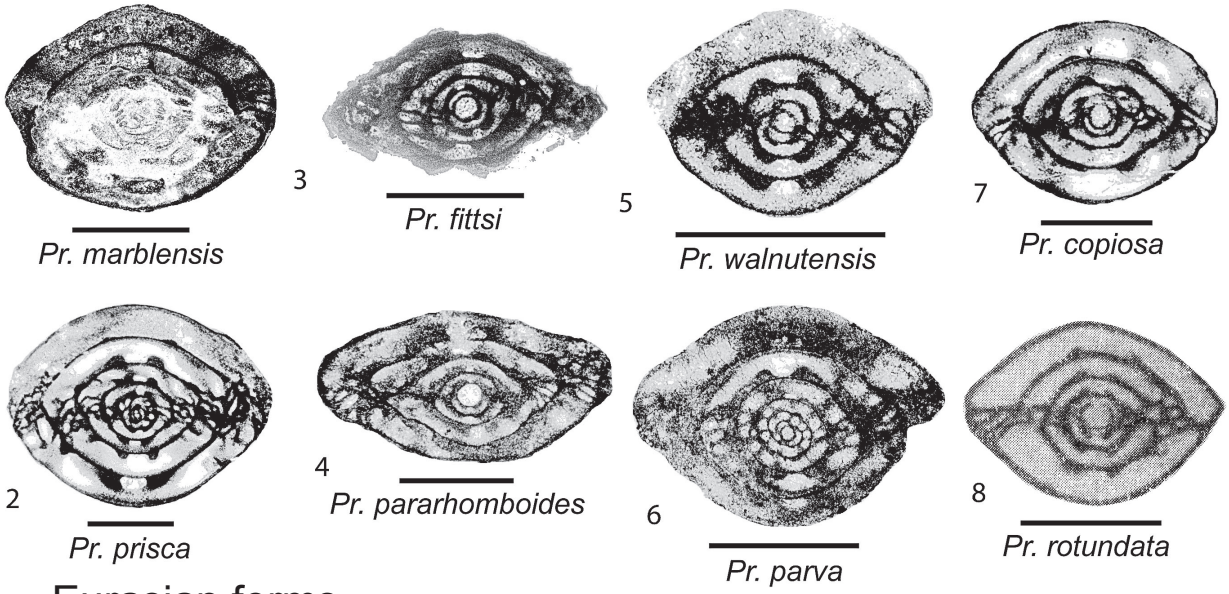
NEWSLETTER ON CARBONIFEROUS STRATIGRAPHY

Volume 25 **July 2007**

North American forms



Eurasian forms

SCCS

I.U.G.S. SUBCOMMISSION ON CARBONIFEROUS STRATIGRAPHY

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Newsletter on Carboniferous Stratigraphy

Edited by D.M. Work

IUGS SUBCOMMISSION ON CARBONIFEROUS STRATIGRAPHY / VOL. 25 - 2007

CHAIRMAN'S COLUMN

This past year has seen more progress in the selection of stage boundaries, as is detailed in the individual reports that follow. The **Tournaisian-Viséan boundary Task Group** has made minor adjustments to its formal GSSP proposal for the Pengchong section in southern China prior to submittal for the Subcommission vote. The **Viséan-Serpukhovian Boundary Task Group** is further evaluating the conodont lineage *Lochriea nodosa – Lochriea ziegleri*, which is fairly widely distributed across Eurasia. A potential candidate section for the GSSP reported by Russian workers from the eastern slope of the southern Urals in 2005 is undergoing further detailed study. In addition, several workers are studying various sections across the boundary interval in North America to search for other biostratigraphically useful fossils and to acquire C-isotope data, in order to try to bracket the boundary there so that correlation can be established in case the *Lochriea* lineage is not discovered in that region. The **Bashkirian-Moscovian Boundary Task Group** continues more detailed investigation of two conodont lineages, involving the first appearances of *Idiognathodus postsulcatus* and *Declinognathodus donetzianus*. Discovery of a new section with the latter taxon beyond its previously known limits has been reported from the southern Urals, and it might be a potential GSSP candidate. In addition, several members are developing a proposal for considering the first appearance of the conodont *Diplognathodus ellesmerensis*, which appears to have an even more widespread distribution than the other lineages. The combined **Moscovian-Kasimovian and Kasimovian-Gzhelian Boundary Task Group** is examining more closely the taxonomy involved in the conodont lineages that appear useful for boundary recognition, utilizing the correlation charts across both boundaries that are based on the scales of glacial-eustatic cyclothems plus conodont and fusulinid biostratigraphy. These charts appeared initially in the 2005 Newsletter, and an updated article will be published in the July 2007 issue of *Geology*. The task group reached nearly unanimous consensus that the **Kasimovian-Gzhelian boundary** be marked by the first appearance of the conodont *Idiognathodus simulator* [sensu stricto], which is common in both Eurasia and North America. A potential GSSP candidate section for this boundary has been proposed in the marine slope deposits at Usolka in the southern Urals. Marine slope deposits are also known in southern China, where preliminary work on the conodont succession at the Nashui roadcut near Luodian in Guizhou Province, published in 2003, shows an apparently complete slope succession extending from late Mississippian through the entire Pennsylvanian and into the Lower Permian. Further detailed work at this section may provide the basis for several GSSP candidates for the remaining stage-boundary stratotypes.

ICCP 2007: XVI International Carboniferous-Permian Congress in Nanjing

The XVI International Carboniferous-Permian Congress will take place June 21-24, 2007, in Nanjing, China. We will have a Carboniferous Workshop with task group meetings, reports of the Boundary Task Groups, and an SCCS meeting at the Congress. Two of the post-congress field trips will visit localities with great interest for proposed and potential Carboniferous stage-boundary GSSPs in southern China. One will visit the proposed Tournaisian-Viséan boundary stratotype at Pengchong in western Guangxi Province. The other will visit the Nashui roadcut in Guizhou Province, which exposes the complete late Mississippian through Pennsylvanian section that may provide candidates for several of the remaining boundary stratotypes.

SCCS Newsletter Funding

The serious problem that I described last year regarding the funding for printing and distributing this Newsletter has been partially alleviated by an increase in contributions from several additional generous members than previously, for which I am very grateful. However, due to further cutbacks in IUGS/ISC support, we are still facing a potential shortfall in funding for future publication of the Newsletter. Therefore, I again strongly urge all those of you who are able, to make as generous a donation as you can afford, in order to ensure the continuing publication of the Newsletter. Please use the form that is inserted into the Newsletter, for making your donation. Thank you very much.

Philip H. Heckel

June, 2007

SECRETARY / EDITOR'S REPORT 2006-2007

I want to thank all who provided articles for inclusion in Volume 25 of the Newsletter on Carboniferous Stratigraphy. I am indebted to P. H. Heckel for editorial assistance; and to P. Thorson Work for coordinating the compilation of this issue.

Future Issues of Newsletter on Carboniferous Stratigraphy

Next year's Volume 26 will be finalized by July 2008, and I request that all manuscripts be sent before May 31—but preferably earlier. Please read the section below (page 4) regarding submission format, especially manuscript length (no more than 5 double-spaced manuscript pages without prior approval). Finally, I would be most grateful if all voting and corresponding members of the SCCS would let me know of any changes to their mailing and e-mail addresses so that we can update our records.

David M. Work

SCCS ANNUAL REPORT 2006

Membership

The Subcommission had 21 voting members in 2006 [see list at end of Newsletter]. In addition, corresponding membership at the time of publication stands at 293 persons and 7 libraries.

Officers

Chair:
Dr. Philip H. Heckel
Department of Geoscience
University of Iowa
Iowa City, IA 52242
U.S.A.
Fax: +1 (319) 335-1821
Email: philip-heckel@uiowa.edu

Vice-Chair:
Dr. Geoffrey Clayton
Department of Geology
Trinity College
Dublin 2
IRELAND
Fax: 3531-6711199
Email: gclayton@tcd.ie

Secretary/Editor:
Dr. David M. Work
Maine State Museum
83 State House Station
Augusta, ME 04333
U.S.A.
Fax: +1 (207) 287-6633
Email: david.work@maine.gov

Task and Exploratory Project Groups

Task Group to establish the Tournaisian-Viséan boundary [which is also the base of the Middle Mississippian Series], chaired by George Sevastopulo of Ireland.

Task Group to establish the Viséan-Serpukhovian boundary [which is also the base of the Upper Mississippian Series], chaired by Barry Richards of Canada.

Task Group to establish the Bashkirian-Moscovian boundary [which is also the base of the Middle Pennsylvanian Series] chaired by John Groves of USA.

Task Group to establish the Moscovian-Kasimovian boundary [which is also the base of the Upper Pennsylvanian Series], chaired by Elisa Villa of Spain. This group is also dealing with the Kasimovian-Gzhelian boundary within the Upper Pennsylvanian Series.

Project Group on Upper Paleozoic boreal biota, stratigraphy and biogeography, chaired by Marina Durante of Russia.

Project Group on Carboniferous magnetostratigraphy, chaired by Mark Hounslow of United Kingdom.

Chief Accomplishments in 2006 and Early 2007

The final adjustments have been made to the GSSP proposal for the Tournaisian-Viséan boundary. Work on the Viséan-Serpukhovian, Bashkirian-Moscovian, and Moscovian-Kasimovian boundaries has reached the point where several informal proposals on event markers for those boundaries have been narrowed down to one to three lineages, mostly among conodonts. The remaining proposals are now under intensive discussion and have engendered much further research in several areas on the lineages and also on potential candidates for GSSPs for at least two of the boundaries. The event marker for the Kasimovian-Gzhelian boundary was voted by the task group to be placed at the first appearance of the conodont *Idiognathodus simulator* (Ellison 1941) [sensu stricto].

The Newsletter on Carboniferous Stratigraphy, Volume 24, published in July 2006, contains reports of the task groups for 2005-6 and 9 articles on various topics of interest, including: The Dombar Limestone in the south Urals and the Viséan-Serpukhovian boundary; Succession and correlation of Viséan floras of the equatorial belt; Pennsylvanian fern taxonomy: new approach through the compact model; Discovery of potential Bashkirian-Moscovian boundary marker conodont *Declinognathodus donetzianus* in south Urals; Fusulinoidea of Kasimovian-Gzhelian transition in northern Timan; Potential candidate for GSSP to define base of global Gzhelian Stage at Usolka section in south Urals; Conodont and ammonoid distribution across position of proposed Kasimovian-Gzhelian boundary in lower Virgilian strata in Midcontinent North America; Latest calibration of Middle to Late Pennsylvanian time scale using succession of Midcontinent cyclothems; Kasimovian and Gzhelian (Upper Pennsylvanian) conodont zonation in Russia, for a total of 53 pages.

Work Plan for 2007 and Following Years

The SCCS is looking forward to the XVI International Carboniferous-Permian Congress in Nanjing, China, in late June of 2007, where there will be meetings of the task groups at a Carboniferous workshop, and the traditional meeting of the SCCS, along with several field trips. One field trip (C2) will visit the proposed Tournaisian-Viséan boundary stratotype GSSP at Pengchong in western Guangxi Province. Another field trip (C3) will visit the Nashui roadcut near Luodian in southern Guizhou Province, which exposes a succession from late Mississippian through the entire Pennsylvanian and into the Lower Permian, and thus may provide candidates for several of the remaining boundary stratotype GSSPs.

Tournaisian-Viséan boundary. This task group has now adjusted the final details in the formal proposal for the GSSP at the Pengchong section in southern China, for a late 2007 SCCS ballot on the GSSP, before submittal to the ICS and IUGS.

Viséan-Serpukhovian boundary. This task group has agreed in principle that the conodont lineage *Lochriea nodosa – Lochriea ziegleri* provides the most likely boundary-defining event. It is focusing work on other biostratigraphically useful fossils across the boundary in areas where this lineage is not yet found, and on evaluating information from a potential

GSSP section in the eastern slope of the southern Urals that was first presented at the May 2005 Liege meeting.

Bashkirian-Moscovian boundary. This task group is now focusing more work on evaluating the proposals for boundary-defining events in the conodont lineages involving the first appearances of *Idiognathoides postsulcatus* and *Declinognathodus donetzianus*, and is considering a new possibility involving the first appearance of *Diplognathodus ellesmerensis*.

Moscovian-Kasimovian boundary. This task group will further evaluate the conodont and fusulinid lineages proposed as boundary-defining events, and deal with the taxonomic issues involved in these lineages across the boundary interval. It will utilize the cyclothem-based correlation chart of strata across this boundary interval as one of the bases for evaluation.

Kasimovian-Gzhelian boundary. The same task group will further discuss the conodont lineage leading to the appearance of *Idiognathodus simulator* [s.s.], which has been overwhelmingly voted as the boundary-defining event. A potential GSSP candidate at Usolka in the southern Urals has been proposed in the Slovenian journal *Geologija*. Recent taxonomic work on the lineage from *I.* aff. *simulator* to *I. simulator* [s.s.] in North America has been submitted for publication. A late 2007 SCCS ballot is anticipated to finalize the boundary-defining event.

Progress appears to have been sufficient in all task groups, such that the selection of the boundary-defining events for all the remaining stage boundaries in the Carboniferous may be achieved by 2008. However, the strong glacial-eustatic control over sedimentation that resulted in widespread exposure surfaces across entire shelves during the time spanning at least the upper two boundaries is hampering the identification of potentially acceptable GSSPs. Nevertheless, possible candidate GSSPs for several of the boundaries are being further investigated in the southern Urals and southern China. Increasingly precise ID-TIMS measurements of U-Pb zircon ages of volcanic tuff beds in the southern Urals indicate progress in dating biostratigraphically constrained successions across important boundaries.

STATEMENT OF OPERATING ACCOUNTS FOR 2005/2006

Prepared by David Work, Secretary

(Definitive accounts maintained in US currency)

INCOME (Oct. 31, 2005 – Oct. 31, 2006)	
IUGS-ICS Grant 2006	$800.00
Donations from Members	1775.00
Interest	14.41
TOTAL INCOME	**$2589.41**
EXPENDITURE	
Newsletter 24 (printing)	$647.64
Postage for bulk mailings	548.90
Mailing/Office Supplies	243.28
Bank Charges	10.00
TOTAL EXPENDITURE	**$1449.82**
BALANCE SHEET (2005 – 2006)	
Funds carried forward from 2004 – 2005	$1529.51
PLUS Income 2005 – 2006	2589.41
LESS Expenditure 2005 – 2006	-1449.82
CREDIT balance carried forward to 2007	**$2669.10**

Donations in 2006/2007:

Publication of the Newsletter on Carboniferous Stratigraphy is made possible with generous donations received from members/institutes during 2006-2007 and anonymous donations, combined with an IUGS subsidy of US $800 in 2006, and additional support from a small group of members who provide internal postal charges for the Newsletter within their respective geographic regions.

A. Blieck, D. R. Boardman, W. R. Danner, F. R. Ettensohn, W. H. Gillespie, P. H. Heckel, N. R. King, J. Kullmann, H. R. Lane, R. H. Mapes, C. E. Mason, W. B. Saunders, G. P. Wahlman, R. R. West, T. E. Yancey, and 3 anonymous donors.

COVER ILLUSTRATION

Comparison of North American (top) and Eurasian (bottom) species-pairs of the fusulinid *Profusulinella* Rauser-Chernousova and Belyaev *in* Rauser-Chernousova et al., 1936. Despite the parallel nomenclature, there are striking morphologic similarities in certain species-pairs of approximately the same age (see Groves et al., 2007 for discussion). Scale bar beneath each image = 0.50 mm.

Illustrations: courtesy of J. R. Groves

J. R. Groves, E. I. Kulagina, and E. Villa. 2007. Diachronous appearances of the Pennsylvanian fusulinid *Profusulinella* in Eurasia and North America. *Journal of Paleontology*, v. 81, p. 227-237.

CONTRIBUTIONS TO THE NEWSLETTER

The Newletter on Carboniferous Stratigraphy is published annually (in July) by SCCS. It is composed of written contributions from its members and provides a forum for short, relevant articles such as:

*reports on work in progress and / or reports on activities in your work place

*news items, conference notices, new publications, reviews, letters, comments

*graphics suitable for black and white publication.

Contributions for each issue of the Carboniferous Newsletter should be timed to reach the Editor before 31 May in the year of publication. It is best to submit manuscripts as attachments to Email messages. Except for very short news items, please send messages and manuscripts to my Email address. Manuscripts may also be sent to the address below on CD prepared with **Microsoft Word (preferred)** or WordPerfect but any common word processing software or plain ASCII text file can usually be acommodated. Word processing files should have no personalized fonts or other code. Maps and other illustrations are acceptable in tif, jpeg, eps, or bitmap format. If only hard copies are sent, these must be camera-ready, i.e., clean copies, ready for publication. Typewritten contributions may be submitted by mail as clean paper copies; these must arrive well ahead of the deadline, as they require greater processing time.

Due to the recent increase in articles submitted by members we ask that authors limit manuscripts to 5 double-spaced pages and 1 or 2 diagrams, well planned for economic use of space.

Please send contributions as follows,

AIR MAIL to: David M. Work
Maine State Museum
83 State House Station,
Augusta, ME 04333, USA

EMAIL to: **david.work@maine.gov**

Report of the Task Group to establish a GSSP close to the traditional Tournaisan/Viséan boundary

George Sevastopulo and Task Group

Department of Geology, Trinity College, Dublin 2, Ireland.

