulata* Events are marked by a flourishing pelagic biota (the opportunistic bivalve *Guerichia venusta*, platyclymenids, the goniatite *Erfoudites*, entomozoacean ostracods, and prasinophyte algae). The initial phase of anoxia saw a bloom of specialized conodont fauna, mostly deep-water outer-shelf palmatolepids such as *Palmatolepis glabra lepta*, before the second anoxic pulse caused a significant crisis amongst this community. Isorenieratane and gammacerane biomarkers indicate the development of photic zone anoxia during both phases. Degree of Pyritisation (DOP) values (estimated from the TOC-TS-Fe diagram) and the uranium-thorium proxies, as well as trace metals enrichments suggest that bottom-

water conditions became dysoxic during deposition of the Lower ABS, while the more distinctly transgressive Upper ABS records anoxic/euxinic deposition during the later Event. When combined with the framboid data, however, unstable anoxia punctuated by short-term oxygenation events are assumed especially for the initial ABS phase, a crucial factor for effective nutrient recirculation from bottom waters to the photic zone and consequent phytoplankton blooming. This organic-rich level is easily identified amongst the background Upper Famennian rhythmic limestone-shaly succession, which was deposited under dysoxic to oxic conditions, with episodic anoxia developing only in the water column. Other well-known Late Devonian anoxic/high productivity episodes, recorded in the Dasberg, Kowala and Hangenberg black shales, also might partly to follow interglacial deepening pulses. These deepenings episodically reversed the overall regressive trend that resulted from a stepwise long-term climate change towards the end-Devonian Gondwanan glaciation.

MARYNOWSKI, L., FILIPIAK, P., ZATOŃ, M., 2010. **Geochemical and palynological study of the Upper Famennian Dasberg event horizon from the Holy Cross Mountains (central Poland).** - Geological Magazine **147** (4), pp. 527-550.

Integrated palynological, organic and inorganic geochemical and petrographical methods have been used for deciphering the depositional redox conditions and character of organic matter of the Famennian Dasberg event horizon from the deep-shelf Kowala succession of the Holy Cross Mountains. The ages of the investigated samples have been established, using miospore data, as VF (*Diducites versabilis-Grandispora famenensis*) and LV (*Retispora lepidophyta-Apiculiretusispora verrucosa*) miospore Zones of the Middle/Upper Famennian. In the standard conodont zonation, this corresponds to the uppermost *postera* to lowermost *praesulcata* Zones. The presence of green sulphur bacteria biomarkers and dominance of small-sized framboids together with the presence of large framboids and low values of the U/Th ratio may indicate that during sedimentation of the lower Dasberg shale, intermittent anoxia occurred in the water column, or the anoxic conditions prevailed in the upper part of the water column, while the bottom waters were oxygenated, at least briefly. Deposition of the upper Dasberg shale was characterized by both bottom water and water column anoxia. The lack of acritarcha taxa from these intervals could have been due to anoxia in the photic zone. Moreover, organic content is high in those samples. There is no geochemical evidence for anoxia during sedimentation of the deposits sandwiched between the lower and upper Dasberg shales, or in the deposits which underlie and overlie both Dasberg shale horizons. The two discrete anoxic events are interpreted to be the result of major transgressions and the blooming of primary producers. Above the Dasberg shales, small fragments of charcoal and raised concentrations of polycyclic aromatic hydrocarbons are detected. This supports the presence of wildfires during deposition of shales just above the boundary of VF/LV palynological zones. Temperatures calculated from the fusinite reflectance values suggest that the charcoal was formed in low-temperature ground and/or surface fires. The typical marine character of sedimentation combined with the high proportion of charcoals suggests that wildfires were large-scale, and that there was intensive transport of terrestrial material. The main causes of intensive wildfires were a significant rise of $O_2$ in the atmosphere and important progress in the land plant diversity during Late Devonian times. Palynofacies studies suggest that the transgression corresponds to the part IIf of the Late Devonian sea-level curve

