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Newsletter edited by Markus Aretz with the assistance of Barry Richards.

Thanks to all colleagues who contributed to this newsletter!

Cover Illustration:

The cover shows the coral – chaetetid biostrome in the basal Absian in the stratotype section at Little Asby Scar, U.K. (see stop 1 SCCS-YGS field trip "Carboniferous Stratotypes North England" October 2015).

(Photo courtesy of Markus ARETZ)

EXECUTIVE'S COLUMN

Dear Fellow Carboniferous Researchers,

The goal of the executive's column is to introduce subcommission members to some of the important current meetings, activities, and issues that concern the subcommission. In this edition of the newsletter, the main items discussed are results of recent conferences and field meetings, our conference/field-workshop schedule for 2016 and 2017 along with themes and anticipated results, and the SCCS elections held from late 2015 to early 2016. In addition, there is a preliminary discussion about the need to dissolve most of the current SCCS task groups and establish new task groups led by new chairs.

This issue of the newsletter differs somewhat from that of recent years by including the full version of the annual report that the SCCS submitted to its parent body the International Commission of Stratigraphy (ICS) for the last fiscal year (November 1, 2014 to October 31, 2015). The full version contains: task-group and progress-group progress reports, work plans for the November 1, 2015 – October 31, 2016 fiscal year, financial statements, summary of chief accomplishments over the past five years, and plans for the next four years. Normally the newsletters contain abbreviated versions of the annual reports that contain minimal information about task-group progress and work plans. The bulk of the information contained in the task-group and project-group progress reports and work plans are typically placed in the body of the newsletter as separate articles authored by task-group members.

Results from Conferences and field meetings November 1, 2013 - October 31, 2014

During the 2014 fiscal year, there were several geological conferences, field meetings and workshops that were of substantial importance and interest for SCCS members but the two most significant meetings were: 1) the Kazan Golovkinsky Stratigraphic Meeting 2014, held on the 20 - 23 of October 2014 in Kazan, Russia; and 2) the Field Meeting on Carboniferous and Permian Nonmarine-Marine Correlation, which was a joint meeting of the SCCS and SPS held in Freiberg, Germany on the 21 - 27 of July, 2014.

The Golovkinsky Stratigraphic Meeting covered all aspects of Carboniferous and Permian stratigraphy, bioevents and the evolution of sedimentary basins and their resources. The aims of the meeting were to provide a platform for discussion of research fields and for international exchange of ideas between research groups working on the Carboniferous and Permian periods. The meeting served as a platform for organizing the field trips and technical sessions at the August 2015 XVIII International Congress on the Carboniferous and Permian (ICCP) in Kazan. The Golovkinsky Stratigraphic Meeting included one day of presentations and several days of business meetings and workshops including a meeting of the Working Group on the Stratigraphy of Oil-and-Gas Bearing Reservoirs of the late Paleozoic. Geoscientists were invited to present contributions on a wide range of topics similar to those that would be covered by the 2015 XVIII ICCP in Kazan.

The Freiberg meeting included two days of oral and poster presentations and five days of field trips to the most important Carboniferous and Permian outcrops in East Germany and the Czech Republic. Several members of the SCCS task groups and corresponding members presented the results of recent work and their abstracts were published in the conference abstract volume (Elicki *et al.*, eds., 2014). An important field guidebook presenting substantial information about the Carboniferous and Permian in eastern Germany and the Czech Republic was also published (Schneider *et al.*, eds., 2014). Presentations at the meeting indicated reliable correlations between nonmarine and marine successions could be achieved by using several methods including palynological studies, U-Pb dating, and stable isotope geochemical studies. Marine microfossils fossils, particularly ostracodes, foraminifers and conodonts, could be used to a limited extent in sections where marine and nonmarine strata intertongue.

The Project Group on Carboniferous and Permian Nonmarine and Marine Correlations held their first general business meeting at the Freiberg conference and the key points are summarized in that group's progress report in this issue of the Newsletter on Carboniferous Stratigraphy and in Permophiles v 61 (Schneider & Lucas, 2015). One of the main goals of the project group at the meeting was to establish work plans for the next two to four years on the basis of the presentations and discussions. To start off the work, the organizers request all participants provide a correlation chart for nonmarine successions in the basins they are working on along with supporting stratigraphic information. In the Permophiles report, Schneider and Lucas give detailed instructions on how participants should construct their correlation charts and provide supporting stratigraphic information.

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Results from Conferences and field meetings November 1, 2014 - October 31, 2015

During the November 1, 2014 - October 31, 2015 fiscal year, there were several conferences and field meetings in which the SCCS membership participated but the most important two were the 2nd International Congress on Stratigraphy (STRATI 2015) in Graz, Austria during July, and the August 11-15, 2015 XVIII International Congress on the Carboniferous and Permian (XVIII ICCP) in Kazan, Russia. From October 9 -13, 2015 the subcommission held a joint field meeting with members of the Yorkshire Geological Society (YGS) and visited several of the Carboniferous stratotype sections for substages in northern England.

STRATI 2015

At the July 19 - 23 meeting in Graz, Markus Aretz, chairman of the Task Group to Redefine the Devonian-Carboniferous (D-C) Boundary, held a business meeting on July 22 and had the group evaluate the results of multi-discipline compilations made by most of the task-group members over the last two years. Results of that workshop will provide future direction for the task group. Two important presentations about the D-C boundary were given at the conference; Aretz & Corradini (2015) and Corradini *et al.* (2015).

XVIII ICCP in Kazan, Russia

The well-organized and scientifically important XVIII ICCP was attended by 165 scientists representing some 33 countries. Russia and China had the most delegates. Because of the political tensions, few came from Canada and the U.S.A. None of the SCCS task groups held workshops and business meetings at the XVIII ICCP; however, the SCCS held a general business meeting on August 12 at the conference and the minutes prepared by Markus Aretz, Svetlana Nikolaeva, and Barry Richards are provided below. Many of our members were deeply involved with the congress organization, leading field trips and giving presentations. The first circular was published in volume 31 of the Newsletter on Carboniferous Stratigraphy and the second and third circulars were available on the conference website: http://www.iccp2015.ksu.ru.

A succinct summary of the accomplishments of the congress are available on the home page of the conference website. Of particular relevance to the SCCS is the statement made about progress toward establishing GSSPs "The Congress demonstrated considerable progress in the studies of candidate GSSP sections of the Carboniferous and Lower Permian stages, which have not yet obtained complete formal status in the International Stratigraphic Scale. These are primarily the Serpukhovian Stage sections (Verkhnyaya Kardailovka section in Russia and Naqing section in China). New data have also been obtained for the base of the Gzhelian (Usolka section in Russia and Naqing in China)."

Papers presented at the congress cover all aspects of Carboniferous earth history. Participants reported on: the boundary definitions of the International Chronostratigraphic Scale and GSSP choices, high-resolution stratigraphy, late Paleozoic glaciations and interglacials, tectonics and orogenies, the evolution of marine and continental biotas, sequence stratigraphy, correlation of marine and non-marine strata, and Carboniferous coal and mineral resources. Task-group members gave progress reports in session S1 "Carboniferous stage boundaries, stratotype sections and GSSPs" chaired by Barry C. Richards and Alexander S. Alekseev. The abstract volume (D.K. NURGALIEV, A.S. ALEKSEEV, G. DELLA PORTA, O.L. KOSSOVAYA, G.V. KOTLYAR, S.V. NIKOLAEVA, V.V. SILANTIEV & M.N. URAZAEVA eds. (2015): XVIII International Congress on the Carboniferous and Permian August 11–15, 2015, Kazan, Russia. Abstracts Volume, Kazan University Press, 228 p.) is available on the congress website at http://kpfu.ru//staff_files/F102932714/2015__ICCP2015_ABSTRACT_VOLUME.pdf

Two pre-congress excursions that are of particular interest to SCCS members are: A1 "Lower Carboniferous of the St. Petersburg region (north-western Russia)." by Savitsky *et al.*, (2015) and A3 "Southern Urals. Deep-water successions of the Carboniferous and Permian." by Chernykh *et al.*, (2015). The post-congress excursions that are of particular interest to the SCCS members are: C2 "Middle Urals. Carboniferous and Permian marine and continental successions." by Ponomareva *et al.* eds. (2015) and C3 "Carboniferous reference sections: potential candidates for the base of the Serpukhovian GSSP and organic buildups, South Urals." by Kulagina *et al.*, (2015). Pdf files for these field guides are available for download at the congress website.

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The "Permanent Committee" met at the end of the conference and determined the next International Congress on the Carboniferous and Permian (XIX ICCP) will be held in the summer of 2019 (probably August) in Cologne Germany at the Institute of Geology and Mineralogy, University of Cologne. See the proposal on the XVIII ICCP website. The proposal was presented by Hans-Georg Herbig (new Congress chairman).