The work of the group is almost complete. The major revision of late Tournaisian/early Viséan *Eoparastaffella* spp. by F.-X. Devuyst and Jiri Kalvoda has been published in the *Journal of Foraminiferal Research* (Devuyst and Kalvoda, 2007). Further study of the material from the proposed GSSP at Pengchong, China has lead to the identification of the first *Eoparastaffella simplex* at the base of Bed 83. F.-X. Devuyst and Hou Hongfei visited the section in January and made sure that the base of Bed 83 could be seen in contact with underlying strata. The base of Bed 83 will now be proposed as the Global Stratotype Point. Participants at the ICCP2007 at Nanjing, China will have the opportunity of inspecting the Pengchong section on Field Excursion C2 (Stratigraphy and lithofacies of the Tournaisian and Viséan in the Guilin-Liuzhou area, Guangxi, South China, June 25-28, led by Jin, X.C., Devuyst, F.-X., Hance, L., Poty, E., Yin, B.A., Wu, X.H., Hou, H.F.)

Devuyst, F.-X., and J. Kalvoda. 2007. Early evolution of the genus *Eoparastaffella* (foraminifera) in Eurasia: the "*interiecta* group" and related forms, late Tournaisian to early Viséan (Mississippian). Journal of Foraminiferal Research, 37:69-89.

Report of the Task Group to establish a GSSP close to the existing Viséan-Serpukhovian boundary

Barry C. Richards and Task Group

Geological Survey of Canada – Calgary, 3303 - 33rd St. NW, Calgary, Alberta, Canada T2L 2A7.

During the past year, continued progress has been made toward the selection of a GSSP for the Viséan-Serpukhovian stage boundary. In spite of a rigorous search for alternatives, the first evolutionary appearance of the conodont *Lochriea ziegleri* in the lineage *Lochriea nodosa – Lochriea ziegleri* still presents the best potential for definition of the Viséan-Serpukhovian boundary. *L. ziegleri* appears near the middle of the Brigantian Substage, which is slightly below the current base of the Serpukhovian as defined by its type section near the town of Zaborie in the Moscow Basin. The lineage, best documented from relatively deep-water sections, has been identified in several European sections (Nemirovskaya et al., 1994; Skompski et al., 1995), Russia, and China. Most recently, the lineage was located in the Cantabrian Mountains of Spain (Nemyrovska, 2005). Unfortunately, the lineage has not been reported from North America. Despite that major shortcoming, the first appearance of *L. ziegleri* is an excellent potential marker for the boundary and the task group will vote on either accepting or rejecting it for GSSP definition after the Nanjing Congress on the Carboniferous and Permian.

Task group member Yu-ping Qi and his associates recently recognized the lineage *L. nodosa – L. ziegleri and* other lineages within the *Lochriea* group of species in the Nashui section near the town of Luodian in Guizhou Province, southern People's Republic of China (Wang and Qi, 2003; Qi and Wang 2005). Qi and Wang have decided to use the first appearance of *L. ziegleri* to define the Viséan-Serpukhovian boundary in southern China. In the near future, Qi plans to study additional sections containing the lineage in South China.

Nikolaeva et al. (2005) recognized the *L. nodosa – L. ziegleri* lineage in a condensed, relatively deep-water, carbonate section along the Ural River opposite the village of Verkhnyaya Kardailovka on the eastern slope of the southern Urals, southern Russia. Tamara Nemyrovska plans to complete a detailed study of the conodonts within the *Lochriea* lineage from the locality and from other Uralian sections that Nikolaeva et al. (2005) have been working on. She has the samples and is ready to start working on them.

During 2006, Svetlana Nikolaeva and her colleagues continued work on the Verkhnyaya Kardailovka section and expanded their study of carbonate-dominant, Viséan-Serpukhovian successions to the Dombar Limestone in the nearby Dombar and Kyzl-Shin region of northern Kazakhstan. In the Dombar Limestone, the *Lochriea* lineage occurs with a taxonomically diverse association of extremely abundant ammonoids (Kulagina et al., 2006).The exact position of the ammonoid zones with respect to those based on other groups, particularly conodonts, has not been precisely established but work is currently underway to develop such a correlation. The study of ammonoids in the Dombar sections combined with related ongoing work by task group members Alan Titus and Dieter Korn on Viséan ammonoids in the Chainman Shale of western Utah and eastern Nevada may lead to a precise correlation with North America at the proposed level of the Viséan-Serpukhovian stage boundary.

Several task group members, in addition to associate member Sergio Rodriguez from Spain and Wayne Bamber from the Geological Survey of Canada-Calgary, are studying various carbonate-dominant, well-exposed sections across the boundary interval in the upper Viséan to Serpukhovian Etherington Formation in the southern Canadian Rocky Mountains. Rodriguez and Bamber are preparing a monograph on the taxonomically diverse, abundant and well preserved rugose coral faunas that span the Viséan-Serpukhovian boundary within the Etherington. In conjunction with that work, task group member Bernard Mamet is studying the associated Etherington foraminifers in order to obtain a precise correlation with Eurasian sections containing the *Lochriea* lineage.

A multidisciplinary study resembling that of the Etherington project is proceeding in western Europe. In collaboration with D. Vachard and L. Pille (University of Lille), task group member Markus Aretz is working on upper Asbian to Serpukhovian

calcareous microfaunas and rugose corals in France, Belgium, Germany, and England. It is hoped that through co-ordination, the western Canadian and European coral/microfaunal projects will lead to the discovery of biostratigraphic markers that are either more globally distributed than the *Lochriea* lineage or can be used to correlate the *L. nodosa – L. ziegleri* transition between Europe and North America.

Gibshman (2001) and Nikolaeva et al. (2002) list a number of the important foraminiferal taxa appearing at the base of the Serpukhovian in Russia. The foraminifers include *Neoarchaediscus postrugosus*, *Janishewskina delicata*, and *Eolasiodiscus donbassicus*. If the *Lochriea* lineage is eventually used to define the Viséan-Serpukhovian boundary, either *Eolasiodiscus donbassicus* or possibly one of the other forams appearing at the base of the Serpukhovian in Russia may be useful for locating the base of the Serpukhovian in North America. Task group member Paul Brenckle recently discovered that *E. donbassicus* occurs in the Chesterian Fraileys Shale of central Kentucky. According to Brenckle, it was identified as *Monotaxinoides* sp. by Browne and Pohl (1973, pl. 26, figs. 4, 5). Unfortunately, *E. donbassicus* may be rather rare in North America.

John Utting (Geological Survey of Canada-Calgary) and Peter Giles (Geological Survey of Canada-Atlantic) have been studying the palynostratigraphy and lithostratigraphy of the partially marine late Viséan to terrestrial early Serpukhovian rocks of southwest Newfoundland, Atlantic Canada (Utting and Giles, 2004). The miospore assemblages recorded enable correlations to be made with spore zones of western Europe, where there is some biostratigraphic control from marine faunas.

Armed with new palynological zonations for the Mississippian of the Maritimes Basin in eastern Canada, Peter Giles and John Utting have recently applied these data to the revision of published magnetic stratigraphy, and are now working with Neil Opdyke (University of Florida) and Vic DiVenere (Long Island University) to expand and refine the polarity stratigraphy of the Late Mississippian. Normal polarity dominates most of the Serpukhovian but several reversals show strong potential for long-range correlation. The Late Viséan record in eastern Canada is dominated by reversed polarity, but as many as seven normal magnetozones can be recognized in the latest Viséan substage alone.

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Report of the Task Group to establish a GSSP close to the existing Bashkirian-Moscovian boundary

John Groves and Task Group

Department of Earth Science, University of Northern Iowa, Cedar Falls, IA 50614, USA.

Our task group is continuing to evaluate two potential events for marking the base of the Moscovian Stage: 1) the appearance of *Idiognathoides postsulcatus* from *I. sulcatus*; and 2) the appearance of *Declinognathodus donetzianus* from *D. marginodosus*. A proposal currently is being developed by Wang Xiangdong, Wang Zhihao, and Katsumi Ueno for a third potential marker event, the appearance of *Diplognathodus ellesmerensis*, which is known from Arctic Canada, Donets Basin, Moscow Basin, Spain, Japan, Western Europe, and possibly cratonic North America.

Significant progress in the past year has been made by teams working in the Cantabrian Mountains (northern Spain) and the South Urals. The Las Llacerias section in the Cantabrian Mountains contains diverse assemblages of foraminifers and conodonts in the Bashkirian-Moscovian boundary interval.

Preliminary studies by E. Villa, C. Méndez, O. Merino-Tomé, L. C. Sánchez de Posada, and M. L. Martínez-Chacón show that upper Bashkirian strata contain *Profusulinella tashliensis*, *Verella* sp., *Profusulinella* ex gr. *primitiva*, and the highest observed occurrences of Archaediscidae. Beds regarded as lower Moscovian contain *Idiognathoides sulcatus*, *I.* aff. *aljutovensis*, *Neognathodus atokaensis*, *Profusulinella sitteri*, *Verella*? sp. (transitional form), *Profusulinella prisca*, and *Tenebrosella asturica*. The suspected position of the boundary falls within a covered interval immediately below the latter assemblage. The Spanish research team plans to continue with more detailed work on this section.

Fusulinid-bearing successions across the Bashkirian-Moscovian boundary are present in the South Urals. According to E. Kulagina, the following evolutionary changes can be used to recognize the base of the Moscovian: 1) the development of an almost spherical shell shape in *Staffellaeformes – Depratina* lineage; and 2) the appearance of primitively fluted septa in the *Profusulinella (Tikhonovichiella) tikhonovichi – Aljutovella subaljutovica – Skelnevatella skelnevatica* and *Profusulinella pararhomboides – Profusulinella (T.) pseudoaljutovica – Aljutovella aljutovica* lineages.

At the Askyn River section, hypostratotype of the Bashkirian Stage, the base of the Moscovian has been placed traditionally at the base of bed 31 in the Solontsovsky Horizon (Sinitsina and Sinitsin, 1987). The fusulinids *Depratina* (= *Profusulinella*) *prisca*, *Profusulinella (T.) pseudoaljutovica, Aljutovella* cf. *subaljutovica, Skelnevatella* sp., and *Schubertella gracilis* appear approximately 4 m above the base of this horizon. However, *Aljutovella aljutovica*, a marker for the base of the Moscovian Stage in its type area, occurs about 28 m higher in bed 35. At the Uklykaya and Seryat sections, similar patterns of occurrences have been observed. *Declinognathodus donetzianus* has been recovered only at the Basu River section (not far from the Askyn River section) with a foraminiferal assemblage similar to that from the lower Solontsovsky Horizon (Pazukhin et al., 2006).

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Progress Report of the Task Group to establish the Moscovian-Kasimovian and Kasimovian-Gzhelian boundaries

Elisa Villa and Task Group

Depto de Geología Universidad de Oviedo, Arias de Velasco s/n 33005 Oviedo SPAIN.

In the last few years, the search for fossil markers to establish worldwide correlation in the upper part of the Pennsylvanian Subsystem has led to important progress. Meetings and discussions undertaken by the task group to establish the Moscovian-Kasimovian and Kasimovian-Gzhelian boundaries enabled achievement of considerable improvement in correlation across both boundary intervals and, ultimately, to the proposal that the level at which the conodont species *Idiognathodus simulator* (Ellison, 1941) [sensu stricto] first appears be selected to mark the base of the global Gzhelian Stage.

Task Group Activities in 2006.

In July-August 2006, the task group held a field trip to relevant sections in the Carnic Alps and Karavanke Mountains. The three-day trip to the Carnic Alps was led by task group members Holger Forke and Elias Samankassou, in cooperation with Prof. Hans-Peter Schönlaub (Geological Survey of Austria). The excursion to the Karavanke Mountains was guided by Matevz Novak (Geological Survey of Slovenia) and Holger Forke.

After the field trip, a meeting with presentations, workshops, and discussions was held during five days at the Geological Survey of Slovenia in Ljubljana. This meeting was well organized by Matevz Novak, Staša Čertalič, and Bojan Ogorelec (Geological Survey of Slovenia) and was attended by task group members A. Alekseev, V. Davydov, H. Forke, N. Goreva, P. Heckel, T. Isakova, M. L. Martínez Chacón, C. Méndez, T. Nemyrovska, E. Samankassou, L. C. Sánchez de Posada, K. Ueno, and E. Villa as well as guests from Croatia (J. Sremac), Poland (B. Blazejowski), Serbia (D. Jovanović, M. Sudar), Spain (O. Merino, J. R. Bahamonde), and Slovenia (K. Drobne). Dr. Andrej Šmuc (Department of Geology, University of Ljubljana), gave an introductory lecture on the geology of Slovenia.

Substantial progress was made on correlation of cyclothem units across both boundaries, and on definition of the K-G boundary. The task group has generally agreed upon a rather detailed correlation of the glacial-eustatic sequence-stratigraphic units called cyclothems in the regions where they can be recognized in strata across these boundaries, specifically, the Midcontinent U.S., Moscow Basin, and Donets Basin. Cyclothem correlation is supported by biostratigraphy of the conodont and fusuline faunas, and, at certain levels, by ammonoids. These cyclothem correlations are being published by P. Heckel et al. (2007). These biostratigraphic data also allow correlation with sections in those areas where cyclothems are not yet recognized, specifically in the southern Urals, Cantabrian region of northern Spain, and the Carnic Alps. These correlations are shown in charts and text published by P. Heckel and task group members in the 2005 Newsletter on Carboniferous Stratigraphy, which are updated for the Donets Basin by Heckel et al. (2007

Studies on the Moscovian-Kasimovian and the Kasimovian-Gzhelian Boundaries

With respect the Moscovian-Kasimovian boundary, one of the more promising taxa being considered as a fossil marker is the conodont *Idiognathodus sagittalis*, although its potential value must still be confirmed using data gathered from ongoing studies. Jim Barrick and his student Steve Rosscoe are preparing a manuscript on *Idiognathodus* morphotypes across the Desmoinesian-Missourian boundary from the Lost Branch through the Hertha cyclothems, which include some forms that resemble *I. sagittalis*.

Other fossils bearing on correlation within the Moscovian-Kasimovian transition beds are *I. subexcelsus* (which links Donets Basin Limestone N3 with the Lower Suvorovo Formation of the Moscow Basin), and *Swadelina nodocarinata* (which links Donets Limestone N3/3, the Voskresensk Formation of the Moscow Basin, and the Lost Branch cyclothem of the Midcontinent). In this scheme, the traditional Lower Kasimovian boundary of Eastern Europe is at a level just below the upper Desmoinesian Farlington cyclothem, but that level is marked by a disconformity with abrupt appearance of the genus *Swadelina* just above it.

The task group has reached general agreement on the characterization of the Kasimovian-Gzhelian boundary. After a ballot among the 23 task group voting members, the first appearance of the conodont *Idiognathodus simulator* [s.s.] was approved to serve as the fossil marker for the global lower Gzhelian boundary, by a vote of 22 in favor and 1 abstention. This boundary is now placed at a level slightly higher than the traditional lower Gzhelian boundary in parts of Eastern Europe and corresponds to the base of the upper Rusavkino Formation in the Moscow Basin, to the base of the O_6 Limestone in the Donets Basin, and to the base of the Oread cyclothem in the Midcontinent (therefore, slightly higher than the base of the regional Virgilian Stage of North America).

I. simulator [s.s.] has been so far identified in Midcontinent North America, the Moscow Basin, the Donets Basin, and the northern and southern Urals of eastern Europe, as well as in southwestern China. Correlation at this level based on this species can be reinforced in some areas by ammonoid data (first appearance of the oldest species of the genus *Shumardites*, *S. cuyleri*, and of *Vidrioceras uddeni*), and by fusuline data (first appearance of *Rauserites rossicus*).

Coming Steps

A detailed report dealing with the topics mentioned above will be presented during the meeting of the IUGS Subcommission on Carboniferous Stratigraphy (SCCS) to be held during the XVI-ICCP in Nanjing (June 2007).

Following acceptance of *I. simulator* as the fossil marker for the base of the global Gzhelian Stage, the next goal for the present task group will be the selection of a GSSP for this level.

In spring 2008, prior to the ICS meeting at the International Geological Congress in Oslo (August 2008), the Task Group to establish the Moscovian-Kasimovian and Kasimovian-Gzhelian boundaries plans to have a Task Group Meeting and Workshop at the University of Oviedo (Spain). This meeting should serve to shape the schedule for the coming years.

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CONTRIBUTIONS BY MEMBERS

Views and interpretations expressed / presented in contributions by members are those of individual authors / co-authors and are not necessarily those of the SCCS and carry no formal SCCS endorsement.

Afanasievo section – neostratotype of Kasimovian Stage (Upper Pennsylvanian Series), Moscow Basin, central Russia

N.V. Goreva[1], A.S. Alekseev[2], T.N. Isakova[1], and O.L. Kossovaya[3]

[1]Geological Institute of RAS, Moscow, Russia.

[2]Moscow State University, Moscow, Russia.

[3]All-Russian Geological Research Institute, St. Peterburg, Russia.