FILIPIAK, P., RACKI, G. 2010. **Proliferation of abnormal palynoflora during the end-Devonian biotic crisis.** - Geological Quarterly **54** (1), pp. 1-14; gq.pgi.gov.pl/gq/article/view/7535/6185 (Open Access). The dispersed miospore assemblage of the *Retispora lepidophyta-Verrucosisporites nitidus* (LN) Zone from the Holy Cross Mountains (Poland) is marked by enrichment (above 4%) in abnormal spore morphotypes during a terrestrial flora turnover close to the Devonian-Carboniferous boundary, recorded just above the Hangenberg Black Shale level. Incomplete and complete tetrads represent mostly *Vallatisporites* spp., supplemented by *Grandispora, Retusotriletes* and *Apiculiretusispora*. Additional peculiar morphotypes, marked by anomalous overall shape and ornamentation, are interpreted as mutated varieties of *Vallatisporites* based on intermediate morphological stages, connecting them with this well known genus. This relatively high aberrant palynomorph frequency is accompanied by volcanic ash intercalations, as well as by charcoal debris and polycyclic aromatic biomarkers indicative of forest wildfire. Thus, the anomalous spore morphology could reflect the mutagenic effect of regional acidification due to explosive volcanism. However, palynological literature data from NW France and Canada highlight the possibility of a supra-regional mutated miospore signal near the Devonian-Carboniferous boundary, and there is need for high-resolution studies of the LN Zone to examine this. The end-Permian scenario of abnormal floral growth in immensely stressed habitats may therefore apply to other potentially volcanically-induced biotic turnovers.

## CM Claudia SPALLETTA

A paper on the upper Famennian-lowermost Carboniferous representatives of the Genus *Protognathus*, written together with Carlo CORRADINI (University of Cagliari) Sandra KAISER (University of Bonn), and M. Cristina PERRI (University of Bologna), was recently submitted for publication.

The study of stratigraphic sections at the Frasnian-Famennian boundary in the Carnic Alps is still under progress. Together with conodont biostratigraphy, taxonomic and biofacies studies, lithostratigraphy and sedimentology analysis are also carried out on the studied sections. This research is made in collaboration with Enzo Farabegoli and M.Cristina PERRI (University of Bologna), and Monica PONDRELLI (University of Pescara).

Another research theme is dealing with the analysis of the Famennian conodont biostratigraphy of many sections of the Carnic Alps (with M.Cristina PERRI, University of Bologna).

I am also continuing the collaboration to the project for the formal definition of the pre-Variscan lithostratigraphic units of the Carnic Alps, coordinated by Carlo Corradini (University of Cagliari) and Thomas Suttner (University of Graz), as responsible for the Devonian pelagic limestone units. As member of the Working Group, I am also involved in the study of the transitional carbonatic units.

## CM Thomas SUTTNER

My research concerns stratigraphy and sedimentology of Devonian neritic deposits of Austria (Carnic Alps and Graz Palaeozoic). Since May 2010 a new subproject of IGCP580 (NAP0017) entitled Gamma-ray spectrometry (GRS) and Magnetic susceptibility (MS) applied on the Devonian sequence of the Carnic Alps for high-resolution stratigraphic correlation is active. Therefore, the last summer was filled with several weeks of fieldwork in Lower and Middle Devonian deposits of the Carnic Alps. In cooperation with colleagues from Italy and the Czech Republic, we collected several hundred of samples of neritic sections for stratigraphically high resolutive logs to correlate them with pelagic deposits of the Carnic region. Apart from a more or less complete GRS and MS log of the neritic sequence we aim to allocate the known global extinction event levels that already have been documented from the pelagic sequence for further studies on the benthic communities across the single event intervals. Additionally, to the continuing work on strata of the Graz Palaeozoic, a manuscript on a small scolecodont fauna from the Lower-Middle Devonian Tyrnaueralm section (Graz Palaeozoic) was published in cooperation with O. Hints.

As this is the first time for me to contribute to the SDS-newsletter, I add a listing of all Devonian-related papers and abstracts published since 2004.