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SCCS Business Meeting at 18th ICCP in Kazan Russia, August 12, 2015

Participants:

Officers: B.C. Richards (Chair), X.-D. Wang (Vice-chair), and M. Aretz (Secretary)

Regular voting members: Z.-Q. Chen, N. Goreva, O. Kossovaya, S. Nikolaeva, E. Poty, Y. Qi

Other Members: A. Alekseev, Y. Gatovsky, A. Grigorian, H.-G. Herbig, T. Nemyrovska, G. Ponomareva, J. Schneider, F. Scholze, V. Silantiev, and D. Weyer

Agenda:

1. Summary of minutes from last SCCS business meeting in Freiberg, Germany; lead: B.C. Richards

2. SCCS elections in 2015/2016; lead: B.C. Richards

2a. Executive elections; lead: B.C. Richards

2b. Election of new regular voting members; lead: B.C. Richards

3. Corresponding members; leaders: B.C. Richards and Markus Aretz

4. Next International Congress on the Carboniferous and Permian (19th ICCP); lead: B.C. Richards

5. New business; all participants

1. Minutes from Freiberg business meeting July 21, 2014 (B.C. Richards)

The main business covered concerned activities of the Nonmarine-Marine Project Group. As the kickoff for this new group, a field meeting on Carboniferous and Permian Nonmarine-Marine Correlation was held at the Technical University Bergakademie Freiberg in Germany from July 21 to July 27, 2014. The aim of the meeting, organized by Joerg W. Schneider, Olaf Elicki, Stanislav Oplustil, and Spencer Lucas, was to bring together colleagues who are interested in the correlation of Carboniferous, Permian and Early Triassic continental deposits with the global marine time scale.

The most important outcomes of the business meeting were:

a. The workers from the various continental basins should be challenged to promote their detailed local and regional knowledge toward the global aims of the SCCS and SPS. Reports on methods, results and perspectives of nonmarine as well as nonmarine – marine intra-basinal and inter-basinal correlations as well as of global correlations should be summarized in correlation charts.

b. A second important outcome was the decision to establish cooperative research proposals to achieve the central goals of the project group. It was agreed that the proposals must be suitable for raising funds from various national and international sources for the realisation of our scientific goals.

c. Another recommendation was that task groups in the Carboniferous and Permian subcommissions should include specialists in nonmarine-marine correlations within their task groups.

2. SCCS elections in 2015/2016 (B.C. Richards)

2a. Executive elections:

The chairman indicated it is time to hold executive elections within the SCCS. He stated that his term and that of Wang Xiangdong will come to an end at the completion of the 35th International Geological Congress, which will be held in Cape Town from August 27 -September 4, 2016. The secretary Markus Aretz has also served two four-year terms, but this position does not fall under the two-term rule in the statutes. It is the duty of the chairman to appoint the secretary. The main points presented by the chairman were:

a. Rules for the terms of officers according to article 9.1 of the ICS statutes are: "The terms of office for the officers of the Executive Committee, the Subcommissions, Ad Hoc Committees, and Task Groups shall be the period between two International Geological Congresses (IGC), normally four (4) years. All officers can be re-elected for one additional term of four (4) years. If circumstances necessitated the term of office to begin in the interval between two IGCs, the period of office will not be extended beyond the second IGC after the officer started in his/her function."

b. The procedure used during the last election in 2011 should be used again. A nomination committee will be set up to collect the nominations for the positions of SCCS chair and SCCS vice-chair. Current voting members have the right to nominate potential candidates.

c. We invite all current voting members to nominate scientists whom you believe would contribute significant expertise to the mission of the SCCS in continuing the process of selecting stage boundaries in a timely fashion.The nominee does not have to be a current voting member.

d. For each nominee, please provide me with their name, affiliation, postal and email address, list of degrees with granting institutions, a brief paragraph describing their area of expertise, and a brief list of recent publications. Please keep the paragraph describing their area of expertise to 150 words or less, and have the list of publications include 5-10 papers that are germane to the mandate of the SCCS.

e. Nominees must submit a paragraph outlining why they would like to accept the nomination for the position and what they intend to do as the chief executives for the SCCS during the 2016-2020 term.

After the chairman presented the need for executive elections and outlined the ICS statute rules for election of the subcommission executive, there was some discussion about the composition of the nominating committee because some members thought current voting members should not be part of the committee. They thought the regular voting members could be strongly biased because they might be interested in being nominated themselves. The following decisions were made about the nominating committee:

a. The chairman would lead the nomination committee because he was not eligible for nomination and would be impartial.

b. A request for nominations should be sent out with a message by the current chairman by August 31, 2015.

c. The end of the nomination process should be September 30, 2016.

d. Elections need to be completed by October 31, 2015.

2b. Election of regular voting members (B.C. Richards)

The chairman summarized the composition of the regular voting membership and indicated the following will have served the maximum 12 years by the end of the 35th International Geologic Congress in Cape Town, South Africa and will be required to step down: Jin Xiao-chi, Jiri Kalvoda, Dieter Korn, Olga L. Kossovaya, Elena I. Kulagina, and Svetlana Nikolaeva.

The chairman outlined the ICS statute rules regarding the terms and election of regular voting members. In addition, he provided instructions on the nomination of voting members. The following points were made:

a. For the six [or possibly more] open voting positions in 2005/2016, we invite current voting members to nominate scientists whom you believe would contribute significant expertise to the mission of the SCCS in continuing the process of selecting stage boundaries and the events used to define them in a timely fashion.

b. Regarding this group of nominees, paragraph 9.4 of the ICS Statutes states: "New voting members of [the SCCS] are elected by its executive, upon consultation with existing voting members, and confirmed by the Executive Committee of ICS." The executive of the SCCS consists of the chairman, secretary, and vice chairman.

c. After input from the regular voting members, we will select new members from the nominees with a view toward achieving and maintaining "regional and methodological diversity" as much as possible, as indicated in the third paragraph of section 5.1 of the ICS Statutes.

d. For each nominee, please provide me with their name, affiliation, postal and e-mail address, list of degrees with granting institutions, a brief paragraph describing their area of expertise, and a brief list of recent publications. Please keep the paragraph describing their area of expertise to150 words or less, and have the list of publications include only 5 to10 of their most recent papers that relative SCCS goals.

e. Please send me all of the requested material for each nominee by September 30, 2015.

I will then distribute the list of nominees along with their qualifications to the voting members of the SCCS for comments. After October 30, the executive will elect the new members from the list of nominees.

After the chairman presented the background information and put out the call for nominations, there was a lengthy discussion about the duration of service for voting members and who should be nominated. The main points are outlined below:

a. The current subcommission has divergent ideas about following the ICS statute rules in the future. Some think it is not practical and fair to remove active members after 12 years since many of our task groups are running for more than 12 years and we need experienced task-group voting members. Other members think that the current ICS rules worked in the past and that a constant renewal is something positive. It should be reminded that a member who stepped down after 12 years becomes eligible for nomination after a four-year break.

b. The position of the ICS executive for the 12-year service rule is not clear. The current ICS chairman Stan Finney applies the statute rules more flexible than they are currently written. Dr. Finney wants the subcommissions to retail active voting members to facilitate getting the work done. However, this position may change with the incoming ICS chairman at the 35th IGC in Cape Town in 2016.

c. Some members thought it was ok to nominate scientists who had served 12 years and had stepped down after a break of four years or more. The secretary felt priority should be given to the nomination of suitable scientists who had not served before. This issue was not voted on.

d. In the discussions, it was also asked what defines activity in SCCS and who is deciding if members are active or not. In this context, the secretary reminded participants that some current voting members could be asked to step down because they had not been active as defined by the ICS statutes.

e. It was decided by general consensus that for the present we should adhere to the ICS statutes and seek the nomination of new persons to replace those who would step down after serving 12 years. If suitable new members could not be found we would retain some of the members for another term.

3. Corresponding members (B.C. Richards and M. Aretz)

The chairman outlined the following points regarding the corresponding members:

a. At present we have about 260 corresponding members and this is an unusually high number compared to that of other ICS subcommissions.

b. The SCCS had most of these members when the current administration took control but we reduced the numbers back in 2011 by eliminating several deceased members and those who could not be contacted.

c. Corresponding members are not elected or appointed. Many of the corresponding members are scientists that had been regular voting members in the past and are still active.

d. At present, a person can become a corresponding member simply by asking the SCCS secretary to put them on the e-mail list.

e. In some subcommissions, corresponding members are selected by nomination and a subsequent vote.

The secretary stated that over the last seven years, communication between many of the corresponding members and the SCCS voting membership has not been adequate. Corresponding members get subcommission information from the SCCS via e-mails and the Newsletter on Carboniferous Stratigraphy but very few corresponding members actively contribute information to the secretary, task-group leaders, and other voting members. The secretary recommended that at least every two years all corresponding members should submit a short report for the newsletter about their Carboniferous work especially that which was related to the SCCS goals. This information should help to make the newsletter more interesting and useful. There was broad agreement on this suggestion but it was not put to a vote.

After the above information was presented and discussed, the chairman asked the participants if the SCCS should continue with present method of obtaining corresponding members or should we have corresponding members nominated and selected by a vote. A variety of views were presented by those present but a formal decision

was not reached and a decision will need to be made at the next SCCS meeting.

4. Location for next ICCP (B.C. Richards)

The chairman indicated the standing committee (Permanent Committee) has not received a proposal or offer to hold the next ICCP in 2019.