Introduction

The Kasimovian Stage is the lower stage of the Upper Pennsylvanian Series. It was established in the Moscow Basin not far from Moscow in the early 1920s. Originally it was named by Ivanov (1926) as the *Tegulifera* (later *Teguliferina*) Horizon of the Upper Carboniferous (in the original threefold subdivision of the Carboniferous System), based on occurrence of the typical brachiopod genus. This taxonomic name was changed by Danshin (1947) into the Kasimovian Horizon, and then into the Kasimovian Stage by Teodorovich (1949). Kasimov is a small town in the Ryazan Region, situated about 200 km southeast of Moscow, where the Oka River crosses the Oka-Tsna swell, a narrow uplift of Paleozoic strata. In spite of its name, its type areas are in the vicinity of Voskresensk in the lower extent of the Moscow River for the lower part, and in the Moscow City region for the upper part.

In the southern Moscow Basin, the Kasimovian succession averages about 50 m in thickness, and is composed of distinctly alternating, poorly fossiliferous fine-grained limestones, and variegated marls and shales with thin limestone interbeds. The

interbeds are commonly rich in macrofossils, which provide the main faunal characteristics of the Kasimovian Stage. In thickness, the clayey members constitute about half of the succession.

According to the unified Carboniferous stratigraphic scheme for the Russian Platform approved formally in 1988 (Kagarmanov and Donakova, 1990), the Kasimovian consists of three substages: Krevyakinian, Khamovnikian, and Dorogomilovian. Each unit corresponds either to one provincial or local fusulinid zone or several conodont zones.

The stratotype of the Krevyakinian Substage was in a quarry 5 or 6 km southeast of Voskresensk near the Tsemgigant train station at the Suvorovo quarry. The quarry does not exist now. The stratotypes of the Ratmirovo and Neverovo formations of the Khamovnikian Substage were established in the same region, and now also are destroyed.

At present, the Afanasievo section in the "Voskresenskcement" quarry on the right bank of the Moscow River is the only section where the Krevyakinian and Khamovnikian substages are accessible. For this reason, this section is selected as a neostratotype of the Kasimovian Stage, of its Krevyakinian Substage consisting of the Suvorovo and Voskresensk formations, and of its Khamovnikian Substage consisting of the Ratmirovo and Neverovo formations. The Afanasievo section is located approximately 90 km southeast of Moscow and about 5 km southwest of Voskresensk (Fig. 1).

Afanasievo Section

The section at Afanasievo (Figs. 2,3) starts with limestones of the uppermost Moscovian (Upper Myachkovian) Peski Formation (up to 5 m), which are overlain by a shallow-water carbonate succession (18 m) of the Krevyakinian (Suvorovo and

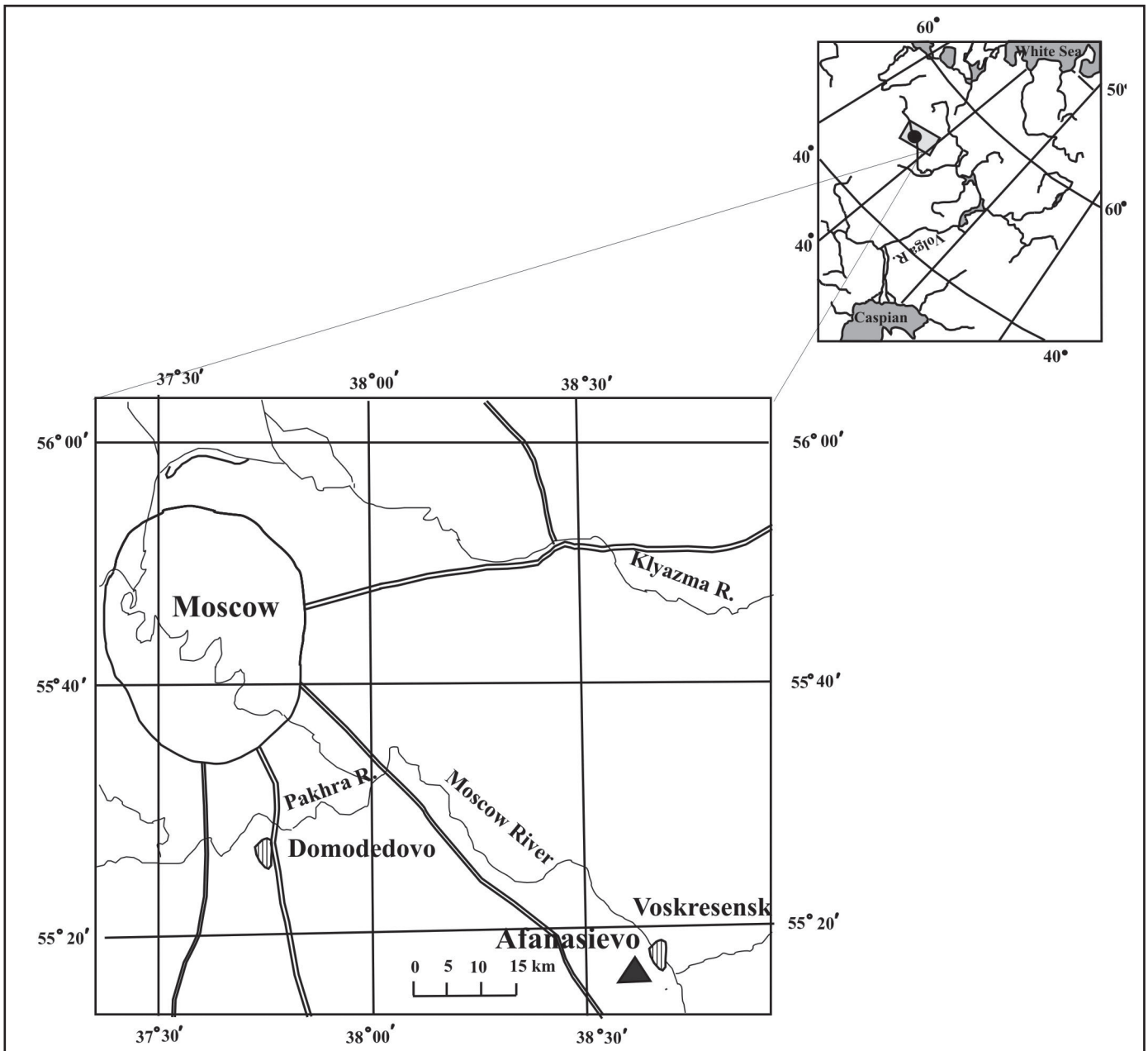

Fig. 1. Location of Afanasievo section in Moscow Basin.

Voskresensk formations) and the lower part of the Khamovnikian (Ratmirovo, and basal, lower and middle Neverovo formations). This succession was formed under the strong influence of glacio-eustatic sea-level fluctuations, in which the marine units are separated by gaps of different duration.

The Moscovian-Kasimovian transition in the Afanasievo section contains fusulinids, brachiopods, bryozoans, rugose corals, fish remains, and conodonts. Also present as paleontological rarities, are well preserved ophiuroids and asteroids in the Neverovo Formation.

Krevyakinian Substage

The Krevyakinian lies on the distinctly eroded surface of the Myachkovian limestones (Fig. 2), and is composed predominantly of variegated shales. The Suvorovo Formation consists of two members (Beds 9-14), about 5 m in overall thickness. The Voskresensk Formation (Beds 15-33) can also be subdivided into two members, and its thickness varies from 3.5 to 6.5 m. The Ratmirovo Formation of the Khamovnikian (Fig. 2) lies on the eroded surface of the Voskresensk shales. Although weakly expressed lithologically, this gap varies greatly in amplitude. Locally, the upper member of the Voskresensk above Bed 22 is only 0.5 m thick.

Conodonts. Many conodont samples were taken from the section (Fig. 2). Each sample was 2 to 5 kg in weight. They yielded a total of more than 11,000 conodont elements, with an average of 100-120 elements per kg. The conodont assemblage of the basal Krevyakinian is essentially different from the Myachkovian assemblage. The difference is pronounced in the complete disappearance of *Neognathodus*, along with the appearance of *Streptognathodus* and *Swadelina* in the basal Krevyakinian. Conodont elements sharply increase in abundance in the Kasimovian relative to the Upper Moscovian, and may exceed 500 specimens per kg.

Characteristic species of the Suvorovo Formation are *Streptognathodus* ("*Swadelina*"?) *subexcelsus* Alekseev and Goreva, *Idiognathodus fischeri* Alekseev and Goreva, and *I. trigonolobatus* Barskov and Alekseev. The Voskresensk Formation contains highly dominant *Swadelina makhlinae* Alekseev and Goreva as well as *I. trigonolobatus* Barskov and Alekseev. Stratigraphic distribution of these species allows establishment of two conodont zones: the lower one of *S. subexcelsus*, and the upper one of *S. makhlinae* (Alekseev and Goreva, 2000, 2007).

Fusulinids. Twelve levels with fusulinids were distinguished in the Afanasievo section from the upper part of the Peski Formation (Moscovian Stage) up to the middle part of the Neverovo Formation (Figs. 2, 3). The Peski contains an assemblage with *Hemifusulina* replaced upward by frequent *Fusulina cylindrica* Fischer, *F. mosquensis* Raus., *F. quasicylindrica* Lee, and forms of the *Fusulinella fluxa* (Lee and Chen) group. The same forms were assigned to *Fusulinella* (?) – conventional *Protriticites* (?) sp. (*P.* ex gr. *ovatus*).

According to the unified stratigraphic scheme for the Russian Platform, the Krevyakinian corresponds to the *Protriticites pseudomontiparus*, *Obsoletes obsoletus* Zone. The base is marked by sharp changes in fusulinid assemblage compared to that in the Myachkovian. *Pseudostaffella*, *Profusulinella*, and *Hemifusulina* disappear. The Suvorovo Formation contains a sparse fusulinid assemblage, which includes the stratigraphically important genera and species *Protriticites subschwagerinoides* Ros. and forms identified as *Obsoletes* ex gr. *O. obsoletus* (Schell.). The assemblage contains also species of wide stratigraphic range, such as *Fusiella typica ventricosa* Raus., *Schubertella gracilis* Raus., and *Ozawainella mosquensis* Raus. The lower part of the Voskresensk Formation yielded an abundant fusulinid assemblage characterized by typical forms of *Protriticites* (*Pr. pseudomontiparus* Putrya, *Pr. formosus* Volozh., *Pr. longus*. Volozh.) and *Obsoletus* (*O. magnus* Kir., *O.* ex gr. *obsoletus* Schell.). It should be noted that some researchers (Ginkel and Villa, 1999) do not regard *Obsoletes* to be an independent genus.

Khamovnikian Substage

The Khamovnikian also comprises two units (Fig. 3). The Ratmirovo Formation consists of very shallow-water white porcelaneous limestones (mudstones) (Beds 34-38) and is about 2 m thick. The Neverovo Formation (Beds 35-39, about 5 m thick) is composed predominantly of shales with limestone interbeds and is subdivided into three members (Basal, Lower, and Middle). In the neostratotype, the Neverovo Formation is incomplete. Only the lower part of the Middle member is present in the Afanasievo section, but to the east in the subsurface, the complete thickness of the Neverovo Formation is 10-12 m.

Conodonts. The assemblage of conodonts in the Ratmirovo Formation is sparse and includes mainly shallow-water *Adetognathus*. At the base of the Ratmirovo, along with *S. makhlinae*, a rare juvenile forms occurs that looks similar to *Streptognathodus neverovensis* Goreva and Alekseev. The lower part of the Basal Neverovo contains a similar conodont assemblage. The uppermost Basal and Lower Neverovo contain abundant *Streptognathodus neverovensis*. Along with abundant *Hindeodus* and *Diplognathodus*, there are forms similar to *Idiognathodus trigonolobatus*, *I. arendti* Barskov and Alekseev, and *I. eccentricus* (Ellison).

I. sagittalis Kozitskaya first appears 2 m above the base of the Neverovo Formation in the bottom of the Middle member, where it occurs with *S. neverovensis* and *Idiognathodus trigonolobatus*. In the upper part of the Middle Neverovo, *Gondolella* appears and reflects the progressive deepening of the marine basin.

The appearance of *I. sagittalis* has been proposed recently as the best index-fossil for definition of the base of the Kasimovian in the global stratigraphic scale. A form that can be interpreted as the ancestor of *Idiognathodus sagittalis* was detected in the upper part of the Suvorovo Formation, but it is more abundant and more advanced in the middle and upper Voskresensk Formation. We identified it as *Idiognathodus* sp. nov. N. This lineage can be considered as a prospect for fixing the GSSP at the level of first appearance of *I. sagittalis*.

Fusulinids. Fusulinids first appear in the uppermost part of the Ratmirovo Formation, and the Ratmirovo-Neverovo boundary interval is characterized by a single assemblage.

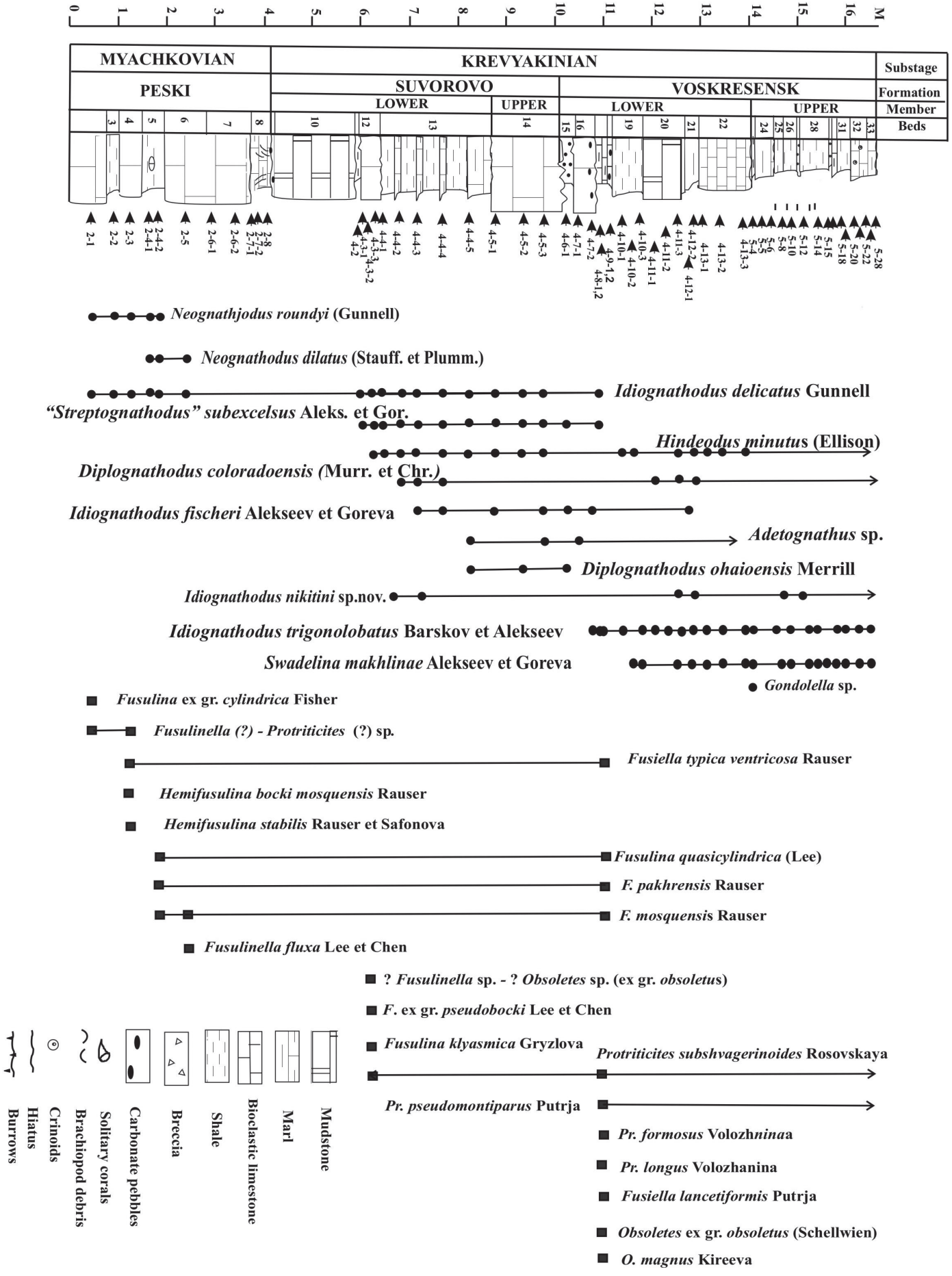

Fig. 2. Distribution of conodonts and fusulinids in uppermost Moscovian – Krevyakinian interval of Afanasievo section.