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BURROW, C.J., TURNER, S.,YOUNG, G.C., 2010. Middle Palaeozoic microvertebrate assemblages and biogeography of East Gondwana (Australasia, Antarctica). - Paleoworld, **19:** 37-54 [IGCP 491 volume]. doi:10.1016/j.palwor.2009.11.001.

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KLUG, C., KRÖGER, B., KIESSLING, W., MULLINS, G. L., SERVAIS, T., FRÝDA, J., KORN, D. & TURNER, S. The Devonian nekton revolution. - Lethaia, **43**: 465–477.

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## TM J. I. VALENZUELA-RIOS

2010 was a hectic year, both in research and in administrative duties. Regarding SDS activities, two Ph. D. Thesis on Devonian conodonts were completed (see below) and a third one is so advanced that will probably be finished within the first half of this year. At the end of the year I paid a four weeks visit to Mike MURPHY in California; we advanced in a joint manuscript (together with Peter CARLS and Karsten WEDDIGE) dealing with the conodont record around the S/D boundary at the type locality (Klonk).

This year and besides basic taxonomic, biostratigraphic and chronostratigraphic work, and on the occasion of the IPA-3 held in London, I have started to analyze in detail the recognition of Global Events, Time Specific Facies,…, in the Pyrenees and, as I have on had a very detailed time-tool (evolutionary conodont successions) try to test synchronicity of such relevant marks in the Pyrenean basin in different facies. This was also fuelled by the last International Congress on Geoevents ("Geoevents: learning about global changes") held in Caravaca de la Cruz (Spain) in connection with the European Regional Meeting of the IGCP.

The interest on the P/E Boundary continues and a new paper dealing with local (Pyrenean) records was published at the end of this year (see below). The joint analysis (Nadya, Ladislav and myself) of collections from Zinzilban has been rather disappointed (see report in this Newsletter); however, I think, we shall not dismay in our labour of searching for a good conodont succession in Central Asia that matches the agreements reached by the SDS in the Kitab Reserve in 2008.

As in previous years the cooperation with friends and colleagues continues and/or is envisaged for the near future (Peter CARLS, Mike MURPHY, Ladislav SLAVÍK, Karsten WEDDIGE, Nadya IZOKH, Carlo CORRADINI, Peter KÖNIGSHOF, Eberhard SCHINDLER, Chuck VER STRAETEN). In Spain, cooperation with my former and currents students (Héctor BOTELLA, Teresa LIAO, Carlos MARTÍNEZ, Sofie GOUWY, Helena CALVO) and with other friends (Esperanza FERNÁNDEZ –corals, Miguel PARDO –brachiopods, Inma GIL and Pilar CLARIANA –both structural geologists) is going to be intensified in the next coming years aiming at a multydisciplinary detailed study of Lower Devonian successions in key areas of Spain (Pyrenees, Iberian Cordillera, Ossa-Morena, Catalonian Coastal Ranges). One result of this new approach is the publication of a joint paper on a Emsian reefal sequence in one of these regions (Ossa-Morena, southwestern Spain).

Finally, and due to the endangered situation of some Pyrenean Devonian sections (speculative actions on sky resorts) I have also started publishing some concerns on geological heritage and contacted with colleagues involved in the "fight".

### Devonian works published in 2010

MARTÍNEZ-PÉREZ, C.; VALENZUELA-RÍOS, J. I. & BOTELLA, H. (2010): Polygnathus rosae n.sp. (Conodonta) and its biostratigraphical correlation potential (Lower Emsian, Lower Devonian) in the Spanish Central Pyrenees. Rivista Italiana di Paleontologia e Stratigrafia, **116** (3): 273-281.

RODRÍGUEZ, S., FERNÁNDEZ-MARTÍNEZ, E., CÓZAR, P., VALENZUELA-RÍOS, J.I., PARDO ALONSO, M.V., LIAO, J-C & MAY, A. (2010): Stratigraphic succession facies and depositional environment of Emsian reefal carbonates in Ossa-Morena Zone (SW Spain). Neues Jahrbuch für Geologie und Paläeontologie, 257 (1): 69-83.