Spencer Lucas is willing to organize the next congress if we have it in 2018 but Stan Finney plans to hold the next STRATI meeting in Nanjing in 2018.

Do we want to have the ICCP in 2018 or wait to see if a group will offer to organize it in 2019? There is some possibility it can be held in Italy.

No conclusion was reached on this issue at the business meeting, but during the closing banquet, Hans-Georg Herbig presented a proposal to have it in Cologne in 2019 and his proposal was accepted by a majority vote of the permanent committee.

5. New business

5a. Progress on principal SCCS goals

The chairman introduced the subject of progress on establishing GSSPs over the last seven years and a brief discussion followed. He pointed out that none of the remaining GSSPs had been established during the present administration (the last one is the ratified GSSP for the base of the Viséan in 2003, but the final publication has not been completed). Most task groups are still searching for events for boundary definition.

After discussing some individual questions and problems for the remaining boundaries, it became obvious that improvements for the functioning of task groups are required. The secretary pointed out that under ICS rules a task group can be set up for a maximum of eight years, which means that apart from the Devonian-Carboniferous boundary task group (established in late 2008) all other task groups are running too long (12 years or more).

There was an open debate about if we should continue to work on all the remaining undefined stage boundaries at the same time or concentrate on one or two boundaries. The SCCS chairman pointed out that Stan Finney wanted us to focus on defining one stage boundary within a fiscal year. Both methods have their advantages and disadvantages, and the members of SCCS have divergent opinions on what boundaries should be worked on.

5b. Newsletter on Carboniferous Stratigraphy (Markus Aretz)

The SCCS secretary informed the meeting participants that about 50% of the newsletter for 2015 (normally completed in the spring to early summer) has been compiled and edited, but the task-group reports and abbreviated version of the November 2014 SCCS annual report to the ICS have not been included yet. Once those reports arrive in Toulouse, the work will be completed.

5c. Field meeting in northern England in October 2015 (Markus Aretz)

The Yorkshire Geological Society in cooperation with the SCCS has organized a field meeting for early October 2015 in Northern England. The focus of the field-trip will be to visit boundary stratotypes of the regional stages in the upper Viséan and former Namurian. The secretary stated that the announcement for the meeting was rather late (end of June) and that many interested SCCS members would not have time to make plans and obtain funding to attend the meeting. He recommended that in the future, SCCS activities should be announced earlier, ideally in the winter before the event so members can made appropriate plans. The chairman stated it was not possible to shift the meeting into 2016.

At this point, the Chairman recommended the meeting be concluded and several members seconded this motion.

Carboniferous Stratotypes North England

Introduction

Development of an international chronostratigraphic nomenclature for the Carboniferous System led to recognition of global subsystems (Mississippian and Pennsylvanian), series, and stages (Heckel & Clayton, 2006a,b). As a consequence, many of the Carboniferous chronostratigraphic units established in Western Europe have been given regional status. Several of the former European series (Namurian, Westphalian, and Stephanian) are now recognized as Western European regional stages and the former Western European stages are now recognized as substages (Heckel & Clayton 2006a,b; Waters, 2011; Richards, 2013). The international framework is still far from complete at the stage level and difficulties occur with precise correlations between Russia, Western Europe, and North America.

Global Carboniferous substages defined by GSSPs have not been established but regional substages have been established in a number of regions including Western Europe and Russia. Northern England encompasses the location of the majority of stratotypes set up for definition of substages within the Viséan and Namurian Regional Stages of Western Europe (Ramsbottom, 1981). The Yorkshire Geological Society organized with the SCCS an excursion to visit and study the stratotype sections in Northern England from the Asbian to the

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STOPS	SUBSTAGE	LOCATION
1	Asbian	Ravenstonedale, Cumbria
2	Brigantian	Janny Wood, near Kirkby Stephen, Cumbria
3	Pendleian	Light Clough, Wiswell, near Whalley, Lancashire
4	Chokierian	Stonehead Beck, near Cowling, North Yorkshire
5	Kinderscoutian	Samlesbury Bottoms, River Darwen, near Preston, Lancashire
6	Marsdenian	Park Clough, west of Marsden, West Yorkshire
7	Alportian	Blake Brook, Shawfield, north of Warslow, Staffordshire
8	Yeadonian	Orchard Common, Knotbury, SW of Buxton, Derbyshire

Yeadonian substages. The sites visited are indicated on the attached map and a brief summary of the fieldtrip itinerary is provided below.

Excursion Summary

Saturday 10 October: Travel to the most northerly sites (Asbian and Brigantian, stops 1 & 2).

Sunday 11 October: Travel to the Pendleian and Chokierian stratotypes (stops 3 & 4).

Monday 12 October: Travel to Kinderscoutian stratotype (stop 5), very close to Preston. Travel in early afternoon to Marsdenian stratotype (stop 6 near Marsden, West Yorkshire). In the late afternoon, we will travel from Marsden to the Buxton area of Derbyshire.

Tuesday 13 October: From Buxton, travel to Alportian and Yeadonian stratotypes (stops 7 & 8).

A relatively small group of SCCS geologists attended the field excursion along with friends, family members and several members of the YGS including the principal organizer Dr. John Knight (President of the YGS). The weather was surprisingly good for October in northern England. On the fieldtrip, we obtained a very good impression of what the Carboniferous substages of northern England were like and gained substantial

knowledge about the regional geology. With the exception of the limestone-dominant Asbian and Brigantian sections, all of the stratotype sections cropped out along stream beds and were dominated by basinal shale and siliciclastic mudstone. Considering the nature of the rock types present, most of the shale and mudstone sections were well exposed. The shale-dominated sections are of basinal aspect but there was some opportunity to see correlative and overlying shallow-water lithofacies. Bases of shale-dominated stratotypes are defined mainly by ammonoids but conodonts and palynomorphs are also useful for boundary recognition. Three-dimensional ammonoids were rare except for in some calcareous intervals of the Stonehead Beck section (loc. 6) by the village of Cowling, North Yorkshire. The leaders placed the sections into their tectonic and regional lithostratigraphic settings.

On the field trip, we were fortunate to have several regional experts including ammonoid expert Nick Riley, regional mapper and stratigrapher Colin Waters (British Geological Survey), palynologist Duncan McLean, and geologic consultant /Geo-conservationist Patrick Cossey to place successions into their regional context. Patrick supplied us with informal field guides for days one and four that included recently completed section logs from Duncan McLean.

Several members of the YGS including Duncan McLean and John Knight helped to clear the sections of brush and covered intervals. Duncan Maclean is resampling many of the sections to revise the palynological record and Nick Riley plans to revise the ammonoid systematics. Several members of the YGS plan to continue working on the stratotype sections in preparation for future geological field trips and possibly for one associated with the 19th International Congress on the Carboniferous and Permian in Cologne, Germany in 2019.

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Upcoming meetings and field trips in 2016 and 2017

35th International Geological Congress (IGC)

27 August – 4 September 2016 in Cape Town South Africa

The 35th IGC will be held at the Cape Town International Convention Centre. This is an international meeting devoted to all aspects of geology and is the most important activity of the International Union of Geological Sciences (IUGS). The SCCS chairman has submitted a symposium proposal titled "The Carboniferous World: Assembly of Pangaea and Onset of Late Paleozoic Glaciations" under the scientific program theme: Phanerozoic Earth History, Stratigraphy and the Geologic Time Scale". SCCS members are encouraged to submit abstracts for this symposium.

The symposium will provide a forum for discussion of the most relevant topics on Carboniferous geology, paleontology, and environments including: the terrestrial Carboniferous World, paleoceanography, glaciations and interglacials, assembly of Pangaea, reefs and carbonate mounds, and the biota.

The Carboniferous (358.9 - 298.9 Ma), comprising the Mississippian (Tournaisian, Viséan and Serpukhovian) and Pennsylvanian (Bashkirian, Moscovian, Kasimovian and Gzhelian), was a period of profound change. Continents were assembled forming Pangaea with continent-continent collisions and subduction causing magmatism, and emplacement of orebodies. From the earliest Mississippian into the late Viséan (Middle Mississippian), marine environments prevailed over vast regions on the continental plates, but from the latest Viséan through the Pennsylvanian, continental environments became progressively more extensive. After Late Devonian extinctions, invertebrate groups recovered substantially and crinoid abundance peaked, contributing vast amounts of debris. Stromatoporoids never recovered but new reef builders evolved and, along with submarine cements, constructed mounds and shallow-water reefs. Components of many major phyla became fully terrestrialized as recorded by the establishment of extensive coal swamps and upland forests, appearance of reptiles, and evolution of diverse assemblages of amphibians and nonmarine invertebrates. The increasing

continentality resulted largely from orogenic and epeirogenic uplift associated with the assembly of the supercontinent Pangaea but oscillatory, low sea levels resulting from the waxing and waning of alpine and continental ice sheets were a major factor. After the latest Famennian glaciation, greenhouse conditions predominated until the late Viséan onset of high-frequency glaciations and interglacials on southern Gondwana that continued into the Permian.