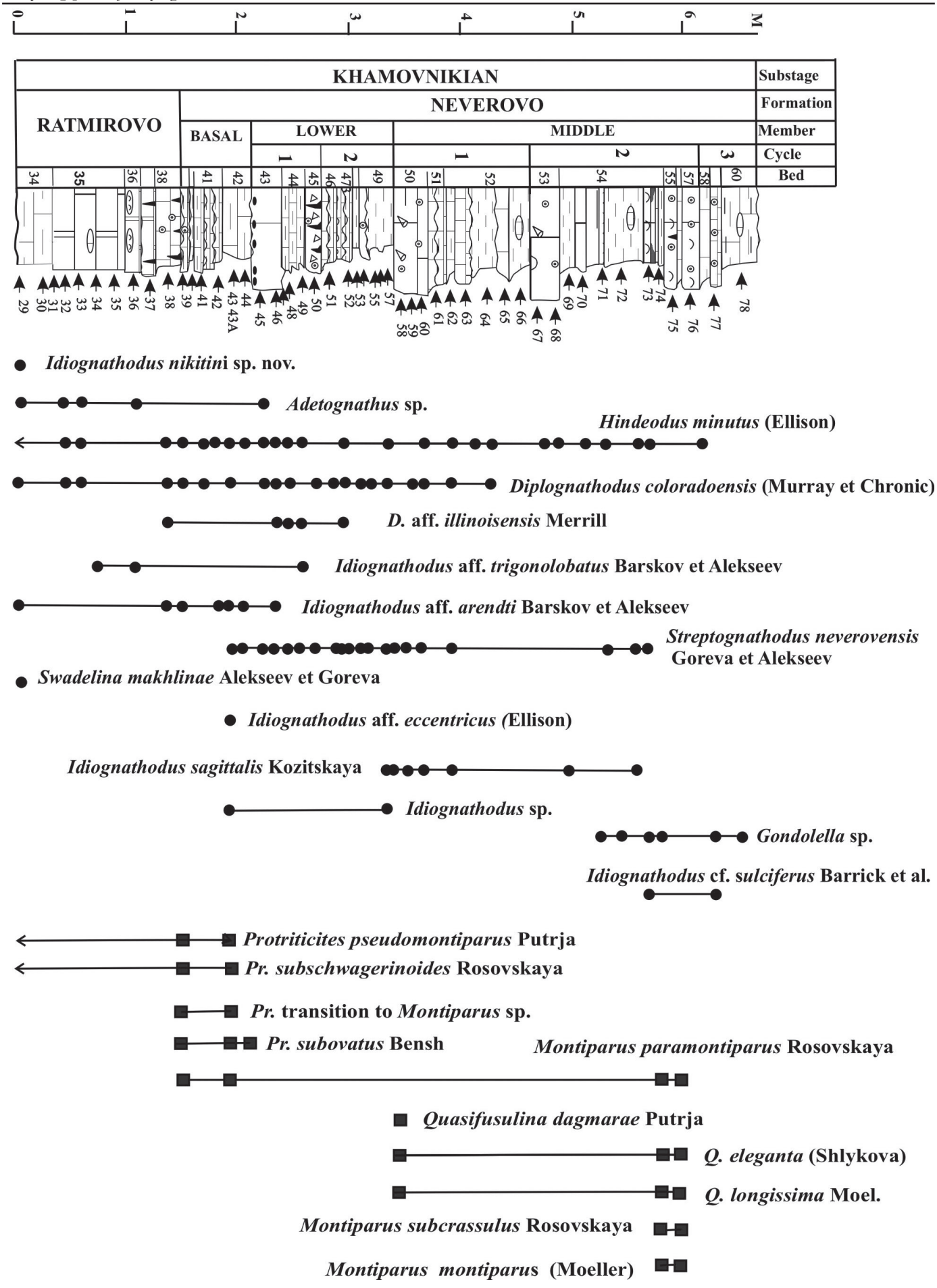

Fig.3. Distribution of conodonts and fusulinids in Khamovnikian interval of Afanasievo section.

Characteristic forms are typical (in wall structure) *Protriticites* (*P. pseudomontiparus, P. subschwagerinoides*., *P.* aff. *subovatus*), rare specimens with transitional wall structure from *Protriticites* to *Montiparus*, and a few *Montiparus paramontiparus*.

The assemblage of the Basal Neverovo Formation is noticeably renewed. It comprises *Montiparus paramontiparus* Ros., *Protriticites subovatus* Bensh, *Pr. subschwagerinoides* Ros., and *Pr. pseudomontiparus* Putr. The Lower member of the Neverovo contains a diverse fusulinid assemblage, which is distinguished by co-occurrence of typical *Montiparus* (*M. montiparus* (Moeller), *M. umbonoplicatus* Raus. and Bel.) and typical *Protriticites*. The Middle member of the Neverovo is marked by the presence of *Quasifusulina* (*Q. longissima* Moel., *Q. eleganta* Shlyk., *Q. dagmarae* Putr. dominating forms) and *Ozawainella*. Above, there are prevailing *Montiparus montiparus* (Moeller) and *M. subcrassulus* Ros. The *Montiparus* forms are widely variable.

The first appearance of *I. sagittalis* is very close to the entrance of the typical Kasimovian fusulinid *Montiparus*.

Macrofauna. The studied interval of the Afanasievo section is also characterized by diverse macrofauna: rugose corals, brachiopods, and bryozoans. Six levels with rugose corals were established.

The sparse rugose assemblage of the Krevyakinian includes a few taxa that survived after the diversity decrease during the late Myachkovian. There is *Bothrophyllum conicum* (Fisher), which occurs with *Bothrophyllum pseudoconicum* (Dobrolyubova) with widely distributed dissepiments. Few corals are found at the base of the Ratmirovo Formation (*Bothroscilisia* sp. 1) and the Basal Neverovo (*Bothrophyllum pseudoconicum*). Corals become more diverse in the Middle Neverovo, where *Bothropyllum conicum* and *B. rareseptatum* (Dobrolyubova) were found, and in its upper part where small fasciculate colonies of *Fomichevella* sp. nov. 1 appear (Beds 55-56).

The Lower and especially Middle Neverovo are characterized by an abundant and diverse brachiopod assemblage: *Admoskovia ivanorum* Lazarev, *Neochonetes carboniferous* (Keys.), *Kozlowskia boreailformiss* Lazarev, and other species were found one meter above the base.

Goryunova (2000) reported the bryozoans *Crustoporella alekseevi* Goryunova, *Rectifenestella constans* (Schulga-Nesterenko) and *Polyporella martis* (Fischer) from the Voskresensk shales, and *Pseudorhabdomeson polygoniium* Goryunova and *Crustoporella sakharovensis* Goryunova were detected 0.5 and 4 m above the base of the Neverovo.

Lower Boundary of the Kasimovian.

The position of the basal Kasimovian boundary in the type area has been a subject of numerous revisions (Makhlina et al., 2001a). In the late 1970s, the Middle-Upper Carboniferous boundary was established at the base of the Suvorovo Formation of the Krevyakinian. This level conventionally coincided with a base of the fusulinid zone of *Protriticites pseudomontiparus*, *Obsoletes obsoletus*, which is the lower zone of the Upper Carboniferous and first distinguished by Semikhatova (1947) in Donskaya Luka as the "subtriticites" Beds. In the last decade, work was intensified to define markers of the lower Kasimovian boundary and to find sections where a reliable phylogenetic succession can be traced, and where, owing to a complex of its properties, the GSSP for this boundary can be established.

It was discovered that the conodont *I. sagittalis* has a high potential for correlation of the lower Kasimovian boundary. It occurs in the Donets Basin (Ukraine), Moscow Basin and South Urals (Russia), Cantabrian Mountains (Spain), Midcontinent USA, northern Canada, and South Korea. Owing to evident morphological characters, this species is easy to identify. In the Afanasievo section, it appears first in the base of the Middle Neverovo Formation of the Khamovnikian, i.e., much higher than the Kasimovian base that was established in 1971. The supposed ancestor of *I. sagittalis* appears in the upper part of the Suvorovo Formation and becomes abundant and more advanced in the upper members of the Voskresensk Formation. This evolutionary line is promising for establishing the GSSP at the level of first appearance of *I. sagittalis*. If this species is selected as the marker, the Kasimovian base will be approximately coincident with first appearance of fusulinid genus *Montiparus*.

Data on oxygen and carbon isotope ratios derived from the Afanasievo carbonates is unsuitable because of strong diagenetic changes during repeated sea-level drops (data of W. Buggisch, personal communication). Oxygen isotope composition of conodont phosphate demonstrates sharp cyclic variations reflecting glacio-eustatic fluctuations (data of M. Joachimski, personal communication).

The Afanasievo section can be considered as a possible candidate for the stratotype of the lower Kasimovian boundary. The most correlative levels are at the base of the *Montiparus montiparus* fusulinid Zone and at the base of the *Idiognathodus sagittalis* conodont Zone. Advantages of the Afanasievo section as a stratotype of the lower boundary of the Kasimovian Stage are as follows: geographic accessibility, refined characterization by conodonts and fusulinids, diverse macrofauna (rugose corals, bryozoans, ostracodes), obtained results of isotopic analysis, and high potential for correlation with Eurasian sections. The disadvantage of this section is constituted by the shallow-water facies that consequently include gaps of uncertain duration, particularly between the Peski and Suvorovo, Suvorovo and Voskresensk and the Ratmirovo and Neverovo formations.

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Carboniferous Conference Cologne 2006 – From Platform to Basin: A research and field conference sponsored by SEPM-CES

Markus Aretz and Hans-Georg Herbig

Institut für Geologie und Mineralogie, Universität zu Köln, Zülpicher Str. 49a, 50674 Köln, Germany.

Almost 100 people from 19 countries including Mexico, the U.S.A., and Canada, many European countries, northern Africa, the Middle East, China, and Australia, attended the symposium "CCC 2006 – From Platform to Basin", which convened 4-10 September 2006 in our department in Cologne. The conference included two pre- and post-meeting field trips, each two days long, as well as 46 oral and 35 poster presentations and gives a representative insight into the activities of the Carboniferous community. The headings of the sessions, which were opened by keynotes, show the main topics addressed.

- Facies patterns: platforms, basins, and their interfaces (Keynote: E Poty, Liège: Sequence stratigraphic model for the Belgian Dinantian: from local to global).
- Diagenesis and hydrocarbon reservoirs (Keynote: W.M. Ahr, College Station/Texas: Hydrocarbon reservoirs in Carboniferous carbonates).
- Basin evolution in front of prograding orogenic belts (Keynote: W. Franke, Frankfurt: Variscan flysch sediments: sedimentary record of orogeny).
- Multistratigraphy, sequence stratigraphy, and eustacy (Keynote: I.D. Somerville, Dublin: Multistratigraphic correlation of platforms and basins in the Mississippian (Carboniferous)).
- Interrelationships of geochemical proxies, facies, and fauna (Keynote: J. Veizer, Ottawa: Climate, water, and carbon cycles on geological time scales).
- Bioconstructions and bioconstructors (Keynote: G.E. Webb, Brisbane: Environmental constraints on Mississippian bioconstructors in different platform to basin transects: fore-arc setting, eastern Australia and passive margin ramp, Sacramento Mountains, New Mexico).

The complete program listing all talks and posters is available from http://www.ccc2006.uni-koeln.de/programm_ccc.pdf. Extended abstracts, up to two pages in length, were published in a volume, which can be purchased from the organizers (25 Euros).

The proceedings of the meeting, to be published in *Geological Journal*, are scheduled for early 2008.

The field trips focused on the central theme of the congress and presented a state-of-the-art overview of the carbonate platform facies of the easternmost part of the northwest European "Carboniferous Limestone" province, transition into basin, and basinal facies ("Kulm facies") of the classical central European Mississippian in the eastern Belgian Ardennes and in the German Rheinisches Schiefergebirge. Two voluminous field guides were prepared, which include much new, previously unpublished information. This concerns especially the Mississippian of the Aachen region, westernmost Germany, and approaches to facies, sea level, and sequence stratigraphy, respectively, within the Rhenohercynian Kulm Basin. The contents of the as yet unpublished field guides have subsequently been revised and improved, in part as a result of discussions generated by participants of the field trips. These should be available at the end of the summer as volume 16 of Kölner Forum für Geologie und Paläontologie.

The positive responses of the participants suggest that CCC 2006 was a successful meeting, enjoyed by participants and organizers alike. Therefore, we envisage that the series of meetings, which started with European Dinantian Environments (Manchester 1984), followed by European Dinantian Environments II (Dublin 1994), and Permo-Carboniferous Carbonate Platforms and Reefs (El Paso 2000) might be successfully continued.

Aretz, M., and H.-G. Herbig (eds.). 2006. Carboniferous Conference Cologne 2006. From Platform to Basin, September 4–10, 2006. Research and Field Conference sponsored by SEPM-CES. Program and Abstracts. Kölner Forum für Geologie und Paläontologie, 15, 130 p.
Aretz, M., E. Poty, and H.-G. Herbig (with contributions by S. Delculée and P. Hecker). 2007. From palaeokarst to calcitur-

bidites – A carbonate platform-slope-transect from the Mississippian Limestone in eastern Belgium to the Kulm Basin in western Germany, 41 p. *In:* Kölner Forum für Geologie und Paläontologie, 16 (in press).

Herbig, H.-G., D. Korn, and M. 2007. The mixed carbonate, siliceous, and siliciclastic facies of the Mississippian Kulm Basin (Rheinisches Schiefergebirge, Germany) – Complex interplay of platform, starved basin and prograding orogeny, 54 p. *In:* Kölner Forum für Geologie und Paläontologie, 16 (in press).

The Carboniferous of Germany

Hans-Georg Herbig

Institut für Geologie und Mineralogie, Universität zu Köln, Zülpicher Str. 49a, 50674 Köln, Germany.

The German Commission on Stratigraphy is currently editing a series of 20 volumes dealing with the Proterozoic to Quaternary Systems of Germany. Nine volumes are currently available (http://www.stratigraphie.de/monographie/index.html). Two volumes, prepared under the guidance of the German Subcommission on Carboniferous Stratigraphy, present a detailed overview of the stratigraphy, paleontology, and regional geology of the Mississippian and Pennsylvanian of the country. Totaling 1066 pages, these volumes present an exhaustive state-of-the-art overview of the German Carboniferous, based on thorough reviews of innumerable, widely dispersed papers as well as new research and interpretations.

Deutsche Stratigraphische Kommission (Ed.; coordinated by V. Wrede) (2005): Stratigraphie von Deutschland V - Das Oberkarbon (Pennsylvanium) in Deutschland. Courier Forschungsinstitut Senckenberg, 254, 477 p.; Frankfurt a.M. ISBN 3-510-61380-5.

(available from Schweizerbart Verlag, Stuttgart).

Deutsche Stratigraphische Kommission (Ed.; coordinated by M. R. W. Amler and D. Stoppel) (2006): Stratigraphie von Deutschland VI - Unterkarbon (Mississippium). Schriftenreihe der Deutschen Gesellschaft für Geowissenschaften, 41, 590 p.; Hannover. ISBN 3-932537-37-8.

(available from Deutsche Gesellschaft für Geowissenschaften, Hannover).

The Misisippian volume contains 39 papers by 40 authors. The introductory part includes a short account of the history of stratigraphic research by D. Stoppel and M.R.W. Amler, followed by an outline of the current state of the boundaries and subdivision of the Mississippian of Germany by Stoppel and coauthors. D. Weyer and M. Menning discuss isotopic age determinations and relations to northwest European and global Carboniferous stages, respectively, as well as relationships between both stratigraphic scales. H.-J. Gursky provides an integrated overview of the paleogeographic, paleooceanographic, and facies evolution of the German Mississippian.

Ten, mostly very well illustrated papers discuss the spatial and stratigraphic distribution of the macrofauna, often including information on facies dependencies: corals (D. Weyer), brachiopods (C.F. Winkler Prins and M.R.W. Amler), bryozoans (H.M. Weber and P.N. Wyse Jackson), gastropods and bellerophontids, bivalves and rostroconchs (both M.R.W. Amler), ammonoids (D. Korn), trilobites (C. Brauckmann and G. Hahn), ostracodes (H. Blumenstengel), and echinoderms (E. Thomas and R. Haude). C. Brauckmann and coauthors discuss "rare fossils" (polyplacophorids, hyolithids, non-trilobite arthropods, including insects). Of special importance is a bivalve biostratigraphy of the Kulm Basin, a review of the known trilobite biostratigraphy in different shallow-water and basinal facies realms, and an extremely detailed ammonoid biostratigraphy.

Four papers present the microfauna. H.-G. Herbig and D. Stoppel review the conodonts, including discussions of the international D–C boundary, T–V boundary, mid-Carboniferous boundary, conodont biofacies, CAI data, and geochemical data. A. Braun elucidates the preservation modes and biostratigraphy of radiolarians. H.-G. Herbig summarizes the previously widely dispersed knowledge on arenaceous and smaller calcareous foraminifers. Another paper on calcareous algae and *incertae sedis* is found in the paleobotany chapter. (With minor exceptions, these three groups were not yet systematically studied in Germany.)

In the paleobotany chapter, H. Kerp and coauthors give a complete overview of the rare, long neglected megafloras. Palynostratigraphy and correlations with Poland and the British Isles are treated by H. Jäger and F. Wierich; H. Jäger also discusses in greater detail the palynostratigraphy and sedimentary development of the island of Rügen, northeastern Germany.

About half of the volume is dedicated to the regional development of the Mississippian in Germany. The three major chapters, partly with colored illustrations, correlate with the structural zones of the German Variscides.