### Abstracts and Proceedings in 2010

GOUWY, S.; LIAO, J.-C. & VALENZUELA-RÍOS, J.I. (2010): The Villech section (Spanish Central Pyrenees): Middle Devonian and Lower Frasnian conodont biostratigraphy and the start of a regional high resolution composite standard. 54th Annual Meeting of the Palaeontological Association, Programme and Abstracts: 51.

VALENZUELA-RÍOS, J.I. & LIAO, J-C. (2010): Potential of Pyrenean Devonian sections as standard of referente for Stage and Substage subdivisions and correlations. In: Geoevents, Geological Heritage, and the Role of the IGCP (Marcos A. LAMOLDA et al. eds.). Caravaca 15th-18th September 2010: 251-252. Ayuntamiento de Caravaca de la Cruz. Spain

VALENZUELA-RÍOS, J.I.; LIAO, J.-C. & MARTÍNEZ-PÉREZ, C. (2010): Lower Devonian Geoevents in the Spanish Central Pyrenees. In: Geoevents, Geological Heritage, and the Role of the IGCP (Marcos A. Lamolda et al. eds.). Caravaca 15th-18th September 2010: 189-190. Ayuntamiento de Caravaca de la Cruz. Spain

LIAO, J.-C.; VALENZUELA-RÍOS, J.I. & GOUWY, S. (2010): Givetian (Middle Devonian) Geoevent at the Villech section (Spanish Central Pyrenees). In: Geoevents, Geological Heritage, and the Role of the IGCP (Marcos A. Lamolda et al. eds.). Caravaca 15th-18th September 2010: 139-140. Ayuntamiento de Caravaca de la Cruz. Spain

VALENZUELA-RÍOS, J.I. (2010): Colour changes and Global Events, a hoax? A case study from the Lochkovian (Lower Devonian) in the Spanish Central Pyrenees. Abstracts of the Third International Palaeontological Congress, London: 388.

VALENZUELA-RÍOS, J.I. & MARTÍNEZ-PÉREZ, C. (2010): Pyrenean conodonts as a relevant tool for evaluating the Pragian/Emsian (Lower Devonian) Boundary Concepts. Abstracts of the Third International Palaeontological Congress, London: 388.

VALENZUELA-RÍOS, J.I. & LIAO, J-C. (2010): Conodont biofacies and palaeoenvironment: a case study for the Middle and Upper Devonian of the Spanish Central Pyrenees. Abstracts of the Third International Palaeontological Congress, London: 387.

**Ph. Tesis finished in 2010**

GOUWY, SOFIE: Middle Devonian conodonts from the north-western margin of Gondwana (Sardinia, Spain, France and Algeria): biostratigraphy and biofacies analysis.

MARTÍNEZ-PÉREZ, CARLOS: Conodontos del Emsiense (Devónico Inferior) del Pirineo Central Español.

## CM Chuck Ver Straeten

The year 2010 was a busy year, in spite of very restricted budgets for New York State government agencies. Limited end of year layoffs of New York State Museum staff leave us all here a little nervous for the future, but enjoying the current work and planning for the future.

A new paper, *Mudrock Sequence Stratigraphy: A Multi-proxy (sedimentologic, paleobiologic, geochemical) Approach, Devonian Appalachian Basin*, examines mid-Eifelian to lower Famennian mudrocks from western New York State, in order to better delineate stratigraphic sequences/T-R cycles in mudrock facies (Devonian T-R Cycles Id-IIe). The study analyzes a large, detailed set of sedimentologic, paleobiologic and geochemical proxies through more than 600 meters of Devonian mudrock-dominated facies. The usefulness of various data sets (e.g., grain size, degree of bioturbation, macrofauna, concentrations of TOC and various elements/elemental ratios) vary between anoxic-, dysoxic-, and oxic-dominated sequences, and help better delineate sequences, their component systems tracts, and boundaries between them all. The paper, with co-authors Carlton BRETT and Brad SAGEMAN, is currently published electronically in Palaeo[3].