Website: http://www.35igc.org/

Important dates:

29th February, 2016 – Revised deadline for abstract submission

31st May, 2016 – Early-bird registration closes

31st May, 2016 – Presenter's registration deadline and bookings for field trips closes

1st May, 2016 – Accommodation bookings close

1st June, 2016 – Standard registration opens

The executive of the ICS will hold a business meeting at the 35th IGC (location will be announced on the program). In addition, the SCCS will have a general business meeting to welcome in the new executive body (Chairman elect Dr. Xiangdong Wang and Vice- chairman elect Dr. Svetlana Nikolaeva). The time and location has not been determined but will be will be announced before the IGC and at our symposium session.

2017 Field trip to carbonate mounds and reefs in Bolshoi Karatau Range In Kazakhstan

A field trip to visit Carboniferous carbonate mounds and reefs in the Bolshoi Karatau Range of the Tien Shan (https://en.wikipedia.org/wiki/Karatau_Mountains) in southern Kazakhstan is planned for August 15-21, 2017. The trip will be organized by the Kazakh National Technical University and will be guided by Professor Adilkhan Baibatsha, while Sezim Mustapaeva will be the principal organizer. The itinerary for the trip is provided below but the fee for the field trip has not yet been determined. If you are interested in attending the field trip, please contact the organizers Sezim Mustapaeva (sezim_mus[at]mail.ru) or Elmira Slyamkhanovna Musina (musina.63[at]mail.ru) and they will provide additional information as it becomes available.

For background information about the Carboniferous mounds and reefs in the region see: 1) COOK, H.E., ZHEMCHUZHNIKOV, V.G., ZEMPOLICH W.G., ZHAIMINA V.Ya., BUVTYSHKIN, V.M., KOTOVA, E.A., GOLUB, L.YA, ZORIN, A.YE., LEHMANN, P.J., ALEXEIEV, D.V., GIOVANNELI, A., VIAGGI, M., FRETWELL, N., LAPOINTE, P. & J.J. CORBOY (2002): Devonian and Carboniferous carbonate platform facies in the Bolshoi Karatau, Southern Kazakhstan: outcrop analogs for coeval carbonate oil and gas fields in the North Caspian Basin, Western Kazakhstan. *In*: ZEMPOLICH, W.G. & H.E. COOK (eds.), Paleozoic carbonates of the commonwealth of independent states (CIS): subsurface reservoirs and outcrop analogues. – *SEPM (Society for Sedimentary Geology),* Special Publication, **74**: 81-122 and 2) ZHAIMINA V.Ya., MUSTAPAEVA, S.N., BAYBATSHA A.B. & Z. BELKA (2014): The Visean-Serpukhovian boundary in the Big Karatau Mountains (south Kazakhstan). *Newsletter on Carboniferous Stratigraphy*, 31: 51-62.

2017 Paleontologic workshop in St. Pertersburg

Our Russian colleagues plan to hold a paleontological workshop at the Karpinski Russian Geological Research Institute in St Petersburg in the summer of 2017 (dates to be announced later but probably immediately before or after the August 2017 Bolshoi Karatau trip in Kazakhstan). The invitation sent by Olga Kossovaya and Alexander Alekseev is provided below and interested scientists are invited to contact Olga (Olga_Kossovaya[at]vsegei.ru) and Alexander (aaleks[at]geol.msu.ru) as soon as possible. Most of the participants who are not citizens of the Russian Federation will require a visa; consequently, you may want to ask the organizers for an official letter of invitation. In addition to the workshop, a field trip to local Carboniferous exposures is planned and participants are urged to take a couple of days to explore historical sites and museums in St. Petersburg.

The invitation

Dear colleagues,

Russian members of the Carboniferous task groups on Serpukhovian, Moscovian, Kasimovian, and Gzhelian boundaries propose to organize an International conodont workshop in the summer of 2017 in Saint Petersburg. The principal aim of the workshop is to discuss phylogeny and stratigraphic distributions of potential marker conodont taxa for the Serpukhovian, Moscovian, Kasimovian and Gzhelian stages. In addition, the workshop could include the study of foraminifers and other groups that have potential for either defining boundaries or functioning as alternate indices. The Karpinski Russian Geological Research Institute in Sankt-Petersburg, Russia will provide the place for workshop. Microscopes and a room for discussions and PowerPoint presentations will be available. The hotel rooms are in the same building as the Institute.

We would like to know if you would like to attend the workshop and what dates in the summer of 2017 would work best for you. We have some flexibility with the time schedule and can select dates to suit the

maximum number of participants. If you have some more ideas or proposals, please let us know as soon as possible.

Sincerely yours,

Alexander Alekseev

Chairman of Russian Commission of Carboniferous Stratigraphy

Newsletter on Carboniferous Stratigraphy

During the last fiscal year, we scanned all of the pre-2002 issues of the Newsletter on Carboniferous Stratigraphy back to volume 1, printed in June 1980. All of the pre-2002 issues have been posted them on our website in pdf format. From volume 20, published in 2002, to the present we have digital versions that could be converted to pdf format and place on the web but we had only hard copies of the earlier volumes that required scanning into pdf format. The old issues provide and interesting history of the membership, task-group progress, and activities of the SCCS members. We encourage you all to have a look at them. Issues published from 1984 to 1980 have a primitive look because they were prepared using typewriters instead of word processors and computers. No issues were published for 1985, 1986 and 1987.

Unfortunately, we did not issue a newsletter in 2015 although most of the articles normally included in the newsletters had been completed by early November. The 2015 issue would have contained the abbreviated version of the annual report for the previous fiscal year (November 1, 2013 to October 31, 2014) along with the complete task-group progress reports with work plans for next fiscal year. In the current issue of the newsletter, we have included the abbreviated version of the 2014 annual report. The complete 2014 report along with the full task-group progress reports and work plans for November 1, 2014 to October 31, 2015 have been posted on our website.

SCCS elections in 2015 and 2016

We are rapidly nearing the end of the 2012-2016 mandate of the International Commission of Stratigraphy (ICS) and its subcommissions; consequently, we have recently completed our elections for the new SCCS executive and regular voting members. The end of the current mandate is the 35th International Geological Congress (IGC) in Cape Town, South Africa from August 27 to September 4, 2016 but the elections had to be completed well before then. During the late fall of 2105, we held a successful election for the new executive of the SCCS and put out the request for nominations for new regular voting members. In January and February of 2106, the SCCS executive selected by ballot eight new regular voting members from the nominations received from the voting members.

Executive election

Since our election to the executive in 2012, Wang Xiangdong and I served the SCCS as the vice chairman and chairman, respectively. We represented you at the formal meetings of the ICS executive and at various other professional meetings such as the XVIII International Congress on the Carboniferous and Permian in Kazan, Russia. Along with our secretary Markus Aretz, we have been pleased to provide leadership within the subcommission, organize elections for the selection of new voting members, prepare the annual reports that the SCCS submits to the ICS, maintain and update our website, and prepare the Newsletter on Carboniferous Stratigraphy. By the close of the 35th IGC, Xiangdong and I will have served two four-year terms as the executive and cannot continue in our current positions for another term.

Article 5.2 of the 2002 version of the ICS statutes states: "The chair shall be the leader of the Subcommission. The chair is responsible for the execution of agreed-upon scientific goals and the preparation and the contents of annual scientific and financial reports of the Subcommission. In consultation with the voting members of the Subcommission, the chair shall establish work plans and operating budget requests. The vice chair shall serve as chair if the position of chair should become vacant. The secretary is appointed by the chair of the Subcommission, shall assist the chair with scientific and administrative duties, and is responsible for the organization of votes within the Subcommission."

In late October, I (Barry C. Richards) put out the request for nominations to the voting members. With names of the nominees, I requested: 1) a short *Curriculum Vitae*, 2) a half page to one-page text in which candidates present their plans for the SCCS over the next four-year term, and 3) a statement from the candidate indicating their willingness to serve in either the chairman or vice chairman positions. After sending out the call for nominations, I received nominations for two candidates for the chairman position (Dr. Markus Aretz and Dr. Wang Xiangdong) and one for the vice-chairman position (Dr. Svetlana Nikolaeva). In each case, the candidates clearly had the qualifications, experience, and willingness to serve the SCCS and its parent organization the International Commission of Stratigraphy (ICS). On November 19, I listed the nominees on a ballot and sent it to the voting members for the vote. The results of the election are presented below and were presented to Dr. Stan Finney, Chairman of the International

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Commission of Stratigraphy (ICS) on December 10, 2015.

Summary for SCCS executive election

Two candidates ran for the Chairman position: Dr. Markus Aretz and Dr. Wang Xiangdong.

Dr. Svetlana Nikolaeva was the only scientist who ran for the Vice-chairman position.

Seventeen of our voting members participated in the executive election.

Two voting members did not file a completed ballot.

Results for chairman position

Wang Xiangdong: 11 yes votes

Markus Aretz: 6 yes votes

Wang Xiangdong received 5 more yes votes than Markus Aretz and had an overall approval rating of 64.7% of those who voted.

Results for vice-chairman position

Svetlana Nikolaeva: 15 yes votes indicating an 88% approval

Subsequent to the election, I asked Wang Xiangdong to appoint a secretary to replace the current secretary Markus Aretz and he chose Dr. Wenkun Qie, of the Nanjing Institute of Geology and Palaeontology, 39 Beijing Road, Nanjing 210008, P. R. China; E-mail address: wkqie[at]nigpas.ac.cn. Dr. Wenkun Qie is our current webmaster for the SCCS.