The first chapter treats the deeper water facies ("Kulm facies") of the Rhenohercynian Zone. Two quite extensive and nicely illustrated contributions by Stoppel and coauthors and of Bender and Stoppel, respectively, describe the Mississippian of the Rheinische Schiefergebirge. In a third contribution, D. Korn proposes a new lithostratigraphic scheme for that region by substituting for the traditional lithostratigraphic terms lithostratigraphic groups and formations defined according to the International Stratigraphic Guide. D. Stoppel presents the isolated, but paleogeographically important occurrences of Missippian rocks in southwestern Germany (Saarland, Rhineland-Palatine). Mississippian stratigraphy and facies of the western Harz Mountains are detailed by Buchholz and coauthors, who also include radiometric ages as well as paleomagnetic data and reconstructed paleopole positions. Although their contribution contains some data concerning the eastern Harz Mountains, that region is only discussed in a short contribution by Stoppel. Paech and coauthors describe the northeastern prolongation of the Mississippian of the Harz Mountain into the subsurface and the northernmost outcrops of the central European Carboniferous in the Flechtingen-Rosslau block between Dessau and Magdeburg. D. Franke gives an overview of the deep exploration wells in the Altmark-Nordbrandenburg Kulm of northeastern Germany. Although not well known to the scientific community, they are

of major paleogeographic importance for the extension of the Rhenohercynian Kulm facies.

The second chapter reviews the Mississippian carbonate platform facies which developed on the external side of the Kulm Basin in northwestern Europe. M.R.W. Amler and H.-G. Herbig discuss stratigraphy and facies of the easternmost platform sediments which rim the London-Brabant massif in easternmost Belgium, westernmost Germany (Aachen region), and in the subsurface of the Niederrhein embayment. They also elucidate the transition into the Kulm Basin in the westernmost Rheinische Schiefergebirge and propose a new lithostratigraphic scheme which as far as possible adapts the Belgian formations. The second well known region in Germany which displays predominantly carbonate platform facies is known from deep wells in western Pomerania, mainly from Rügen Island, at the southwestern margin of the eastern European platform (N. Hoffmann and coauthors). Additional interesting boreholes in northern and northwestern Germany are briefly reviewed by Stoppel.

The third chapter deals with the Kulm facies in the more internal zones of the Variscides (i.e., in the Saxothuringian and Moldanubian Zones). J. Gandl outlines the complex development of the Mississippian in northeastern Bavaria (Frankenwald). That paper is supplemented by that of H. Blumenstengel, who describes the development in adjoining areas of eastern Thuringia. Knowledge of the isolated occurrences of Mississippian rocks in Saxony and southern Brandenburg, including well data, is compiled by A. Kampe; this paper also includes a new geological map of the Görlitzer Schiefergebirge. In a second contribution, A. Kampe and coauthors describe the isolated Upper Viséan to Lower Namurian (Arnsbergian) intramontane molasse sediments from Saxony and southern Brandenburg which is the earliest sedimentary record of the uplifted Variscan orogen in Germany. The stratigraphic and structural development of the Carboniferous of the Black Forest-Vosges region, lateral correlations within the Variscides, and a geodynamic interpretation is elucidated by R. Maass.

In a separate chapter, H.-D. Nesbor treats the Mississippian volcanism in the eastern Rheinisches Schiefergebirge which is composed of basaltic submarine pillow lava and dacitic to rhyodacitic ashtuffs which originating outside of the basin. Finally, F. Wierich discusses geodynamic models of the northern Variscides which are based on the existence of the Mid German Crystalline rise. According to the postulated Carboniferous exhumation of that unit, it is interpreted as a Variscan nappe.

The Pennsylvanian volume contains 27 papers by 44 authors. In the introduction, the process leading to definition of the the Mid-Carboniferous boundary and its position and applicability in Germany are discussed by H.-G. Herbig. A second contribution by Krull elucidates the paleogeographic framework of the German Pennsylvanian, outlining the development of the Northern European paralic foredeep between the British Isles and Poland, and of intramontane basins.

The paleontological chapters begin with a discussion of the low diversity ammonoid faunas by J. Kullmann. A short review of marine bivalves, gastropods, and bellerophontids by M.R.W. Amler is perfectly complemented by a very well illustrated contribution to the stratigraphy, ecological variability, and paleogeographic relations of the non-marine and limnic bivalves by R.C.M. Eagar. H.-G. Herbig reports on the taxonomy, stratigraphic distribution, and paleoecological constraints of paralic microfaunas (foraminifers, ostracodes, conodonts, and other less studied groups). The revised conodont zonation, which is based on valid taxa, is particularly important. In a well figured contribution, C. Brauckmann reviews the rare, but diverse arthropods and their paleoecology (insects, arachnids, xiphosurids, eurypterids, "myriapods", arthropleurids, trilobites). A discussion of the non-marine and limnic faunas of the intramontane basins and the Variscan foredeep treats, among others, fishes, conchostracans, and insects (blattoids), and their biostratigraphic significance; a new combined conchostracan-blattoid biostratigraphy is established for the Westphalian and Stephanian by J. Schneider and coauthors. K.-H. Josten reviews the detailed macroplant stratigraphy, based on some 250 species from 46 genera. Finally, Ch. Hartkopf-Fröder contributes to the history of palynological research in the Pennsylvanian, reviewing the palynostratigraphic zonation of paralic and intramontane basins, and commenting on the paleoecological constraints of the microfloras.

An important chapter is "Zeitmarken" (time marks). It includes three papers dealing with cyclothems, cycles, and sequences in the Ruhr Basin and their interdependent controlling factors (by M.P. Süss), the stratigraphic importance of kaolin coal tonsteins (by K. Burger and coauthors), and the refinement and discussion of a numerical time scale for the central European Pennsylvanian (by M. Menning and coauthors).

More than half of the volume concerns the regional development of the German Pennsylvanian and focuses on the lithostratigraphy, biostratigraphy, stratigraphic correlations, and facies in both outcrop and subsurface. In many cases, lithostratigraphic formations have been newly defined or redefined, respectively.

Seven contributions concern the paralic realm of the Subvariscan zone. V. Wrede and M. Zeller deal with the region between the Rhine River in the east and the Dutch South Limburg Basin in the west. Of particular importance is a correlation of coal seams between the latter and the Ruhr area. The 5000–7000 m thick, intensively mined succession of the Ruhr Basin is reviewed by V. Wrede; K.-H. Ribbert contributed to that paper and suggests a new lithostratigraphic scheme for the less well known Namurian below the coal-bearing strata. Surface and subsurface stratigraphy of the Osnabrück district is reviewed by K. Köwing and R. Rabitz. In a longer, well illustrated contribution, G. Drozdzewski comments on the interplay of eustacy, subsidence, and sedimentary development, as well as basin evolution and paleogeographic relations of the Northwest German Subvariscan Basin. H.-J. Paech describes the Pennsylvanian of the Flechtingen Block west of Magdeburg. In two contributions, Hoth and coauthors present the Pennsylvanian known from deep wells in the subsurface of northeastern Germany. Except for the island of Rügen and adjacent Vorpommern, this is the first comprehensive review

of the region.

The late Pennsylvanian of the German intramontane basins is described in seven further contributions. A. Schäfer gives a detailed review of the stratigraphy of the Permo-Carboniferous Saar-Nahe Basin including discussions of chronostratigraphic attributions and the Stephanian–Rotliegend boundary. R. Maas and D. Vogellehner present the Pennsylvanian of the Black Forest, and D. Andreas and coauthors discuss the structurally complex region of the Thuringian Forest. In two contributions, Schneider and coauthors deal with the NE-striking, about 150-km long by 90-km wide Saale Senke of Saxony-Anhalt, and several smaller basins in Saxony, which are relicts of a greater drainage system. These papers are supplemented by two shorter contributions describing the Westphalian known from wells between Leipzig and Wittenberg (V. Steinbach and A. Kampe) and north of Görlitz (H. Brause), eastern Germany (Saxony, Saxony-Anhalt).

SCCS VOTING & CORRESPONDING MEMBERSHIP 2007

Please check your entry and report any changes to the Secretary

ALGERIA

Mrs Fatma Abdesselam-Rouighi
Centre de Recherche et Developpement
Ave du 1er Novembre
35000 Bounerdes
ALGERIA

A. Sebbar
Universite de Boumerdes
Faculte des Hydrocarbures et de la Chimie
Dept. Gisements Miniers et Petroliers.
Ave du l' Independance
35000 Boumerdes
ALGERIA
Fax: (213) 24 81 91 72
Email: sebbar_2001@yahoo.fr

ARGENTINA

Dr S. Archangelsky
URQUIZA 1132
Vicente Lopez
1638 Buenos Aires
Rep. ARGENTINA
Fax: 54-1-982-4494
Email: sarcang@overnet.com.ar

Dr Carlos Azcuy
Depto. de Ciencias Geológicas
Pabellón 2, Ciudad Universitaria
1428 Núñez, Buenos Aires
Rep. ARGENTINA
Fax: 54-1-638-1822
Email: azcuy@aspapa.org.ar

Dr Silvia Césari
Div. Paleobotanica
Museo de Cs. Naturales 'B.Rivadavia'
Av. A. Gallardo 470
1405 Buenos Aires
Rep. ARGENTINA

Dr N. Rubén Cuneo
Palaeontological Museum 'E. Feruglio'
Av. 9 de Julio 655
9100 Trelew, Chubut
Rep. ARGENTINA

Dr Carlos R. González
Dirección de Geología
Fundación Miguel Lillo
Miguel Lillo 251
4000 Tucumán
Rep. ARGENTINA
Fax: 081-330868
Email: fmlgeo@tuccbbs.com.ar

Mercedes di Pasquo
Facultad de Ciencias Exactas y Naturales.
Depto. Geologia. Ciudad Universitaria. Pabellon II. Nuñez.
Capital Federal. C.P. 1428.
Rep. ARGENTINA
Email: medipa@aspapa.org.ar
medipa@tango.gl.fcen.uba.ar

Dr Arturo C. Taboada
Instituto de Paleontologia
Fundación Miguel Lillo
Miguel Lillo 251
4000 S.M. deTucumán
Rep. ARGENTINA

Dr M.S. Japas
Depto. de Ciencias Geológicas
Pabellón 2, Ciudad Universitaria
1428 Núñez, Buenos Aires
Rep. ARGENTINA

Dr Nora Sabattini
Universidad Nacional de la Plata
Facultad de Ciencias Naturales Y Museo
Paseo del Bosque
1900, La Plata
Rep. ARGENTINA

AUSTRALIA

Dr J.C. Claoué-Long
Aust. Geol. Survey Organisation
P.O. Box 378
Canberra City, A.C.T. 2601
AUSTRALIA
Fax: 06-249-9983
Email: jclong@agso.gov.au

Dr B.A. Engel
10 Fay Avenue
New Lambton, NSW 2305
AUSTRALIA
Email: bengel@kooee.com.au

Dr P.J. Jones
Department of Geology
Australian National University
Canberra ACT 0200
AUSTRALIA
Fax: 61-2-62495544
Email: peter.jones@geology.anu.edu.au

Dr L. Masini
Department of Zoology
La Trobe University
Melbourne, VIC 3086
AUSTRALIA
Fax: 61-3-94791551
Email: lisa@zoo.latrobe.edu.au

Dr I. Metcalfe
Asia Centre
University of New England
Armidale, NSW 2351
AUSTRALIA
Fax: 02-67733596
Email: imetcal2@une.edu.au

Prof. G. Playford
Earth Sciences/
School of Physical Sciences
The University of Queensland
Brisbane,
AUSTRALIA 4072
Fax: 07-3365-1277
Email: geoff@earth.uq.edu.au

Prof. J. Roberts
School of Applied Geology
The University of
New South Wales
Sydney, NSW 2052
AUSTRALIA
Fax: 61-2-9385-5935
Email: J.Roberts@unsw.edu.au

Dr Guang R. Shi
School of Ecology and Environment
Deakin University
Melbourne Campus
221 Burwood Highway
Burwood, VIC 3125
AUSTRALIA
Email: grshi@deakin.edu.au

S. Stojanovic-Kuzenko
71 Barracks Road
Hope Valley
Adelaide, SA 5090
AUSTRALIA
Fax: 373-4098

Dr S. Turner
Queensland Museum
122 Gerler Road
Hendra, QLD 4011
AUSTRALIA
Fax: 61-7-3406-8355
Email: sue.turner@qm.qld.gov.au
s.turner@uq.edu.au

AUSTRIA

Dr F. Ebner
Institut für Geowissenschaften
Montanuniversität Leoben
A-8700 Leoben
AUSTRIA

Dr K. Krainer
Inst. für Geol. und Paläontologie
Universität Innsbruck
Innrain 52
A-6020 Innsbruck
AUSTRIA
Fax: 0043-512-507-5585
Email: Karl.Krainer@uibk.qc.at

Prof. Dr H.P. Schönlaub
Geol. Bundesanstalt Wien
Postfach 127
Rasumofskygasse 23
A-1031 Wien
AUSTRIA
Fax: +431-712-5674-56
Email: hpschoenlaub@cc.geolba.ac.at

BELGIUM

Dr F.-X. Devuyst
Unité de Géologie
Université Catholique de Louvain
3 place Louis Pasteur
1348, Louvain-la-Neuve
BELGIUM
Email: devuyst@hotmail.com

Dr Michiel Dusar
Geological Survey of Belgium
Jenner str. 13
B-1000 Brussels
BELGIUM
Email: michiel.dusar@naturalsciences.be

Dr E. Groessens
Service Géologique de Belgique
13, rue Jenner 1000
Bruxelles
BELGIUM
FAX: 02/6477359
Email:
eric.groessens@sciencesnaturelles.be

Dr Luc Hance
Unité de Géologie
Université Catholique de Louvain
3 place Louis Pasteur
1348, Louvain-la-Neuve
BELGIUM
FAX: 322-647-7359
Email: hance@geol.ucl.ac.be

Prof. Bernard L. Mamet
Laboratoire de Geologie
Universite de Bruxelles
50 avenue F.D. Roosevelt
Bruxelles B1050
BELGIUM

Prof. E. Poty
Service de Paléontologie animale
Universitè de Liège
Bât. B18, Sart Tilman
B-4000 Liège
BELGIUM
Fax: 32-43-665338

Hon. Prof. Maurice Streel
University of Liège
Paleontology,
Sart Tilman Bat. B18
B-4000 LIEGE 1
BELGIUM
Fax: 32-4-366 5338
Email: Maurice.Streel@ulg.ac.be

Dr Rudy Swennen
Fysico-chemische geologie
Katholieke Universiteit Leuven
Celestijnenlaan 200C
B-3001 Heverlee
BELGIUM

BRAZIL

Mr L.E. Anelli
Instituto de Geosciências
Universidade de São Paulo
CP 11348 CEP 05422-970
São Paulo
BRAZIL
Fax: 55-011-818-4129
Email: anelli@usp.br

Dr U.G. Cordani
Instituto de Geosciências
Universidade de São Paulo
CP 11348 CEP 05422-970
São Paulo
BRAZIL

Dr Jose Henrique G. Melo
Petrobras/Cenpes/PDEXP/BPA
1112 Cicade Universitaria
Quadra 7, Ilha do Fundao
21941-598 Rio de Janeiro
BRAZIL
Fax: 55-21-2590-1291
Email: jhmelo@petrobras.com.br

Dr A.C. Rocha-Campos
Instituto de Geosciências
Universidade de São Paulo
CP 11348 CEP 05422-970
São Paulo
BRAZIL
Fax: 11-818-4129
Email: acrcampo@usp.br

Dr Paulo Alves de Souza
Departamento de Paleontologia e Estratigrafia
Instituto de Geosciências
Universidade Federal do Rio Grande do Sul
Av. Bento Gonçalves, 9500
91.540-000 - Porto Alegre - RS
BRAZIL

Email: 1363669@vortex.ufrgs.br

BULGARIA

Dr Y.G. Tenchov
Geol.Inst. ul. Acad.
Bonchev bloc. 24
Sofia 1113
BULGARIA
Email: geoins@bgearn.acad.bg

CANADA

Dr Wayne Bamber
Geol.Surv.Canada, Calgary
3303-33rd St. N.W.
Calgary AB, T2L 2A7
CANADA
Fax: 403-292-6014
Email:bamber@gsc.nrcan.gc.ca

Dr B. Beauchamp
Geol.Surv.Canada, Calgary
3303-33rd St. N.W.
Calgary AB, T2L 2A7
CANADA

Dr A.R. Berger
Geological Survey of Canada
Room 177, 601 Booth Street
Ottawa ON, K1A 0E8
CANADA

Dr P.H. von Bitter
Royal Ontario Museum
100 Queen Park
Toronto ON, M5S 2C6
CANADA

Fannie Couzaris
Redpath Museum
McGill University
859 Sherbrooke West
Montreal, PQ, H3A 2K6
CANADA
Email:
fanniecouzaris@yahoo.ca

Dr W.R. Danner
University of British Columbia
Dept Earth & Ocean.Sciences
6339 Stores Rd.
Vancouver B.C., V6T 1Z4
CANADA

Dr Martin Gibling
Department of Geology
Dalhousie University
Halifax N.S., B3H 3J5
CANADA

Prof. Charles Henderson
Department of Geology
& Geophysics
The University of Calgary
2500 University Drive, N.W.
Calgary AB, T2N 1N4
CANADA
Fax: 1 403 284 0074
Email:
henderson@geo.ucalgary.ca