A second paper, *Lessons from the foreland basin: Appalachian basin perspectives on the Acadian orogeny*, examines the Devonian sedimentary rock record in New York and the broader Appalachian foreland basin, to interpret the character and timing of events during the Acadian orogeny. Changes in sediment composition, stratal geometry, stratigraphic anomalies, and distribution of volcanic air-fall tephras through time and space provide insights into patterns of tectonism and quiescence, uplift and unroofing, tectonically induced basin flexure, and explosive volcanism in the orogenic belt.

I continue to work on collaborative projects with Devonian paleontologists. The first examines Emsian-Eifelian biostratigraphy in the Appalachian basin (eastern U.S.), with Dick LINDEMANN and Eberhard SCHINDLER (dacryoconarids), and Bill KIRCHGASSER (goniatites), and additional collaborators. At the SDS Old Red Sandstone fieldtrip this summer I gave palynology samples to Rainer BROCKE, John MARSHALL and Charles WELLMAN, to further this study. In the second study, I've been working some with Jeff OVER and his students, along with Alex BARTHOLOMEW, working to find the Eifelian-Givetian boundary in the Marcellus "shale" in New York. I am also working with two other paleontologists on two additional projects involving lower Givetian fossils in eastern New York, and their paleoecology and life modes.

During 2010 I began bedrock mapping uppermost Eifelian and lower Givetian marine to terrestrial strata, in the Helderberg hills west of Albany, New York (including my own property which rises through approximately 100 m of nearly flat-lying, synorogenic lower Givetian sandstones and shales). It is the first part of a four year program mapping uppermost Silurian through lower Givetian strata (with Ordovician turbidite facies on the bottom) on the Berne 15 minute quadrangle.

Also, while on a vacation with my wife in Prague, I was able to get out for a day with Jindra HLADIL and Leona KOPTIKOVA, for another brief look at Emsian and Eifelian strata in the Prague basin. It seemed I was able to pinpoint the precise position of the base of T-R Cycle Ic, and it's point of maximum transgression. I hope to return there in the next couple years for more collaborative work to delineate Emsian and Eifelian T-R cycles $Ib_1$-$1b_5$, Ic, and Id.

**PUBLICATIONS AND ABSTRACTS, 2010**

**Published papers, 2010**

VER STRAETEN, C.A., 2010, *Lessons from the foreland basin: Appalachian basin perspectives on the Acadian orogeny*. *In* Tollo, R.P., Bartholomew, M.J., Hibbard, J.P. and Paul M. Karabinos, P.M., eds., From Rodinia to Pangea: The Lithotectonic Record of the Appalachian Region, Geological Society of America, Memoir **206**, p. 251-282.

VER STRAETEN, C.A., BRETT, C.E., and SAGEMAN, B.B., in press (published electronically, 11/10), *Mudrock Sequence Stratigraphy: A Multi-proxy (sedimentologic, paleobiologic, geochemical) Approach, Devonian Appalachian Basin.* Palaeogeography, Palaeoclimatology, Palaeoecology.

**Public Outreach/Popular Geology Articles, 2009**

SCHINDLER, E., BRETT, C.E., BROCKE, R., JANSEN, U., KONIGSHOF, P., VER STRAETEN, C.A., WEHRMANN, A., WILDE, V., and YALCIN, M.N., 2010, *Zyklische Sedimente im Devon – Hinweis auf Meeresspiegelschwankugen und Klimaveränderungen.* – Senckenberg 2007-2008: v. 44-45; Frankfurt am Main, Germany.

VER STRAETEN, C.A. 2010, *View From the Devonian Period*. In *Arts Alive*, Jan.-Feb. 2010 edition, Greene County Council of the Arts. One of two articles about "GEOgraphy" exhibit: Geology- and paleontology-related fine art photos, sculpture, graphics jewelry, and fossil specimens. At the galleries of the Greene County Council of the Arts, Catskill, NY.