Election for regular voting members

During late October, 2105 I (the SCCS chairman) sent out a request to the voting members to nominate suitable geoscientists to replace the regular voting members who will retire in 2016. Twelve persons were nominated. Regarding these nominees, paragraph two of article 9.6 of the ICS Statutes states: "New voting members of existing subcommissions [the SCCS] are elected by its executive, upon consultation with existing voting members, and confirmed by the Executive Committee of ICS." After input from the voting membership, the SCCS executive selected eight new members from the nominees with a view toward achieving and maintaining regional and methodological diversity as much as possible, as indicated in the third paragraph of section 9.6 of the ICS Statutes. The new members and their contact information are listed below. On March 2, 2016 I sent the list of new members to Stan Finney for approval and he provided it on March 3, 2016.

Dr. Alexander Alekseev: Lomonosov State University, 119991 Moscow GSP-1 Russia; E-mail: aaleks[at]geol.msu.ru.

Dr. Hans-Georg Herbig: Universität Köln, Institut für Geologie und Mineralogie, Zülpicher Strasse 49a, D-50674 Köln, Germany; E-mail: herbig.paleont[at]uni-koeln.de.

Dr. Tatiana Isakova: Geological Institute, Russian Academy of Sciences, Pyzhevsky per. 7 109017 Moscow, Russia: E-mail: isakova[at]ginras.ru.

Dr. Vera A. Konovalova: Russian Academy of Sciences, Profsoyuznaya 123 117997 Moscow, Russia E-mail: konovalovavera[at]mail.ru

Dr. Spencer G. Lucas: New Mexico Museum of Natural History and Science, 1801 Mountain Road N. W., Albuquerque, New Mexico 87104-1375 USA; E-mail: spencer.lucas[at]state.nm.us

Dr. Bernard Mottequin: Royal Belgian Institute of Natural Sciences, O.D. Earth and History of Life, rue Vautier 29, B 1000 Brussels, Belgium; E-mail: bmottequin[at]naturalsciences.be.

Dr. Katsumi Ueno: Department of Earth System Science, Faculty of Science, Fukuoka University, Fukuoka 814-0180 Japan; E-mail: katsumi[at]fukuoka-u.ac.jp.

Dr. Wenkun Qie: Nanjing Institute of Geology and Palaeontology, Chinese Academy of Sciences, 39 Beijing Road, Nanjing 210008, P. R. China; E-mail**:** wkqie[at]nigpas.ac.cn.

Paragraph 9.2 of the 2002 revision of the Statutes of the International Commission on Stratigraphy [ICS] entitled 'Terms of Office for Voting Members' states: "The terms of office for voting members of Subcommissions and Task Groups shall be the period between two IGCs (International Geological Congresses), normally four (4) years, and can be extended for a maximum of two additional four (4) year periods." Therefore, the following seven voting members who will have served three terms [12 years] are required to retire from regular voting membership in the SCCS at the close of the 35th IGC in Cape Town, South Africa: Olga Kossovaya [Russia] (specialty: corals, general stratigraphy); Elena Kulagina [Russia] (specialty: foraminifers, biostratigraphy); Jiri Kalvoda [Czech Republic] (specialty: foraminifers, conodonts); Dieter Korn [Germany] (specialty: ammonoids, biostratigraphy); Xiaochi Jin (specialty: stratigraphy, paleogeography); Wang Xiangdong [China] (specialty: corals, conodonts, biostratigraphy); and Svetlana Nikolaeva [Russia] (specialty: ammonoids, biostratigraphy). In addition, James Barrick has decided not to continue on for another four-year term as a voting member.

I am sorry to see the terms for all of these friends and colleagues come to a close and think the ICS statutes require revision so valuable scientists will not be required to step down after only 12 years of

service. At least the voting members that step down can continue as active corresponding members; in addition, they will be eligible for nomination for regular voting membership after the four-year break required by the statutes. On behalf of the SCCS I wish to thank all of the retiring members for their hard voluntary work on the SCCS over the last 12 years. Their efforts have made a substantial contribution toward the completion of the subcommission's principal goals, which are the selection of suitable events for defining boundary stratotypes and the establishment of GSSPs.

Voting member Svetlana Nikolaeva recently contacted the ICS chair, Stan Finney, about the mandatory retirement of voting members and he informed her that if they are actively contributing they should stay on because the subcommissions need active voting members. The issue of retirement of regular voting members was discussed at length during the SCCS business meeting at the XVIII International Congress on the Carboniferous and Permian in Kazan and the general consensus was that we should continue to apply the ICS statute rules until they are revised. At that meeting, participants also decided that active voting members should continue for another four-year term if suitable new voting members cannot be located.

The following regular voting members can continue on automatically for the next four-year term: Javier Sanz-López, Ondrej Bábek, Markus Aretz, Lance Lambert, Zhong Chen, Holger Forke, Nataliya Goreva, Edouard Poty, Yuping Qi, and David Work.

Dissolution of task groups and their reestablishment

The time has come to dissolve and reestablish all of our task groups. On several occasions during the past fiscal year, Secretary Markus Aretz informed me that the SCCS is not being properly run because we are violating several of the ICS statutes or permanent rules regarding the administering of our task groups. As recorded in the minutes of our business meeting held at the 18th ICCP in Kazan in 2015, most of our task groups have been around for 12 years or more. Several statements in the 2002 version of the ICS statutes give direction to the establishment, duration, and dissolution of subcommission task groups. The most important statutes are quoted below. Rule 7.0 - Task Groups: "Task Groups are organizational bodies for limited, short-term stratigraphic tasks. Task Groups generally are organized under individual Subcommissions, but the Executive Committee also may appoint Task Groups for specific tasks that relate to its activities and responsibilities. Commonly, a Task Group is created for the selection and definition of the lower boundaries of geochronologic/chronostratigraphic units. Task Groups may also be created for the purpose of replacing and/or selecting new boundary definitions, stage units or other stratigraphic units. Each Task Group will have a single scientific task." Rule 7.1 – Task: "Task Groups have a four (4) year term that may be extended for a single additional four (4) year term, depending on sufficient progress with the entrusted task." 9.1- Terms of Office for Officers: "The terms of office for the officers of the Executive Committee, the Subcommissions, Ad Hoc Committees, and Task Groups shall be the period between two International Geological Congresses (IGC), normally four (4) years. All officers, except for the councilor, can be re-elected for one additional term of four (4) years. If circumstances necessitated the term of office to begin in the interval between two IGCs, the period of office will not be extended beyond the second IGC after the officer started in his/her function." Rule 9.5 **-** Election of the leaders of Task Groups: "The leaders (chair and secretary) of a Task Group are proposed by the management of the Subcommission or the Executive Committee of ICS under which the Task Group resides. Task Group leaders are confirmed by normal voting procedure in the ICS Subcommission or ICS Executive Committee under which they reside."

In response to the advice of Secretary Markus Aretz to reorganize the task groups, I sent the following message to Markus on January 28, 2016. "Like my predecessor, Phil Heckel, I think most of the rules regarding the task groups are overly bureaucratic and are largely a stumbling block to progress within the subcommission. However, after the election of the regular voting members has been completed and I have consulted with Stan Finney and the ICS/SCCS executives, I plan to dissolve all of the task groups including yours and have them re-established. We will follow all of the rules including the holding of elections of confidence. Some task groups will have new chairs and some will not. All of the task groups will be reorganized." On January 29, 2016 Markus forwarded my message along with his reply and suggestions to Stan Finney. Stan's reply on January 29, 2016 is: "From the annual report of the Carboniferous, Subcommission, it appears that little progress has been made by most task groups. When I read the task-group reports, I see that much basic work still needs to be done to study taxonomy and biostratigraphy of fusulinids, goniatites, and conodonts before these task groups can move forward with selection of boundary definitions and consideration of candidate stratotype sections. The reasons for the lack of progress can be varied: little to no support from national funding agencies to support basic biostratigraphic studies, few people available to carry out this fundamental work, and lack of leadership of the task group. I believe at this

time it is most important to get a good leader for each task group, and then to make them accountable."

Memorial volume for H. Richard Lane

SCCS members Jim Barrick and Paul Brenckle are preparing a memorial volume in honour of the late Richard Lane. In the statement below, Jim and Paul provide a brief eulogy for Rich Lane along with instructions for contributing to a memorial volume for Rich.

H. Richard Lane Memorial Volume

When Rich Lane passed away on October 16, 2015, the geological community lost a valuable colleague who excelled in research as well as in the promotion of scientific progress in the geosciences. He earned his B.S. from the University of Illinois and M.S. and Ph.D. degrees in Geology from the University of Iowa. Rich worked at Amoco Production Company for 28 years, first as a research paleontologist and head of the Paleozoic paleontological research group in Tulsa, Oklahoma, and later in Houston, Texas, as the Worldwide Manager of Paleontology and Director of Biostratigraphic Support and Development for Amoco. During this time, he published numerous articles on Carboniferous conodonts and biostratigraphy, and played a leading role in the establishment of the Mid-Carboniferous boundary.