Dr W. Nassichuk
Geological Survey of Canada
3303-33rd St. N.W.
Calgary AB, T2L 2A7
CANADA

Dr M.J. Orchard
Geological Survey of Canada
101-605 Robson Street,
Vancouver, B.C., V6B 5J3
CANADA
Fax: 604-666-1124
Email:
morchard@gsc.nrcan.gc.ca

Dr Sylvie Pinard
2209 Vimy Way S.W.
Calgary, AB T2T 6H7
CANADA
Email: s.pinard@shaw.ca

Dr Catherine Reid
Dept. of Geological Sciences and Geo. Eng.
Miller Hall
Wueen's University
Kingston ON, K7L 3N6
CANADA
Email: reid@geol.queensu.ca

Dr B.C. Richards
Geological Survey of Canada
3303-33rd St. N.W.
Calgary AB, T2L 2A7
CANADA
Fax: 403-292-5377
Email: brichards@gsc.emr.ca

Dr Michael Rygel
Department of Earth Sciences
Dalhousie University
Halifax,
Nova Scotia B3H 4J1
CANADA
Fax: 902-494-6889
Email: mike rygel@hotmail.com

Dr J. Utting
Geol.Surv.Canada, Calgary
3303-33rd St. N.W.
Calgary AB, T2L 2A7
CANADA
Fax: 403-292-6014
Email: JUtting@NRCan.gc.ca

Dr Erwin L. Zodrow
Univ. College of Cape Breton
Dept Geology, Glace Bay H'way
Sydney N.S., B1P 6L2
CANADA
Fax: 902-562-0119
Email:
ezodrow@sparc.uccb.ns.ca

CZECH REPUBLIC

Dr Jirí Kalvoda
Dept. Geol. Paleont.
Masaryk University
Kotlárská 2
61137 Brno
CZECH REPUBLIC
Email:
dino@sci.muni.cz

Dr Jirí Král
Dept Genetics & Microbiology
Fac. Science, Charles University
Vinicná 5
128 44 Praha 2
CZECH REPUBLIC

RNDr Stanislav Oplustil
Charles University
Institute of Geology & Palaeontology
Albertov 6
CZ-128 43 Prague
CZECH REPUBLIC
Email:
oplustil@prfdec.natur.cuni.cz

Dr Jirí Pesek
Dept. Geol. Paleontol., Fac. Science
Charles University
128 43 Praha 2, Albertov 6
CZECH REPUBLIC
Fax: +02-296-084

RNDr Zbynek Simunek
Czech Geological Survey
Klárov 3/131
CZ-118 21 Prague
CZECH REPUBLIC

Email: simunek@cgu.cz

EGYPT

Dr Mahmoud M. Kholief
Egyptian Petroleum
Research Inst
Nasr City, 7th Region
Cairo
EGYPT
Fax: 202-284-9997

FRANCE

Dr J-F. Becq-Giraudon
1 rue de Villiers
79500 - Melle
FRANCE
Email:
jfbecqgiraudon@wanadoo.fr

Dr Alain Blieck
U.S.T.L.
Sciences de la terre
UPRESA 8014 et FR
1818 du C.N.R.S.
F-59655 Villeneuve d'Ascq
Cedex
FRANCE
Fax: 00 333 20 43 6900
Email:
Alain.Blieck@univ-lille1.fr

Dr O. Bruguier
ISTEEM,
Université de Montpellier II,
34 095 Montpellier, Cedex 5
FRANCE
Email:
Olivier.Bruguier@dstu.univ-montp2.fr

Henri Fontaine
8 Allee de la Chapelle
92140 Clamart
FRANCE
Fax: 33-1-40940892

Dr Alain Izart
Université de Nancy I
Département des Sciences de la Terre
BP 239, 54506 Vandoeuvre les Nancy
FRANCE
Fax: (33) 83 91 25 89
Email:
Alain.Izart@g2r.u-nancy.fr

Dr J.P. Laveine
Lab.Paléobot.,UFR Sci.de la Terre
Univ. des Sci. et Techn. de Lille
F-59655 Villeneuve d'Ascq Cedex
FRANCE
Fax: 33-2043-6900
Email:
Jean-Pierre.Laveine@univ-lille1.fr

Dr Marie Legrand-Blain
Institut de Géodynamique
Université de Bordeaux 3
1 Allee F. Daguin
33607 Pessac
FRANCE
Fax: 56-848-073

Home: "Tauzia"
33170 Gradignan
FRANCE
Fax: (0)5-56-89-33-24
Email: egrandblain@wanadoo.fr

Dr D. Mercier
Ecole des Mines de Paris
35, Rue Saint-Honoré
F-77305 Fontainebleau
FRANCE

Dr G.S. Odin
Lab.Géochron.et Sédim.Océanique
Univ. P.&M.Curie, 4 Place Jussieu case 119
F-75252 Paris Cédex 05
FRANCE
Fax: 33-1-4427-4965
Email: gilodin@ccr.jussieu.fr

Dr M.F. Perret
Université Paul-Sabatier
Lab.Géol.Structurale
38 rue des 36 Ponts
F-31400 Toulouse
FRANCE
Fax: 61-55-82-50
Email: perret@cict.fr

Carine Randon
Lab. de Paléontolgie et Paléogéographie du Paléozoique
Univ. des Sci. et Techn. de Lille
UFR Sciences de la Terre
F-59655 Villeneuve d'Ascq cedex
FRANCE
Email:
carine.randon@ed.univ-lille1.fr

Dr D. Vachard
Univ.des Sciences et Techniques
Science de la Terre
F-59655 Villeneuve d'Ascq Cédex
FRANCE
Fax: 00-33-20-43-69-00
Email:
Daniel.Vachard@univ-lille1.fr

GERMANY

Dr H.W.J. van Amerom
Geol.Landesamt Nordrh.-Westfalen
De Greiff Str.195
D-47803 Krefeld
GERMANY
Fax: 2151-897-505

Prof. Dr Michael R. W. Amler
Institut für Geologie und Palaeontologie
der Philipps-Universitaet Marburg
Hans-Meerwein-Strasse
D-35032 Marburg
GERMANY
Fax: +49 (0)6421 282-8919
Email:
amler@mailer.uni-marburg.de

Prof. Dr. R. Thomas Becker
Westfälische Wilhelms-Universität
Geologisch-Paläontologisches Institut u. Museum
Corrensstrasse 24
D-48149 Münster
GERMANY
Email: rbecker@uni-muenster.de

Dr Z. Belka
Inst.und Mus.für Geol.und Paläont.
Universität Tübingen
Sigwartstr. 10
D-72076 Tübingen
GERMANY
Email:
belka@ub.uni-tuebingen.de

Prof. Dr Carsten Brauckmann
Technische Universität Clausthal
Institut für Geologie und Paläontologie
Leibnizstrasse 10
D-38678 Clausthal-Zellerfeld
GERMANY
Fax: 05323-722903
Email:
Carsten.Brauckmann@tu-clausthal.de

Dr Peter Bruckschen
Ruhr-Universität Bochum
Geologisches Institut
Universitätsstr. 150
D-44801 Bochum
GERMANY

Dr Günter Drozdzewski
Geologisches Landesamt Nordrhein-Westfalen
De-Greiff-Str. 195
D-47803 Krefeld
GERMANY
Fax ++49-2151-89 75 05
Email: drozdzewski@gla.nrw.de

Dr Holger Forke
Institut für Paläontologie
Loewenichstr. 28
D-91054 Erlangen
GERMANY
Email:
forke@pal.pal.uni-erlangen.de

Christoph Hartkopf-Fröder
Geologischer Dienst NRW
De-Greiff-Str. 195
D-47803 Krefeld
GERMANY
Fax: +49(0)-2151-897505
Email:
hartkopf-froeder@gd.nrw.de

Prof. Dr Hans-Georg Herbig
Universität zu Köln,
Geologisches Institut
Zülpicher Str. 49a
D-50674 Köln
GERMANY
Fax: +49-221-470-5080
Email:
herbig.paleont@uni-koeln.de

Dr Peer Hoth
Bundesanstalt für Geowissenschaften und Rohstoffe
AS Berlin
Wilhelmstr. 25-30
D-13539 Berlin
GERMANY
Fax ++49-30-36 99 31 00
Email: peer.hoth@bgr.de

Prof. Dr Hans Kerp
Westfälische Wilhelms-Universität
Abt.Paläobot.am Geol-Pal.Inst. u Mus.
Hindenburgplatz 57-59
D-48143 Münster
GERMANY
Fax: 49-251-834-831
Email: Kerp@uni-muenster.de

Dr Dieter Korn
Naturhistorisches Forschungsinstitut
Museum für Naturkunde
Humboldt-Universität zu Berlin
Institut für Paläontolgie
Invalidenstrasse 43
D-10115 Berlin
GERMANY
Fax ++49-(0) 30 2093 8568
Email:
dieter.korn@museum.hu-berlin.de

Prof. Dr J. Kullmann
Inst.und Mus.für Geol.und Paläont.
Universität Tübingen
Sigwartstr. 10
D-72076 Tübingen
GERMANY
Fax: +49-7473-26768
Email:
Juergen.Kullman@uni-tuebingen.de

Dr Manfred Menning
GeoForschungs Zentrum Potsdam
Telegrafenberg, Haus C128
D-14473 Potsdam
GERMANY
Fax: +49-331-288-1302
Email: menne@gfz-potsdam.de

Dr Klaus-Jürgen Müller
Institut für Paläontologie
Nussallee 8,
D-53115 Bonn
GERMANY

Dr E. Paproth
Schwanenburgstr. 14
D-47804 Krefeld
GERMANY
Fax: +49-2151-710774

Dr Elias Samankassou
Institute of Paleontology
University of Erlangen-Nuernberg
Loewenichstrasse 28
D-91054 Erlangen
GERMANY
Fax: +49-9131-85 22690
Email:
samelias@pal.uni-erlangen.de

Prof. Dr. Jörg Schneider
TU Bergakademie Freiberg
Institut für Geologie
Bernhard-von-Cotta-Str. 2
D-09596 Freiberg
GERMANY
Fax ++49-3731-39 35 99
Email:
schneidj@geo.tu-freiberg.de

Dr D. Stoppel
Bundesanst.für Geowissen. u. Rohstoffe
Postfach 51 0153
D-30631 Hannover
GERMANY
Fax: 511-643-2304

Dr E. Thomas
Rhsbergstr. 22
D-58456 Witten-Herbede
GERMANY

Dr Dieter Weyer
Löwestr. 15
D-10249 Berlin
GERMANY
Email:
dieter.weyer@t-online.de

Dr Volker Wrede
Geologisches Landesamt Nordrhein-Westfalen
de-Greiff-Str. 195
D-47803 Krefeld
GERMANY
Fax ++49-2151-89 75 42
Email:
volker.wrede@gd.nrw.de

HUNGARY

Dr Sc. Heinz Kozur
Rézsü u. 83
H-1029 Budapest
HUNGARY
Fax: +36-1-204-4167
Email: h12547koz@ella.hu

IRELAND

Dr Geoff Clayton
Department of Geology
Trinity College
Dublin 2
IRELAND
Fax: 3531-6711199
Email: gclayton@tcd.ie

Dr Ken Higgins
Department of Geology
University College
Cork
IRELAND

Dr G.D. Sevastopulo
Department of Geology
Trinity College
Dublin 2
IRELAND
Email: gsvstpul@tcd.ie

ISRAEL

Dr Olga Orlov-Labkovsky
Department of Zoology
Tel-Aviv University
Tel-Aviv 69978
ISRAEL
Email: olgaorl@post.tau.ac.il

ITALY

Prof. Mario Pasini
Universitarà delle Studi di Siena
Dipartimento di Sienza della terra
I-53100 Siena
ITALY

JAPAN

Dr Shuko Adachi
Earth Evolution Sciences
Graduate School of Life and Environmental Sciences
Univ. Tsukuba
Tsukuba
Ibaraki, 305-8572
JAPAN

Dr Masayuki Ehiro
Tohoku Univ. Museum
Aoba, Aramaki
Aoba-ku
Sendai, 980-8578
JAPAN
Fax: +81-22-795-7759
Email:
ehiro@mail.tains.tohoku.ac.jp

Dr Yoichi Ezaki
Dept. Geosciences
Fac. Science
Osaka City Univ.
Sumiyoshi-ku
Osaka, 558-8585
JAPAN

Dr Masayuki Fujikawa
Akiyoshi-dai Muse.
Natural History
Mine-gun
Yamaguchi, 754-0511
JAPAN
Fax: +81-837-62-0324
Email: mafujikw@ymg.urban.ne.jp

Mr Takehiko Haikawa
Akiyoshi-dai Sci. Muse.
Nat. Hist.
Shuhou-chou, Mine-gun
Yamaguchi, 754-0511
JAPAN

Mr Masahiro Ichida
Kyoto Univ. Museum
Kyoto Univ.
Yoshida Honmachi, Sakyo-ku
Kyoto, 606-8501
JAPAN

Dr Hisaharu Igo
Dept. Earth Scienes
Tokyo Gakugei Univ.
Koganei
Tokyo, 184-8501
JAPAN

Dr Hisayoshi Igo
Sakae-chou 1-31-7
Tachikawa
Tokyo, 190-0003
JAPAN
Email: igohisa@mac.com
igohisay@beige.plala.or.jp

Mr Atsushi Kaneko
Fukae-honchou 1-15-7
Higashi-nada-ku
Kobe, 658-0021
JAPAN

Dr Makoto Kato
Hokkaido Univ. Museum
Kita 10-jou, Nisi 8-choume
Kita-ku
Sapporo, 060-0810
JAPAN
Fax: +81-11-706-2724

Dr Toshio Kawamura
Dept. Earth Sci., Fac. Education
Miyagi Univ. Education
Aoba-ku
Sendai, 980-0845
JAPAN
Email:
t-kawa@staff.miyakyo-u.ac.jp

Dr Toshio Koike
Tokiwadai 36-6-606
Hodogaya-ku
Yokohama, 240-0067
JAPAN
Email: koikebaltan@yahoo.co.jp

Dr Koichi Nagai
Dept. Physics & Earth Sciences
Fac. Sciences
Univ. the Ryukyus
Nishihara
Okinawa, 903-0213
JAPAN
Email: k-nagai@sci.u-ryukyu.ac.jp

Dr Tsutomu Nakazawa
Geological Survey of Japan
AIST
Tsukuba, 305-8567
JAPAN
Fax: +81-29-861-3591
Email: t-nakazawa@aist.go.jp

Dr Masamichi Ota
c/o Kitakyushu Museum
Natural History & Human History
Higashida 2-4-1
Yahatahigashi-ku
Kitakyushu, 805-0071
JAPAN
Fax: +81-93-661-7503

Dr Yasuhiro Ota
Kitakyushu Museum
Natural History & Human History
Higashida 2-4-1
Yahatahigashi-ku
Kitakyushu, 805-0071
JAPAN
Fax: +81-93-661-7503

Dr Hiroyoshi Sano
Dept. Earth & Planetary Sci.
Faculty of Sciences
Kyushu Univ.
Fukuoka, 812-8581
JAPAN
Fax: +81-92-642-2686
Email: sano@geo.kyushu-u.ac.jp

Dr Tetsuo Sugiyama
Dept. Earth System Sci.
Fac. Science
Fukuoka Univ.
Jonan-ku
Fukuoka, 814-0180
JAPAN
Fax: +81-92-865-6030
Email: sugiyama@fukuoka-u.ac.jp

Dr Jun-ichi Tazawa
Dept. Geology
Fac. Science
Niigata Univ.
Niigata, 950-2181
JAPAN
Fax: +81-25-262-6194
Email:
tazawa@geo.sc.niigata-u.ac.jp

Dr Katsumi Ueno
Dept. Earth System Sci.
Fac. Science
Fukuoka Univ.
Johnan-ku
Fukuoka, 814-0180
JAPAN
Email: katsumi@fukuoka-u.ac.jp

KAZAKHSTAN

Dr V. Koshkin
KazIMS
ul. K. Marx, 105
480100 Almaty
REP. KAZAKHSTAN

Dr Alexei Pronin
3, Dossorskaya Str.
Atyrau, 465002
REP. KAZAKHSTAN

Dr M.I. Radchenko
ul. Shagabutdinova 80 kv. 39
480059 Alma-Ata
REP. KAZAKHSTAN

KYRGYZSTAN

Dr Alexandra V. Djenchuraeva
Agency on Geology and Mineral Resources of Kyrgyz Republic
prospekt Ekindik 2
720300 Bishkek
KYRGYZSTAN
Email: mail@geoagency.bishkek.gov.kg

Alexandr V. Neyevin
Agency on Geology and Mineral Resources of Kyrgyz Republic
prospekt Ekindik 2
720300 Bishkek
KYRGYZSTAN
Email: mail@geoagency.bishkek.gov.kg

Timur Yu. Vorobyov
Agency on Geology and Mineral Resources of Kyrgyz Republic
prospekt Ekindik 2
720300 Bishkek
KYRGYZSTAN
Email: mail@geoagency.bishkek.gov.kg

Olga Getman
Agency on Geology and Mineral Resources of Kyrgyz Republic
prospekt Ekindik 2
720300 Bishkek
KYRGYZSTAN
Email: mail@geoagency.bishkek.gov.kg