**Publications Awaiting Publication *or* in Review**

BRETT, C.E., BAIRD, G.C., BARTHOLOMEW, A., and VER STRAETEN, C.A., in press, *Sequence stratigraphy and revised sea level curve for the Middle Devonian in eastern North America*. Palaeogeography, Palaeoclimatology, Palaeoecology

**Published Abstracts, 2010**

OVER, D.J., GRADY, B., TRAVIS, M.E., VER STRAETEN, C.A., and BARTHOLOMEW, A.J., 2010, *Conodont and magnetic susceptibility stratigraphy of the Marcellus Shale and the placement of the Eifelian-Givetian Boundary, Middle Devonian, Northern Appalachian basin*. Geological Society of America *Abstracts with Programs*, **42** (5), p. 544.

VER STRAETEN, C.A., 2010, *Unroofing the Acadian Orogen: Composition and Provenance of Devonian Clastics, New York State.* Geological Society of America *Abstracts with Programs*, **42**, (1), p. 126.

GRADY, B., TRAVIS, M., OVER, D.J., VER STRAETEN, C.A., BARTHOLOMEW, A., and SCHRAMM, T.J., 2010, *Magnetic Susceptibility Based Placement of the Eifelian-Givetian Boundary in the Marcellus Shale of the lower Hamilton Group in New York State*. Geological Society of America *Abstracts with Programs*, **42** (1), p. 137.

**Abstracts Submitted for 2011**

VER STRAETEN, C.A., 2011, *Northern Appalachian Basin Sedimentation and the Timing of Acadian Orogenic Events*. Geological Society of America, *Abstracts with Programs*, **43**.

VER STRAETEN, C.A., 2011, *Circumbasinal Outcrop Perspective of the Marcellus "Shale", Appalachian Basin*. Geological Society of America *Abstracts with Programs*, **43**.

LINDEMANN, R.L., VER STRAETEN, C.A., and SCHINDLER, E., 2011, *Dacryoconariid faunas of the basal Eifelian to Choteč bioevents interval in the north and central Appalachian basin.* Geological Society of America *Abstracts with Programs*,. **43**.

BROCKE, R., BERKYOVA, S., FATKA, O., LINDEMANN, R.H., SCHINDLER, E. and VER STRAETEN, C.A., 2011, *The early Mid-Devonian Choteč Event: Do palynomorphs have the potential for long distance correlations?* Geological Society of America *Abstracts with Programs*, **43.**

## CM Tony WRIGHT

I am continuing to write up numerous projects, having given up editing ***Alcheringa*** some years ago. My interests are now very largely in the Devonian of NSW, as the death of my colleague Barrie RICKARDS in late 2009 has meant winding down research on NSW Silurian graptolites. Similarly, most of the Iranian collections made by and with my former student Mir Alireza HAMEDI and me have been described. Similarly, largely due to the efforts of NZ and Australian colleagues, the large Ordovician Thompson Creek fauna from New Zealand has been published in **AAP Memoir 37** (2010: see publication list below). Recent papers on corals have focused on calceoloid corals, and a few papers on these remain to be done. Large Emsian tetracoral faunas from NSW remain to be written up, and possibly some Early Devonian brachiopod faunas as well. A Frasnian (?) brachiopod fauna is also on the list.

**Papers for the last 10 years are:**

WRIGHT, A. J., TALENT, J. A., YOUNG, G. C. & LAURIE, J.R., eds, 2000 (2001). Palaeobiogeography of Australasian Faunas and Floras. *Memoir of the Association of Australasian Palaeontologists* **23**, 516 p.

PICKETT, J.W., BURROW, C.J., HOLLOWAY, D.J., MUNSON, T.J., PERCIVAL, I.G., RICKARDS, R.B., SHERWIN, L., SIMPSON, A.J., STRUSZ, D.L., TURNER, S. & WRIGHT, A.J., 2000. Silurian palaeobiogeography of Australia. *Memoir of the Association of Australasian Palaeontologists* **23**, 127-165.