For the past 18 years, Rich served as program director for the Sedimentary Geology and Paleobiology Program at the National Science Foundation (NSF). He helped lead the Advancing Digitization of Biodiversity Collections Program, the Genealogy of Life Program, and the Coastal SEES Program. He was instrumental in supporting the National Center for Earth Dynamics (NCED), the Paleobiology Database, Macrostrat, NEOTOMA, Morphobank, the Interdisciplinary Earth Data Alliance (IEDA), iDigBio, the University of Texas CT-Scanning Facility (UTCT), the Tree of Life, Chronos, Earthtime, the System for Earth Sample Registration (SESAR), and the STEPPE office. Rich was committed to building ties between American and Chinese paleontologists through collaborations of NSF-USA and NSF-China.

To honor his lifetime of achievement, we plan to publish a special volume of papers dedicated to him. We would especially like to receive manuscripts on Devonian and Carboniferous stratigraphy and conodonts, and in view of Rich's broad range of interests, we also welcome manuscripts on a wide spectrum of topics on geology and paleontology. If you wish to submit a manuscript for this volume, please send a title and a few sentences describing the proposed content of the submission by March 1. This will allow us to see the range of topics that will be included and give us time to compile a list of potential reviewers.

We anticipate that the volume will be published as a single or double issue in the journal Stratigraphy, edited by Jim Barrick and Paul Brenckle, and ask that the manuscripts be prepared in the format for that journal (http://www.micropress.org/stratigraphy/suggestions.html). The deadline for submission of completed manuscripts will be August 1, 2016. Please direct correspondence to Jim Barrick (jim.barrick[at]ttu.edu).

Best regards,

Jim Barrick

OBITUARY

29 October 2014 Dr. Marina Viktorovna Durante, the well-known Russian palaeobotanist and stratigrapher, longstanding member of SCCS passed away.

She was born 26 January 1934 in Dmitrov near Moscow in the family of an engineer. In 1957 she graduated from the Geological department of Moscow State University as a field geologist and stratigrapher.

In 1957–1965 she worked in several expeditions in the most distant regions of Sayan-Altai Region and Verkhoyanie, studying geology ant stratigraphy of the Middle and Upper Palaeozoic deposits.

In 1967 M.V Durante took part in the geological survey of the territory of Mongolian People Republic and at that time began to study fossil plants under the guidance of S.V. Meyen (1935–1987). In 1968 she became his post-graduate student in the Geological institute of USSR (nowadays – Russian) Academy of Sciences. Her PhD thesis (1971) was untitled "Palaeobotanical basing of the stratigraphy of the Upper Palaeozoic of Mongolian People Republic".

In the following years the scientific interests of M.V. Durante were concentrated in the Upper Palaeozoic floras and stratigraphy of Siberia, Mongolia and North China.

Her scientific activities have been marked already in the soviet time: M.V. Durante was a member of Interdepartmental stratigraphical committee of the USSR. She took an active part in several international research programs and projects, and was a co-author of fundamental monograph "The Carboniferous of the World".

Many years M.V. Durante worked up the problem of tracing the Carboniferous System boundaries in the continental flora-bearing deposits of Angaraland. In particularly she was interested in the position of Mid-Carboniferous boundary. In her latest publications she tried to demonstrate that this boundary should be laid not at the bottom of Kaesovsky Horizon as it is accepted in the Regional Uniform Chart, but higher – at its top. At this level in Angaraland the Pteridosperm-Cordaitean flora replaces the Pteridosperm (Post-Lepidophytean) one, i.e. cordaites begin playing a noticeable role in plant assemblages. It is interesting to note that the analogous replacement can be observed in the continental deposits of Gondwana, Kathaysia and Euramerica, where a mass appearance of cordaites and cordaite-like remains takes place at the Mid-Carboniferous boundary too.

M.V. Durante was kind, modest person, loving and having faith in God. As well as her tutor in palaeobotany S.V. Meyen she sympathized with all Western European. In her scientific studies she tried to be guided by established facts.

M.V. Durante died in her sister house, in hands of her relatives. Let she remembered forever.

I.A. Ignatiev, Yu.V. Mosseichik

ANNUAL REPORT FOR NOVEMBER 1ST, 2013 TO OCTOBER 31ST, 2014

1. This version of the 2014 SCCS Annual Report is abbreviated from the document submitted by our chairman to the International Commission of Stratigraphy in December 2014. The full version of the Annual Report has been posted on our website at http://www.stratigraphy.org/ carboniferous/.

2. OVERALL OBJECTIVES, AND FIT WITHIN IUGS SCIENCE POLICY

The SCCS promotes and coordinates international cooperation among various geologic specialists for the purpose of defining standard global chronostratigraphic boundaries within the Carboniferous System. The GSSP for the Devonian-Carboniferous boundary is at La Serre in southern France (Paproth and Streel, 1984; Paproth *et al.*, 1991), and the Carboniferous-Permian boundary GSSP at the top has been selected in northern Kazakhstan (Davydov *et al.*, 1998). The Mid-Carboniferous boundary GSSP is preserved in Arrow Canyon, Nevada, U.S.A. (Lane *et al.,* 1999), and it subdivides the Carboniferous into two subsystems, the Mississippian Subsystem below and the Pennsylvanian Subsystem above. The immediate SCCS goals are to redefine the Carboniferous-Devonian boundary and select the best stage boundaries within the two Carboniferous subsystems to facilitate global correlation within the system.

3a. CHIEF ACCOMPLISHMENTS AND PRODUCTS IN November 1st 2013 - October 31st 2014 fiscal year

The SCCS has five task groups: 1) The Joint Devonian-Carboniferous Boundary GSSP Reappraisal Task Group, 2) Task Group to Establish the Tournaisian-Viséan Boundary, 3) Task Group to Establish the Viséan-Serpukhovian Boundary, 4) Task Group to Establish the Bashkirian-Moscovian Boundary, and 5) Task Group to Establish the Moscovian–Kasimovian and the Kasimovian – Gzhelian Boundaries. In addition, the subcommission has two project groups: 1) The Project Group on Carboniferous Magnetostratigraphy, and 2) The Project Group on Carboniferous and Permian Nonmarine and Marine Correlations. In this issue of the Newsletter, the 2014 progress reports and 2015 work plans have not been included in the Annual Report. Instead, they have been placed on the SCCS website under Organization/Working Groups.

Results from Conferences and field meetings November 1st, 2014 - October 31st, 2015

There were several geological conferences, field meetings, and workshops that were of substantial importance and interest for SCCS members but the two most significant meetings were: 1) the Kazan Golovkinsky Stratigraphic Meeting 2014, held on the 20-23 of October 2014 in Kazan, Russia, and 2) the Field Meeting on Carboniferous and Permian Nonmarine-Marine Correlation, which was a joint meeting of the SCCS and SPS held in Freiberg, Germany on the 21-27 of July, 2014.

The Golovkinsky Stratigraphic Meeting covered all aspects of Carboniferous and Permian stratigraphy, bioevents and the evolution of sedimentary basins and their resources. The aims of the meeting were to provide a platform for discussion of research fields and for international exchange of ideas between research groups working on the Carboniferous and Permian periods. The meeting served as a platform for organizing the field trips and technical sessions at the August 2015 XVIII International Congress on the Carboniferous and Permian in Kazan. The meeting included one day of presentations and several days of business meetings and workshops including a meeting of the Working Group on the Stratigraphy of Oil-and-Gas Bearing Reservoirs of the Late Paleozoic. Geoscientists were invited to present contributions on a wide range of topics similar to those that will be covered by the 2015 XVIII ICCP in Kazan.

The Freiberg meeting included two days of oral and poster presentations and five days of field trips to the most important Carboniferous and Permian outcrops in eastern Germany and the Czech Republic. Several members of the SCCS task groups and corresponding members presented the results of recent work and their abstracts were published in the conference abstract volume (Elicki *et al.*, eds., 2014). An important field guidebook presenting substantial information about the Carboniferous and Permian in eastern Germany and the Czech Republic was also published (Schneider *et al.*, eds., 2014). Presentations at the meeting indicated reliable correlations between nonmarine and marine successions could be achieved by using several methods including palynological studies, U-Pb dating, and stable-isotope geochemical studies. Marine microfossils fossils, particularly ostracodes, foraminifers and conodonts, could be used to a limited extent in sections where marine and nonmarine strata intertongue.

The Project Group on Carboniferous and Permian Nonmarine and Marine Correlations held their first general business meeting at the Freiberg conference and the key points are summarized on our website in the Annual Report for 2014 and in a multi-author report under Organization/Working Groups. One of the main goals of the project group at the Freiberg meeting was to establish work plans for the next two to four years on the basis of the presentations and discussions.