MALAYSIA

Ibrahim bin Amnan
Technical Services Division
Minerals and Geoscience Department Malaysia
Jalan Sultan Azlan Shah
31400 Ipoh
Perak,
MALAYSIA
Email: ibrahim@jmg.gov.my

NEW ZEALAND

Dr J.B. Waterhouse
25 Avon St.
Oamaru
NEW ZEALAND

PEOPLES REP. CHINA

Prof. Hou Hongfei
Episodes
P.O. Box 823
26 Baiwanzhuang Road
Beijing 100037
PEOPLES REPUBLIC OF CHINA

Dr Gao Lianda
Inst. Geol., Chinese Acad.Geol. Sciences
Baiwanzhuang Road
Beijing
PEOPLES REPUBLIC OF CHINA

Dr Guo Hongjun
Changchun College of Geology
6 Ximinzhu Street
Changchun, Jilin
PEOPLES REPUBLIC OF CHINA

Dr Jin Xiao-chi
Institute of Geology
Chinese Academy of Geological Sciences
26 Baiwanzhuang Road
Beijing 100037
PEOPLES REPUBLIC OF CHINA
Email: jinxchi@cags.net.cn

Dr Li Xingxue
Nanjing Inst. Geol. Paleont.
Academia Sinica, Chi-Ming-Ssu
Nanjing 210008
PEOPLES REPUBLIC OF CHINA
Fax: 86-25-3357026
Email: lixx@njnet.ihep.ac.cn

Dr Ouyang Shu
Nanjing Inst. of Geol. & Palaeont.
Academia Sinica, Chi-Ming-Ssu
Nanjing 210008
PEOPLES REPUBLIC OF CHINA
Fax: 86-25-335-7026
Email: lixx@njnet.nj.ac.cn

Dr Yang Shipu
China University of Geosciences
Chengfu Lu
Beijing 100083
PEOPLES REPUBLIC OF CHINA

Prof. Wang Xiang-dong
Nanjing Institute of Geology and Palaeontology
Chinese Academy of Sciences
39 East Beijing Road
Nanjing 210008
PEOPLES REPUBLIC OF CHINA
Email: xdwang@nigpas.ac.cn

Prof. Wang Zhi-hao
Nanjing Institute of Geology and Palaeontology
Academia Sinica
Nanjing 210008
PEOPLES REPUBLIC OF CHINA

Email: fmxu@nigpas.ac.cn

POLAND

Prof. Jerzy Fedorowski
Institute of Geology
Adam Mickiewicz University
Maków Polnych 16
PL-61601 Poznan
POLAND
Fax: 48-61-536-536
Email: jerzy@vm.amu.edu.pl

Dr Tadeusz Peryt
Dept of Chemical Resources
Panstwowy Instytut Geologiczny
Rakowiecka 4
PL-00975 Warszawa
POLAND

Dr S. Skompski
Institute of Geology, Warsaw Univ.
Al Zwirki i Wigury 93
PL-02089 Warszawa
POLAND
Fax: 0-048-22-220-248
Email: skompski@sungeo.biogeo.uw.edu.pl

Dr Elzbieta Turnau
Institute of Geological Sciences PAS
Senacka 1
PL-31002 Krakow
POLAND
Email: ndturnau@cyf-kr.edu.pl

PORTUGAL

Prof. M.J.Lemos de Sousa
Dept. de Geologia, Fac.Ciências
Universidade do Porto
Praça de Gomes Teixeira
4099-002 Porto
PORTUGAL
Fax: (+ 351) 22 3325937
Email: mlsousa@fc.up.pt

Prof. J.T. Oliveira
Instituto Geológico e Mineiro
Estrada da Portela, Bairro Zambujal
Apartado 7586
2720 Alfragide
PORTUGAL

RUSSIA

Dr Alexander S. Alekseev
Dept of Palaeont., Geol. Faculty
Moscow State University
119991 Moscow GSP-1
RUSSIA
Fax: 70953391266
Email: aaleks@geol.msu.ru

Dr I.S. Barskov
Dept. of Paleontology, Geology Faculty
Moscow State University
119991 Moscow GSP-1
RUSSIA
Fax: 7095-9392190

Dr I.V. Budnikov
Siberian Inst. Geol., Geophys.& Min. Res.
Siberian Geological Survey
Krasny prospekt 67
630104 Novosibirsk
RUSSIA
Fax: 383-2-20-35-17, 22-57-40

Dr T.V. Byvsheva
ul. Bolshaia Academycheskaja
77 kor.1 kv. 154
125183 Moscow
RUSSIA

Dr Boris Chuvashov
Inst. Geology/Geochemistry
Russian Academy of Sciences
Pochtoryi per. 7
620151 Ekaterinburg
RUSSIA
Email: chuvasov@igg.uran.ru

Dr Marina V. Durante
Geological Institute
Russian Academy of Sciences
Pyzhevsky per. 7
109017 Moscow
RUSSIA
Fax: +7-95-231-0443
Email: durante@ginran.msk.su

Dr A.V. Durkina
Timan-Pechora Research Center
ul. Pushkina 2
169400 Ukhta
Komi Republic
RUSSIA
Fax: 6-13-04

Dr V.G. Ganelin
Geological Institute
Russian Academy of Sciences
Pyzhevsky per. 7
109017 Moscow
RUSSIA

Dr Nilyufer B. Gibshman
Moscow Oil and Gas Academy
Leninsky Prospect 65
117917 Moscow GSP-1
RUSSIA
Email:
nilyufer@mtu-net.ru

Dr N. Goreva
Geological Institute
Russian Academy of Sciences
Pyzhevsky per. 7
109017 Moscow
RUSSIA
Fax: +7-095-231-04-43
Email:
goreva@ginras.ru

Dr Igor A. Ignatiev
Geological Institute
Russian Academy of Sciences
7 Pyzhevsky per.
119017 Moscow
RUSSIA

Dr T.N. Isakova
Geological Institute
Russian Academy of Sciences
Pyzhevsky per. 7
109017 Moscow
RUSSIA
Fax: +7-095-231-04-43
Email:
isakova@ginras.ru

Dr R.M. Ivanova
Instit. of Geology & Geochemistry
Uralian Branch, Russian Academy of Sciences
Pochtovyi per. 7
620151 Ekaterinburg
RUSSIA
Email: root@igg.e-burg.su

Dr Pavel B. Kabanov
Paleontological Institute
Russian Academy of Sciences
Profsoyuznaya 123
117868 Moscow GSP
RUSSIA
Email: kabanov@paleo.ru

Dr Alexander G. Klets
Institute of Geology and Mineralogy of RAS
Koptyug 3
630090 Novosibirsk
RUSSIA
Email: KletzAG@uiggm.nsc.ru

Dr L.I. Kononova
Dept. of Paleontology,
Geology Faculty
Moscow State University
119991 Moscow GSP-1
RUSSIA

Dr M.V. Konovalova
Timan-Pechora Research Center
ul. Pushkina 2
169400 Ukhta
Komi Republic
RUSSIA
Fax: 6-13-04

Dr Olga L. Kossovaya
V.S.E.G.E.I.
Sredni pr. 74
199106 St Petersburg
RUSSIA
Email: koss@mail.wplus.net

Dr Elena I. Kulagina
Inst. Geology
Uralian Res. Center
Russian Academy of Sciences
Ufa RUSSIA
Email: kulagina@anrb.ru

Dr S.S. Lazarev
Paleontological Institute
Russian Academy of Sciences
Profsoyuznaya 123
117868 Moscow GSP
RUSSIA

Dr M.M. Marfenkova
ul. Bolshaya Akademicheskaya 77
Korpus 1, Kr. 338
125183 Moscow
RUSSIA

Dr Yulia V. Mosseichik
Geological Institute
Russian Academy of Sciences
7 Pyzhevsky per.
119017 Moscow
RUSSIA
Email: mosseichik@ginras.ru

Dr E. V. Movshovich
P.O. Box 1204
344091 Rostov-na-Donu-91
RUSSIA

Dr Svetlana Nikolaeva
Paleontological Institute
Russian Academy of Sciences
Profsoyuznaya 123
117868 Moscow GSP
RUSSIA
Email: 44svnikol@mtu-net.ru

Dr Olga A. Orlova
Department of Paleontology
Geology Faculty
Moscow State University
119991 Moscow GSP-1
RUSSIA
Email: oorlova@geol.msu.ru

Mrs M.V. Oshurkova
V.S.E.G.E.I.
Sredni pr. 74
199106 St Petersburg
RUSSIA

Dr Vladimir N. Pazukhin
Inst. Geology
Uralian Res. Center
Russian Academy of Sciences
Ufa
RUSSIA

Dr L.N. Peterson
Krasnoyarskgeolsyomka
ul. Beresina, 3
660020 Krasnoyarsk
RUSSIA

Dr A.V. Popov
Leningrad University
16 Linia, 29
199178 St Petersburg
RUSSIA

Dr B.V. Poyarkov
Moskovsky prospekt 163 kv. 639
150057 Yaroslavl
RUSSIA

Dr S.T. Remizova
Inst.Geol., Komi Scientific Centre
ul. Pervomajskayja 54
167000 Syktyvkar
Komi Republic
RUSSIA
Fax: 821-2-42-53-46
Email: kirul@rol.ru

Dr Yuriy V. Savitsky
St Petersburg State University
Geological Faculty
16 Linia, 29
199178 St Petersburg
RUSSIA

Dr R.A. Schekoldin
Dept of Historical Geology
Mining Institute, 21st line V.O. 2
199106 St Petersburg
RUSSIA
Fax: 812-213-26-13
Email: benin@sovam.com

Dr O.A. Shcherbakov
Polytechnical Institute
Komsomolskiy Avenue 29a
614600 Perm
RUSSIA
Email:
geology@pstu.ac.ru

Dr M.V. Shcherbakova
Polytechnical Institute
Komsomolskiy Avenue 29a
614600 Perm
RUSSIA

Dr V. Tchizhova
V.N.I.I.neft
I Dmitrovsky proezd 10
125422 Moscow
RUSSIA

Dr Alexander P. Vilesov
Geological Faculty
Perm State University
u1. Bukireva 15
614600 Perm
RUSSIA
Email: geology@pstu.ac.ru

SLOVENIA

Dr Matevz Novak
Geological Survey of Slovenia
Dimiceva 14
SI - 1000 Ljubljana
SLOVENIA
Fax: 386-01-2809753
Email:
matevz.novak@geo-zs.si

Dr A. Ramovs
Katedra za geologijo in paleontologijo
Askerceva 2
SLO-1000 Ljubljana
SLOVENIA
Fax: 386-61-1259-337

SOUTH AFRICA

Dr Colin MacRae
Palaeont.Sect.,Geological Survey
Private Mail Bag X112
Pretoria 0001
SOUTH AFRICA

Mr Barry Millsteed
Palaeont.Sect.,Geological Survey
Private Mail Bag X112
Pretoria 0001
SOUTH AFRICA
Fax: 012-841-1278
Email:
bmillstd@geoscience.org.za

Dr J.N. Theron
Geological Survey
P.O. Box 572
Bellville 7535
SOUTH AFRICA

SPAIN

Dr A. García-Loygorri
Cátedra de Geología
Escuela Sup. Ing. Minas
Ríos Rosas 21
28003 Madrid
SPAIN

L.F. Granados
Avda Juan Andrés 10bis
28035 Madrid
SPAIN

Dr M.L. Martinez Chacón
Depto de Geología
Universidad de Oviedo
Arias de Velasco s/n
33005 Oviedo
SPAIN
Fax: 34-98-510-3103
Email:
mmchacon@asturias.geol.uniovi.es

Dr Sergio Rodríguez
Depto de Paleontología
Facultad de Ciencias Geológicas
Ciudad Universitaria
28040 Madrid
SPAIN
Fax: 1-394-4854
Email:
sergrodr@eumax.sim.ucm.es

Dr L.C. Sánchez de Posada
Depto de GeologRa
Universidad de Oviedo
Arias de Velasco s/n
33005 Oviedo
SPAIN
Fax: 34-98-510-3103
Email:
lposada@asturias.geol.uniovi.es

Dr Elisa Villa
Depto de Geología
Universidad de Oviedo
Arias de Velasco s/n
33005 Oviedo
SPAIN
Fax: 34-98-510-3103
Email: evilla@geol.uniovi.es

Dr R.H. Wagner
Centro Paleobotánico
Jardín Botánico de Córdoba
Avenida de Linneo s/n
14004 Córdoba
SPAIN
Fax: 34-57-295-333
Email:
cr1wagro@uco.es

TARTARSTAN

Dr V.S. Gubareva
ul. Kosmonavtov 7 kv. 7
420061 Kazan
TARTARSTAN

THE NETHERLANDS

Dr O.A. Abbink
Department of Geo-Environment
Section Paleo-Environmental Research
NITG TNO: National Geological Survey
P.O. Box 80015
3508 TA Utrecht
THE NETHERLANDS

Bibliotheek Palaeobotanie
Lab. Palaeobotany and Palynology
Budapestlaan 4
3584 CD Utrecht
THE NETHERLANDS
Fax: 31-30-253-5096
Email: Z.Smeenk@bio.uu.nl

Dr A.C. van Ginkel
Nationaal Natuurhistorisch Museum
Postbus 9517
NL-2300 RA Leiden
THE NETHERLANDS

Dr W. Khrschner
Lab. Palaeobotany & Palynology
Budapestlaan 4
NL-3584 CD Utrecht
THE NETHERLANDS

Subcommissie Stratig. Nederland
Nationaal Natuurhistorisch Museum
Postbus 9517
NL-2300 RA Leiden
THE NETHERLANDS

Dr C.F. Winkler Prins
Nationaal Natuurhistorisch Museum
Postbus 9517
NL-2300 RA Leiden
THE NETHERLANDS
Fax: 31-71-5687666
Email: winkler@naturalis.nnm.nl

TURKEY

Prof. Dr Demir Altiner
Department of Geological Engineering
Middle East Technical University
06531 Ankara
TURKEY
Fax: +90-312-2101263
Email: altiner@tubitak.gov.tr
demir@metu.edu.tr

Dr Cengiz Okuyucu
MTA Genel Mudurlugu
Jeoloji Etutleri Dairesi
06520 Balgat-Ankara
TURKEY
Email: okuyucu@mta.gov.tr

UNITED KINGDOM

Acquisitions
Department of Library Service
The Natural History Museum
Cromwell Road
London SW7 5BD
UNITED KINGDOM

Dr R.L. Austin
21 Bellevue Road
West Cross, Swansea
South Wales SA3 5QB
UNITED KINGDOM

Dr C.J. Cleal
Department of Botany
National Museum & Gallery of Wales
Cathays Park
Cardiff CF1 3NP
UNITED KINGDOM
Fax: 01222-239-829
Email:
100015.567@compuserve.com

Dr R.M.C. Eagar
23 High Bond End
Knaresborough
North Yorks HG5 9BT
UNITED KINGDOM
Fax: 01423-865-892
Email:
100305.1736@compuserve.com

Dr Mark Hounslow
Centre for Environmental Magnetism and Palaeomagnetism,
Lancaster Environment Centre,
Geography Department,
Lancaster University,
Bailrigg, Lancaster, LA1 4YW
UNITED KINGDOM
Fax: 44 (0) 1524 847099
Email: m.hounslow@lancaster.ac.uk

Dr G.A.L. Johnson
Department of Geology
University of Durham
Durham DH1 3LE
UNITED KINGDOM

Dr Duncan McLean
Palynology Research Facility
University of Sheffield
Dainton Building
Brook Hill
Sheffield S3 7HF
UNITED KINGDOM
Email: d.mclean@sheffield.ac.uk

Mr M. Mitchell
11 Ryder Gardens
Leeds, W. Yorks. LS8 1JS
UNITED KINGDOM

Dr B. Owens
Langdale
14th Park Avenue,
Plumtree Park
Nottingham NG12 5LU
UNITED KINGDOM

Dr N.J. Riley
British Geological Survey
Keyworth
Nottingham NG12 5GG
UNITED KINGDOM
Fax: 44-115-9363200
Email: n.riley@bgs.ac.uk

Dr A.R.E. Strank
British Petroleum Res.Centre
Chertsey Rd, Sunbury-on-Thames
Middlesex TW16 7LN
UNITED KINGDOM

Dr N. Turner
British Geological Survey
Keyworth
Nottingham NG12 5GG
UNITED KINGDOM

Dr W.J. Varker
Department of Earth Sciences
The University of Leeds
Leeds LS2 9JT
UNITED KINGDOM

Dr Colin N. Waters
British Geological Survey
Keyworth
Nottingham NG12 5GG
UNITED KINGDOM

Prof. V.P. Wright
Department of Earth Sciences
University of Cardiff
Cardiff CF1 3YE
UNITED KINGDOM
Fax: 01222 874326
Email: wrightvp@cardiff.ac.uk

U.S.A.