TALENT, J.A., MAWSON, R., AITCHISON, J.C., BECKER, R.T., BELL, K.N., BRADSHAW, M.A., BURROW, C.J., COOK, A.G., DARGAN, G.M., DOUGLAS, J.G., EDGECOMBE, G.D., FEIST, M., JONES, P.J., LONG, J.A., PHILLIPS-ROSS, J.R., PICKETT, J.W., PLAYFORD, G., RICKARDS, R.B., WEBBY, B.D., WINCHESTER-SEETO, T., WRIGHT, A.J., YOUNG, G.C. & ZHEN, Y.-Y., 2000 (2001). Devonian palaeobiogeography of Australia and adjoining regions. *Memoir of the Association of Australasian Palaeontologists* **23**, 167-257.

WRIGHT, A. J., TALENT, J. A., & YOUNG, G. C., eds, 2000 (2001). Palaeobiology of Australasian faunas and floras. *Historical Biology* **15**, 191 p.

ZHEN, Y.-Y., WRIGHT, A.J. & JELL, J.S., 2000 (2001). Rugose coral diversifications and migrations in the Devonian of Australasia. *Historical Biology* **15**, 61-76.

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PACKHAM, G.H., PERCIVAL, I.G., RICKARDS, R.B. & WRIGHT, A.J., 2001. Late Silurian and Early Devonian biostratigraphy of the Hill End Trough and the

Limekilns area, New South Wales. *Alcheringa* **25**, 251-261.

WRIGHT, A.J., 2001a. A new Early Devonian operculate coral from eastern Australia. *Records of the Western Australian Museum, Supplement* **58**, 21-35.

WRIGHT, A.J., 2001b. Bibliography of Palaeozoic biogeography of Iran. *Records of the Western Australian Museum, Supplement* **58**, 255-271.

RICKARDS, R.B. & WRIGHT, A.J., 2001. Early Devonian graptolites from Limekilns, New South Wales. *Records of the Western Australian Museum, Supplement,* **58**, 122-131.

RICKARDS, R.B., HAMEDI, M.A. & WRIGHT, A.J., 2001b. Late Ordovician and Early Silurian graptolites from southern Iran. *Records of the Western Australian Museum, Supplement* **58**, 103-122.

RICKARDS, R.B. & WRIGHT, A.J., 2002. Lazarus taxa, refugia and relict faunas: evidence from graptolites. *Journal of the Geological Society of London* **159**, 1-4.

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RICKARDS, R.B., CHAPMAN, A.J., WRIGHT, A.J & PACKHAM, G.H., 2003. Dendroid and tuboid graptolites from the Llandovery (Silurian) of the Four Mile Creek area, New South Wales. *Records of the Australian Museum* **55**, 305-330.

RICKARDS, R.B. & WRIGHT, A.J., 2004. Early Silurian graptolites from Cadia, New South Wales. *Proceedings of the Linnean Society of New South Wales* **125***,* 173-175.

EDGECOMBE, G.D. & WRIGHT, A.J., 2004. Silicified Early Devonian trilobites from Brogans Creek, New South Wales. *Proceedings of the Linnean Society of New South* Wales **125***,* 177-188.

WRIGHT, A.J. & STRUSZ, D.L., 2004. Wenlock (Early Silurian) brachiopods from the Orange district, New South Wales. *Proceedings of the Linnean Society of New South Wales* **125**, 165-172.

RICKARDS, R.B. & WRIGHT, A.J., 2004. *Enigmagraptus* n. gen., a new graptoloid (Pridoli, Silurian, New South Wales, Australia). *Paläontologische Zeitschrift* **78**, 189-194.

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WRIGHT, A.J. 2006. New genera of early Devonian calceoloid corals from Australia and France. *Palaeoworld* **13**, 185-193.

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WRIGHT, A.J., 2008. Emsian (Early Devonian) tetracorals (Cnidaria) from Grattai Creek, New South Wales. *Proceedings of the Linnean Society of New South Wales* **129**, 83-96.

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