3b. Output

The **Newsletter on Carboniferous Stratigraphy, Volume 31**, published in August, 2014 and available for download from our website http://www.stratigraphy.org/carboniferous/ includes commentaries by the SCCS executive on various current issues, summaries about field meetings and workshops, reports of the task groups for November 1 2012 to October 31 2013, and articles on various topics of interest. Volume 31 also contains a revised directory for the corresponding membership. The Newsletter provides a significant outlet for timely presentation and discussion of useful information relating to boundary selection, often from areas that are not typically covered in other journal venues. During the last fiscal year, task-group and corresponding members published a number of papers in refereed journals and in abstract volumes associated with conventions. Many of the most important of these publications are cited in the progress reports included in 2014 Annual Report. Some of the most important outputs during the year are:

BARHAM, M., MURRAY, J., SEVASTOPULO, G.D. & M. WILLIAMS (2014): Conodonts of the genus *Lochriea* in Ireland and the recognition of the Viséan-Serpukhovian (Carboniferous) boundary. – *Lethaia*, DOI: 10.1111/let.12096.

KABANOV, P.B., ALEKSEEV, A.S., GIBSHMAN, N.B., GABDULLIN, R.R. & A. BERSHOV, A., (2014a): The upper Viséan-Serpukhovian in the type area for the Serpukhovian Stage (Moscow Basin, Russia): Part 1. Sequences, disconformities, and biostratigraphic summary. – *Geological Journal*, DOI: 10.1002/gj.2612.

KABANOV. P.B., ALEKSEEV, A.O. & T. ZAITSEV (2014b): The upper Visean-Serpukhovian in the type area for the Serpukhovian Stage (Moscow Basin, Russia): Part 2. Bulk geochemistry and magnetic susceptibility. – *Geological Journal*, DOI: 10.1002/gj.2623.

OPDYKE, N.D. GILES, P.S. & J. UTTING (2014): Magnetic polarity stratigraphy and palynostratigraphy of the Mississippian-Pennsylvanian boundary interval in eastern North America and the age of the beginning of the Kiaman. - *Geological Society of America Bulletin*, **126**: 1068-1083.

SCHNEIDER, J., OPLUSTIL, S. & F. SCHOLZE eds. (2014): CPC-2014 Field Meeting on Carboniferous and Permian nonmarine-marine correlation.- Excursion Guide, *Institut für Geologie, Technische Universität Bergakademie Freiberg*, Wissenschaftliche Mitteilungen, **46**: 121 p.

3c. CHIEF PROBLEMS ENCOUNTERED IN 2015

Several ongoing problems confronted the SCCS task groups during the fiscal year but the most significant issue confronting the SCCS has been the difficult and time-consuming task of locating suitable evolutionary lineages and first occurrences for boundary definition. Within the Carboniferous, the endemism of conodont, foraminiferal and ammonoid lineages between Eurasia and North America continues to hamper the choice of the boundary levels for the Viséan-Serpukhovian and Bashkirian-Moscovian boundaries. Progress by the project group on Carboniferous magnetostratigraphy has been hampered by a shortage of members, insufficient funding, and a lack of integration with the activities of the other task groups.

Essentially all lineages being chosen for GSSP definition are conodont based and have the most utility in carbonate-dominant, lower-slope and basin deposits containing few other taxa than ammonoids that are suitable for global correlations.

4a. Work plans, critical milestones, anticipated results and communications to be achieved next year (2016)

The following activities are planned for the Nov. 1, 2014 to Oct 31, 2015 fiscal year by the task groups, as communicated by task-group chairs and distilled from the reports mentioned in 3a above.

Our principal mandate

The establishment of GSSPs for the Carboniferous and its main subdivisions is our principle mandate

from the ICS. During the current four-year term, the ICS executive wants to have the SCCS establish GSSPs for as many of the Carboniferous Stage boundaries as possible. At present, GSSPs need to be established for the Viséan-Serpukhovian, Bashkirian-Moscovian, Moscovian-Kasimovian and Kasimovian-Gzhelian boundaries. In addition, the GSSP at the base of the Tournaisian has been reassessed and both a new marker event and a new section will probably be required for that boundary.

Meeting-field workshop schedule with themes and anticipated results.

During the November 1, 2014 - October 31, 2015 fiscal year, there will be several conferences and field meetings in which the SCCS membership will participate but the most important two are the 2nd International Congress on Stratigraphy (STRATI 2015) in Graz, Austria during July, and the August XVIII International Congress on the Carboniferous and Permian (XVIII ICCP) in Kazan, Russia.

At the July meeting in Graz, Markus Aretz, the chairman of theTask Group to Redefine the Devonian-Carboniferous Boundary, plans to have the group evaluate the results of multi-discipline compilations made by most of the task-group members over the last two years. Results of the workshop will provide future direction for the task group.

All of the SCCS task groups and project groups will hold workshops and business meetings at our important quadrennial meeting, the August XVIII ICCP; in addition, the SCCS will hold a general business meeting. Many of our members will be deeply involved with the congress organization, leading field trips and giving presentations. Contact: iccp2015[at]ksu.ru; http://www.iccp2015.ksu.ru

4b. Specific GSSP Focus for 2015

Viséan-Serpukhovian boundary

5. Summary of expenditures in 2015: statement of operating accounts for November 1st, 2013 to October 31st, 2014

prepared by Barry Richards, Chairman SCCS
(Accounts maintained in Canadian currency)

INCOME (November 1, 2013 – October 31, 2014)

IUGS-ICS Grant – May 6, 2014: $2,333.00 US =$2,482.31 Canadian	$2,482.31
Donations from Members; November 1, 2013 - October 31 2014	$0.00
Interest Bank of Montreal; November 1, 2013 - October 31, 2014	$0.00
TOTAL INCOME	$2,482.31

EXPENDITURES (November 1, 2013 – October 31, 2014)

Bank Charges: Bank of Montreal	$0.00
Travel and conference registration support for SCCS voting members and executive to attend and give presentations (Freiberg, Germany meeting; Russian field trip organization for XVIII ICCP in 2015)	$1,500.00
TOTAL EXPENDITURE	$1,500.00

BALANCE SHEET (2013 – 2014)

Funds carried forward from October 31, 2013	$,706.62
Plus Income November 1, 2013 – October 31, 2014	$2,482.31
Total assets	**$3,188.93**
Less Expenditures November 1, 2013 – October 31, 2014	$1,500.00
BALANCE CARRIED FORWARD (to Nov. 1, 2014 - Oct. 31, 2015 fiscal year)	**$ 1,688.93**

6. BUDGET AND ICS COMPONENT FOR Nov. 1, 2014 - Oct. 31, 2015 fiscal year

PROJECTED EXPENSES

Support for voting members to participate in July STRATI 2015 conference in Graz, Austria and August 2015, XVIII ICCP in Kazan, Russia	$1,500.00
TOTAL PROJECTED EXPENSES	$1,500.00

INCOME

Carryover (from CREDIT balance at end Nov. 1, 2013 - Oct. 31 2014 fiscal year)	$1,688.93
Estimated donation	$100.00
TOTAL PROJECTED INCOME	$1,788.93

BALANCE

Estimated (deficit) /credit from above	$288.93
BUDGET REQUEST FROM ICS for 2015	$1,500.00

Appendix A

7. Summary of chief accomplishments over past five years (2011-2015)

Background: A vote by the ICS in late 1999 resulted in approval of the names Mississippian and Pennsylvanian along with a reconfirmation of the previous decisions of the SCCS to regard their rank as subsystems. In 2003 the SCCS voted to classify the two subsystems into Lower, Middle, and Upper Mississippian Series and Lower, Middle, and Upper Pennsylvanian Series, by a 74% majority of those 90% of the total membership who voted. This vote with its implicit acceptance of the stage names used

in Russia as the global stage names for the Carboniferous now provides the Carboniferous with its official global series and stage names (Heckel & Clayton, 2006a, 2006b), and effort is now focused on selecting events and GSSPs for stage boundaries.

The joint Devonian-Carboniferous Boundary GSSP Reappraisal Task Group

Studies by Ji *et al.* (1989) and subsequent analysis (Kaiser, 2009) demonstrated problems exist with the Devonian-Carboniferous boundary GSSP (Paproth *et al.*, 1991) at La Serre Hill, France. Because of the problems with the integrity of the GSSP, the Joint Devonian-Carboniferous Boundary GSSP reappraisal Task Group was established in 2008.

Initial plans for future work by the task group were outlined in the 2008 SCCS Annual Report to the ICS. The plan had three recommendations: 1) the use of the first evolutionary occurrence of the conodont *Siphonodella sulcata* (Huddle, 1934) in the lineage *S. praesulcata* Sandberg, 1972 to *S. sulcata* for boundary definition requires re-evaluation; 2) if the FAD of *S. sulcata* is retained for boundary definition, either the position of the GSSP at La Serre must be lowered or a more suitable section located, and 3) because the first appearance of *S. sulcata* may not be the best marker, other conodont lineages require evaluation.

Progress

The *S. praesulcata* to *S. sulcata* conodont lineage used to define the boundary has been re-evaluated by several scientists including Kaiser and Corradini (2011), and the protognathodids, the other conodont group that had shown potential for boundary definition is being re-studied (Corradini *et al.* 2011; Corradini *et al.*, 2013). The conodont studies have been disappointing because it appears that neither the siphonodellid lineage nor the protognathodids are suitable for D-C boundary definition and other appropriate taxa have not been discovered. However, there is considerable disagreement among the conodont specialists about the utility of the siphonodellid lineage and the conclusions of Kaiser and Corradini (2011) require testing by other specialists before the FAD of *S. sulcata* is abandoned for boundary definition.