Dr Thomas Algeo
Department of Geology
University of Cincinnati
Cincinnati, OH 45221-0013
U.S.A.
Email: Thomas.Algeo@uc.edu

Dr James E. Barrick
Department of Geosciences
Texas Tech University
Lubbock, TX 79409-1053
U.S.A.
Email: ghjeb@pop.ttu.edu

Dr Jack D Beuthin
Department of Geology
Univ. of Pittsburgh-Johnstown
Johnstown, PA 15904
U.S.A.
Email: beuthin@pitt.edu

Mitch Blake
West Virginia Geological Survey
1 Mont Chateau Road
Morgantown, WV 26508-8079
U.S.A.
Email: blake@geosrv.wvnet.edu

Dr Darwin R. Boardman
School of Geology
Oklahoma State University
105 Noble Research Ctr.
Stillwater, OK 74078
U.S.A
Email: darwin.boardman@okstate.edu

Dr Paul Brenckle
1 Whistler Point Road,
Westport, MA 02790
U.S.A.
Email:
saltwaterfarm1@cs.com

Dr D.K. Brezinski
Maryland Geological Survey
2300 St Paul Street
Baltimore, MD 21218
U.S.A.

Dr Lewis M. Brown
Department of Geology
Lake Superior State University
Sault Sainte Marie,
MI 49783-1699
U.S.A.
Email:
lbrown@lakers.lssu.edu

Dr D.R. Chesnut
Kentucky Geological Survey
228 Min.Res.Bldg,
University of Kentucky
Lexington, KY 40506-0107
U.S.A.
Email: chesnut@ukcc.uky.edu

Dr William C. Darrah
2235 Baltimore Pike
Gettysburg, PA 17325
U.S.A.

Dr Vladimir I. Davydov
Dept. Geosciences
Boise State University
1910 University Drive
Boise, ID 83725
U.S.A.
Email:
vdavydov@boisestate.edu

Dr Lewis S. Dean
Library
Geological Survey of Alabama
P.O. Box 869999
420 Hackberry Lane
Tuscaloosa, AL 35486
U.S.A.
Email: library@gsa.state.al.us

Dr J.T. Dutro Jr
5173 Fulton St. NW
Washington, DC 20016
U.S.A.
Email: dutro.tom@simnh.si.edu

Dr Cortland Eble
Kentucky Geological Survey
228 Min.Res.Bldg, Univ. Kentucky
Lexington, KY 40506-0107
U.S.A.

Dr F.R. Ettensohn
Dept. of Geological Sciences
University of Kentucky
101 Slone Building
Lexington, KY 40506-0053
U.S.A.
Email: fettens@uky.edu

Dr Robert Gastaldo
Dept. of Geology
Colby College
Waterville, ME 04901
U.S.A.

Geology Library
The University of Iowa
136 Trowbridge Hall
Iowa City, IA 53342-1379
U.S.A.

William H. Gillespie
U.S. Geological Survey
916 Churchill Circle
Charleston, WV 25314-1747
U.S.A.

Dr Brian F. Glenister
Department of Geoscience
121 Trowbridge Hall
University of Iowa
Iowa City, IA 52242-1379
U.S.A.
Email: brian.glenister@uiowa.edu

Dr Ethan Grossman
Dept. of Geology & Geophysics
Texas A&M University
College Station, TX 77843-3115
U.S.A.
Email: e-grossman@tamu.edu

Dr John Groves
Dept. of Earth Sciences
University of Northern Iowa
Cedar Falls, IA 50614
U.S.A.
Email: John.Groves@uni.edu

Dr Philip H. Heckel
Department of Geoscience
University of Iowa
Iowa City, IA 52242
U.S.A.
Email: philip-heckel@uiowa.edu

Dr Peter Holterhoff
ExxonMobil Upstream
Research Company
ST-4102
P.O. Box 2189
Houston, TX 77252-2189
U.S.A.
Email:
peter.holterhoff@exxonmobil.com

Dr John Isbell
Department of Geosciences
Univ. of Wisconsin-Milwaukee
P.O. Box 413
Milwaukee, WI 53201
U.S.A.
Email: jisbell@csd.uwm.edu

Dr Thomas W. Kammer
Dept. Geology and Geography
West Virginia University
P.O. Box 6300
Morgantown, WV 26506-6300
U.S.A.
Email: tkammer@wvu.edu

Claren M Kidd
100 E Boyd R220
University of Oklahoma
Norman, OK 73019-0628
U.S.A.
Email: ckidd@uoknor.edu

Dr Norman R. King
Dept. of Geosciences
University of Southern Indiana
Evansville, IN 47712
U.S.A.
Email: nking@usi.edu

Albert Kollar
Carnegie Museum of Natural History
Invertebrate Paleontology
4400 Forbes Ave
Pittsburgh, PA 15213
U.S.A.
Email:
KollarA@CarnegieMuseums.Org

Ms Andrea Krumhardt
Dept of Geology & Geophysics
University of Alaska
P.O. Box 755780
Fairbanks, AK 99775
U.S.A.
Email: fnapk@aurura.alaska.edu

Dr Lance Lambert
Earth and Environmental Sciences, Univ. of Texas at San Antonio,
San Antonio,TX 78249
U.S.A.
Email: CW12@swt.edu

Dr H. Richard Lane
National Science Foundation
4201 Wilson Blvd., Room 785
Arlington, VA 22230
U.S.A.
Email: hlane@nsf.gov

Dr Ralph L. Langenheim
Dept Geol.,Univ. of Illinois
254 N.B.H.,1301 W. Green St.
Urbana, IL 61801
U.S.A.

Dr R.L. Leary
Illinois State Museum
Research & Collections Center
1011 East Ash Street
Springfield, IL 62703
U.S.A.
Email: Leary@museum.state.il.us

Dr Spencer G. Lucas
New Mexico Museum
of Natural History
1801 Mountain Road N.W.
Albuquerque, NM 87104
U.S.A.
Email: SLucas@nmmnh.state.nm.us

Dr Richard Lund
Department of Biology
Adelphi University
Garden City, NY 11530
U.S.A.

Dr W.L. Manger
Department of Geology
Univ. of Arkansas
Fayetteville, AR 72701
U.S.A.
Email: wmanger@comp.uark.edu

Dr Gene Mapes
Dept of Envir. & Plant Biology
Ohio University
Athens, OH 45701
U.S.A.

Dr R.H. Mapes
Department of Geology
Ohio University
Athens, OH 45701
U.S.A.

Dr C. G. Maples
Dept. of Geological Sciences
Indiana University
Bloomington, IN 47405
U.S.A.

Charles E. Mason
Dept. of Physical Sciences
Morehead State University
Morehead, KY 40351
U.S.A.
Email: c.mason@morehead-st.edu

Dr Patrick Mulvany
Geological Survey
Missouri DNR
P.O. Box 250
Rolla, MO 65402
U.S.A.
Email:
patrick.mulvany@dnr.mo.gov

Dr Greg Nadon
Dept. of Geological Sciences
Ohio University
Athens, OH 45701
U.S.A.

Dr Hermann W. Pfefferkorn
Department of Geology
University of Pennsylvania
240 S 33rd St.
Philadelphia, PA 19104-6316
U.S.A.
Email: hpfeffer@sas.upenn.edu

Dr John P. Pope
Department of Geology
Northwest Missouri State University
800 University Drive
Maryville, MO 64468
U.S.A.
Email:jppope@nwmissouri.edu

Dr E. Troy Rasbury
Department of Geosciences
SUNY Stony Brook
Stony Brook, NY 11794-2100
U.S.A.
Email:
troy@pbisotopes.ess.sunysb.edu

Dr Carl B. Rexroad
Indiana Geological Survey
611 N. Walnut Grove
Bloomington, IN 47405
U.S.A.
Email: crexroad@indiana.edu

Dr J. G. Richardson
Columbus State Community College
Dept of Physical & Biological Science
550 East Spring Street
Columbus, OH 43215
U.S.A.
Email: jrichard@cscc.edu

Dr C.A. Ross
GeoBioStrat Consultants
600 Highland Drive
Bellingham, WA 98225-6410
U.S.A.
Email:
rossjpr@henson.cc.wwu.edu

Dr June R.P Ross
Dept. Biology,
Biology Building 315
Western Washington Univ.
Bellingham, WA 98225-9160
U.S.A.
Email: rossjpr@henson.cc.wwu.edu

Dr C.A. Sandberg
U.S. Geological Survey
Box 25046, Federal Center, MS 940
Denver, CO 80225
U.S.A.

Dr Matthew Saltzman
Dept. of Geological Sciences
275 Mendenhall Laboratory
Ohio State University
Columbus, OH 43210-1398
U.S.A.
Email: saltzman.11@osu.edu

Dr W. Bruce Saunders
Geology Department
Bryn Mawr College
Bryn Mawr, PA 19010
U.S.A.
Email: wsaunder@brynmawr.edu

Dr Tamra A. Schiappa
Department of Geosciences
Boise State University
1910 University Dr
Boise, ID 83725
U.S.A.
Email: tschiapp@boisestate.edu

Dr Steve Schutter
Murphy Exploration and Production International
550 Westlake Park Blvd., Suite 1000
Houston, TX 77079
U.S.A.
Email: steve-schutter@murphyoilcorp.com

Serials Department
Univ. of Illinois Library
1408 West Gregory Drive
Urbana, IL 61801
U.S.A.

Dr Gerilyn S. Soreghan
Geology & Geophysics
University of Oklahoma
100 E. Boyd St.
Norman, OK 73019
U.S.A.
Email: lsoreg@uoknor.edu

Janice Sorensen
Kansas Geological Survey
University of Kansas
Lawrence, KS 66047
U.S.A.

Dr Calvin H. Stevens
Department of Geology,
School of Science
San Jose State University
San Jose, CA 95192-0102
U.S.A.
Email: stevens@geosun.sjsu.edu

Ms Mathilda Stucke
30 Oakland Avenue
West Hempstead, NY 11552-1923
U.S.A.
Email: stucke@adlibv.adelphi.edu

Dr T.N. Taylor
Department of Botany,
Haworth Hall
University of Kansas
Lawrence, KS 66045
U.S.A.
Email: ttaylor@falcon.cc.ukans.edu

Dr T.L. Thompson
Missouri Geological Survey
Box 250
Rolla, MO 65401
U.S.A.

Dr Alan L. Titus
Grand Staircase-Escalante National Monument
190 East Center St.
Kanab, UT 84741
U.S.A.
Email: Alan_Titus@ut.blm.gov

U.S. Geological Survey Library
12201 Sunrise Valley Drive
National Center, MS 950
Reston, VA 20192
U.S.A.

Dr Peter R. Vail
Dept Geol., Rice University
P.O. Box 1892
Houston, TX 77251
U.S.A.

Dr Gregory P. Wahlman
BP America
501 Westlake Park Blvd.
Houston, TX 77079
U.S.A.
Email: wahlmagp@bp.com

Dr Bruce Wardlaw
U.S. Geological Survey
970 National Center
Reston, VA 22092
U.S.A.

Dr J.A. Waters
Department of Geology
West Georgia College
Carrollton, GA 30118
U.S.A.
Email: jwaters@westga.edu

Dr W. Lynn Watney
Kansas Geological Survey
1930 Constant Avenue - Campus West
Lawrence, KS 66047
U.S.A.
Email: lwatney@kgs.ukans.edu

Dr Gary Webster
Department of Geology
Washington State University
Physical Science 1228
Pullman, WA 99164
U.S.A.
Fax: 509-335-7816

Dr R.R. West
Dept Geol., Thompson Hall
Kansas State University
Manhattan, KS 66506-3201
U.S.A.
Email: rrwest@ksu.edu

Dr Brian Witzke
Iowa Geological Survey
109 Trowbridge Hall
University of Iowa
Iowa City, IA 52242-1319
U.S.A.
Email: bwitzke@igsb.uiowa.edu

Dr David M. Work
Maine State Museum
83 State House Station
Augusta, ME 04333-0083
U.S.A.
Email: david.work@maine.gov

Dr Thomas Yancey
Department of Geology
Texas A&M University
College Station, TX 77843
U.S.A.
Email: yancey@geo.tamu.edu

UKRAINE

Dr N.I. Bojarina
Institute of Geology
Ukrainian Academy of Science
Gonchar Str., 55b
252054 Kiev
UKRAINE

Dr R.I. Kozitskaya
Institute of Geology
Ukrainian Academy of Science
Gonchar Str., 55b
252054 Kiev
UKRAINE

Dr T.I. Nemyrovska
Institute of Geological Sciences
Ukrainian Academy of Sciences
Gonchar Str., 55b
252054 Kiev
UKRAINE
Email: tnemyrov@i.com.ua

Dr V.I. Poletaev
Institute of Geology
Ukrainian Academy of Science
Gonchar Str., 55b
252054 Kiev
UKRAINE

Dr Z.S. Rumyantseva
ul. Vasilovskaja 42, Kv.33
252022 Kiev
UKRAINE

Dr A.K. Shchegolev
Institute of Geology
Ukrainian Academy of Science
Gonchar Str., 55b
252054 Kiev
UKRAINE

Dr N.P. Vassiljuk
Donetskij Politekhn. Inst.
ul. Artema 58
Donetsk
UKRAINE

Mrs M.V. Vdovenko
Institute of Geology
Ukrainian Academy of Science
Gonchar Str., 55b
252054 Kiev
UKRAINE

UZBEKISTAN

Dr Iskander M. Nigmadjanov
ul. G. Lopatina 80, kv. 35
700003 Tashkent
UZBEKISTAN

SUBCOMMISSION ON CARBONIFEROUS STRATIGRAPHY (SCCS) OFFICERS AND VOTING MEMBERS 2004-2008

CHAIR:

Dr Philip H. Heckel
Department of Geoscience
University of Iowa
Iowa City, IA 52242
U.S.A.
Email: philip-heckel@uiowa.edu

VICE-CHAIR:

Dr Geoffrey Clayton
Department of Geology
Trinity College
Dublin 2
IRELAND
Email: gclayton@tcd.ie

SECRETARY/EDITOR:

Dr David M. Work
Maine State Museum
83 State House Station
Augusta, ME 04333-0083
U.S.A.
Email: david.work@maine.gov

OTHER VOTING MEMBERS:

Dr Alexander S. Alekseev
Dept of Palaeont., Geol. Faculty
Moscow State University
119991 Moscow GSP-1
RUSSIA
Email:aaleks@geol.msu.ru

Dr Demir Altiner
Department of Geological Engineering
Middle East Technical University
06531 Ankara
TURKEY
Email: demir@metu.edu.tr

Dr Darwin R. Boardman
School of Geology
Oklahoma State University
105 Noble Research Ctr.
Stillwater OK 74078
U.S.A.
Email: darwin.boardman@okstate.edu

Dr John Groves
Department of Earth Sciences
University of Northern Iowa
Cedar Falls, IA 50614
U.S.A.
Email: John.Groves@uni.edu

Dr Luc Hance
Unité de Géologie,
Université Catholique de Louvain,
3 place Louis Pasteur,
1348, Louvain-la-Neuve,
BELGIUM
Email: hance@geol.ucl.ac.be
luc.hance@skynet.be

Dr Jin Xiao-chi
Institute of Geology
Chinese Academy of Geological Sciences
26 Baiwanzhuang Road
Beijing 100037
CHINA
Email: jinxchi@cags.net.cn

Dr Jirí Kalvoda
Department of Geology and Paleontology
Masaryk University
Kotlárská 2
61137 Brno
CZECH REPUBLIC
Email: dino@sci.muni.cz

Dr Dieter Korn
Museum für Naturkunde der
Humboldt-Universität zu Berlin
Invalidenstrasse 43
D-10115 Berlin
GERMANY
Email:
dieter.korn@museum.hu-berlin.de

Dr Olga L. Kossovaya
V.S.E.G.E.I.
Sredni pr. 74
199106 St Petersburg
RUSSIA
Email: koss@mail.wplus.net

Dr Elena I. Kulagina
Institute of Geology
Uralian Research Center
Russian Academy of Sciences
Ufa
RUSSIA
Email: kulagina@anrb.ru

Dr Ian Metcalfe
Asia Centre
University of New England
Armidale NSW 2351
AUSTRALIA
Email: imetcal2@une.edu.au

Dr T.I. Nemyrovska
Institute of Geological Sciences
Ukrainian Academy of Sciences
Gonchar Str., 55b
252054 Kiev
UKRAINE
Email: tnemyrov@i.com.ua

Dr Svetlana Nikolaeva
Paleontological Institute
Russian Academy of Sciences
Profsoyuznaya 123
117868 Moscow GSP
RUSSIA
Email: 44svnikol@mtu-net.ru

Dr B.C. Richards
Geological Survey of Canada
3303-33rd St. N.W.
Calgary AB, T2L 2A7
CANADA
Email: brichard@NRCan.gc.ca

Dr N.J. Riley
British Geological Survey
Keyworth
Nottingham NG12 5GG
UNITED KINGDOM
Email: N.Riley@bgs.ac.uk

Dr Katsumi Ueno
Dept. Earth System Science
Faculty of Science
Fukuoka University,
Jonan-ku, Fukuoka 814-0180
JAPAN
Email: katsumi@fukuoka-u.ac.jp

Dr Elisa Villa
Depto de Geología
Universidad de Oviedo
Arias de Velasco s/n
33005 Oviedo
SPAIN
Email: evilla@geol.uniovi.es

Dr Wang Xiang-dong
Nanjing Institute of Geology and Palaeontology
Chinese Academy of Sciences
39 East Beijing Road
Nanjing 210008
CHINA
Email: xdwang@nigpas.ac.cn