The multi-phase Hangenberg Event (Kaiser, 2005; Kaiser *et al.*, 2008) has been identified as a level of interest for boundary definition. More data, however, on the precise timing of phases of the Hangenberg and the correlation of the biostratigraphic, geochemical, sedimentologic and sequence stratigraphic patterns within it are needed to evaluate the event's potential for boundary definition. To obtain a better understanding of the Hangenberg and its utility for boundary definition, group members have embarked on multi-disciplinary investigations aimed at understanding the event.

From the work completed through 2014, it is clear that the La Serre section is not suitable for the GSSP. A major issue is the base of bed 84b, which contains the FAD of *S. sulcata,* is a sharp facies change Kaiser (2009) and probably erosional; in addition, underlying strata lack the evolutionary lineage from *S. praesulcata* to *S. sulcata*. An event for boundary definition boundary has not been chosen, but the search for better GSSP sections is progressing

Task Group to establish the Tournaisian-Viséan Boundary

By 2003, work by the Task Group to Establish the Tournaisian-Viséan Boundary progressed to the point that a proposal for the GSSP in south China was published (Devuyst *et al.,* 2003), unanimously approved by the SCCS, and ratified by the ICS and IUGS. Task-group Chairman George Sevastopulo is preparing the final report and plans to have it completed during the 2015 fiscal year.

Task Group to establish the Viséan-Serpukhovian Boundary

The Task Group to Establish the Viséan-Serpukhovian Boundary plans to use the FAD of *Lochriea ziegleri* Nemirovskaya, Perret and Meischner 1994 in the conodont lineage, *Lochriea nodosa* (Bischoff, 1957) -*Lochriea ziegleri,* for boundary definition. The *L. nodosa*-*L. ziegleri* lineage has become widely recognized in Western Europe, Russia and Asia (Nikolaeva *et al.*, 2009; Qi *et al.*, 2013). A proposal for using *L. ziegleri* for boundary definition is being written in preparation for discussion at the 2015 XVIII ICCP in Kazan, Russia and a subsequent vote by the task group and SCCS. The task group has concluded the Naqing (Nashui) section in China and the Verkhnyaya Kardailovka section in Russia have the best potential as GSSP candidates.

The identification of the *Lochriea* lineage along with recognition of the conodont, ammonoid, ostracode, and foraminiferal zones in a deep-water (basinal), carbonate section by the village of Verkhnyaya Kardailovka on the eastern slope of the Russian Urals established that section as a strong candidate for a GSSP. The section has been thoroughly examined and synthesis published about the ammonoids, conodonts, and ostracodes (Nikolaeva, 2013). Conodonts that are transitional between *L. nodosa* and *L. ziegleri* occur immediately below the FAD of *L. ziegleri.* Prior to 2010, extensive parts of the section were poorly exposed but from 2010 to 2012 the covered intervals were excavated and permanent aluminum marker pins placed at one

metre intervals in preparation for a bed-by-bed sedimentologic analysis and the systematic sampling for conodonts, stable-isotope geochemistry and magnetic susceptibility studies, which were largely completed by 2014. An important development at the locality has been the discovery of volcanic ash layers below the proposed boundary level. Schmitz and Davydov (2012) dated an ash sample that was considered to lie 1.48 m below FOD of *Lochriea ziegleri*. Four dated zircons gave a weighted $^{206}Pb/^{238}U$ date of 333.87+/-0.08 Ma and that was interpreted as the eruptive age.

The Naqing (Nashui) section in southern Guizhou Province, China has become a strong potential candidate for a GSSP at the base of the Serpukhovian (Qi *et al.*, 2013) and conodonts spanning the Viséan-Serpukhovian boundary in the section have undergone intensive study. Conodonts within the *L. nodosa - L. ziegleri* lineage are well preserved and abundant. Elements transitional between *L. nodosa* and *L. ziegleri* are plentiful, occurring through several metres of section. A detailed stratigraphic section extending from the upper Viséan into the Bashkirian has been measured at Naqing and aluminum marker pins placed at one-metre intervals through the section. Bed-by-bed sampling for sedimentologic and geochemical analyses has been completed across the Viséan-Serpukhovian and Serpukhovian-Bashkirian boundaries and the samples are being processed. A study of the foraminifers (Groves *et al.*, 2012) indicates they can be used to bracket the level of the FAD of *L. ziegleri* thereby facilitating correlations into shallow-water carbonate sections lacking diagnostic conodonts. The measurement and intensive study of several other sections (Yashui, Loukun, Narao, and Dianzishang sections) in the region from 2010 through 2014 by B. C. Richards and colleagues is enabling the task group to place the Naqing section into its paleogeographic, stratigraphic, and lithofacies contexts. In 2014 at the Naqing, Narao and Luokun sections, several volcanic ash beds in the upper Viséan and another in the lower Serpukhovian were discovered. Zircons have been extracted from the ash samples and are being processed in the U.S.A. by Jitao Chen and Isabel Montanez with the ID-TIMS U-Pb age dating method.

Several sections span the Viséan-Serpukhovian boundary in the Cantabrian Mountains of Spain and two of those sections, the Vegas de Sotres and Millaró in the Alba Formation, are excellent deep-water carbonate sections rivaling the better known Kardailovka and Naqing exposures. In the Vegas de Sotres and Millaró sections, conodonts within the *L. nodosa - L. ziegleri* lineage are well preserved and abundant; in addition, the first occurrence of *L. ziegleri* has been located with moderate precision. A major biostratigraphic advantage of the two sections is the common occurrence of abundant, well-preserved ammonoids that are being studied by Svetlana Nikolaeva. The conodont biostratigraphy has been relatively well established in the two sections (Blanco-Ferrera *et al.*, 2009) but the biostratigraphic and sedimentologic work at the two localities is less advanced than at the Naqing and Verkhnyaya Kardailovka sections.

By the end of the 2014 fiscal year, the lineage had not been identified in North America but *L. ziegleri* has been found in the Barnett Shale in Texas and other species of *Lochriea* have been identified at several localities. Work has been initiated on ammonoid-rich successions in the western U.S.A. (Korn and Titus, 2011) and on foraminifer- and coral-rich successions in western Canada in order to bracket the level of the first appearance of *L. ziegleri* in North America.

Task Group to establish the Bashkirian-Moscovian Boundary

The conodonts *Diplognathodus ellesmerensis* Bender, 1980 and *Declinognathodus donetzianus* Nemirovskaya, 1990 are considered to have the best potential for boundary definition. A marker for the Bashkirian-Moscovian Boundary has not been selected and voted on but there is a good chance a proposal can be developed advocating the use of *D. ellesmerensis* and discussed at workshops at the August 2015 XVIII ICCP in Kazan, Russia.

Substantial work has gone into evaluating the *Declinognathodus marginonodosus—D. donetzianus* lineage for boundary definition but the lineage appears to lack a sufficiently wide geographic distribution. Other conodont taxa and fusulinids are being used for correlations into successions where the latter lineage has not been located. For example, members reported the appearance of the distinctive *Profusulinella prisca* fusulinid group near this boundary level in Spain, Turkey, southern Urals, and possibly North and South America.

An evolutionary lineage of *Declinognathodus marginonodosus—D. donetzianus* occurs in the Basu River section in the southern Urals, which also contains rich foraminiferal faunas, and might be a candidate for a GSSP. The well exposed Basu section contains the first appearance of the fusulinid *Profusulinella prisca* a few metres below that of *D. donetzianus*. The discovery of the *Declinognathodus* lineage at the Basu River section along with a rich fusulinid fauna including the *P. prisca* group make it a good potential candidate section for a GSSP.

In the Naqing (Nashui) section south China, Qi *et al.* (2007) reported the appearance with *D. donetzianus* of another conodont, *Diplognathodus ellesmerensis*, which has a broader more global distribution and would help identify the level of *D. donetzianus* in places where it is absent. Several

task-group members have proposed that the first appearance of *D. ellesmerensis* be considered as the marker event for this boundary because of its distribution is broader than that of *D. donetzianus.* More specimens of *Diplognathodus ellesmerensis* and its ancestral forms were found in both the Naqing and Luokun sections in Guizhou during the 2014 fiscal year. The lineage of *D. ellesmerensis* from its ancestral species is being intensively studied and its evolutionary first occurrence would provide an almost ideal GSSP to define the base of the global Moscovian Stage.

A detailed stratigraphic section extending from the upper Serpukhovian into the Moscovian has been measured at Naqing and aluminum marker pins placed at one-meter intervals. Groves (2010) completed his study of the foraminifers in the Naqing section and presented the findings at the November 2010 SCCS workshop in Nanjing. The provisional Bashkirian-Moscovian boundary recognized by Qi *et al.* (2007) on the lowest occurrence of *Diplognathodus ellesmerensis* falls 173 m above the base of the section, a level containing a foraminiferal association dominated by *Profusulinella* spp. and *Pseudostaffella* spp.

Task group to establish the Moscovian–Kasimovian and the Kasimovian –Gzhelian boundaries

Moscovian-Kasimovian Boundary

The Task Group to Establish the Moscovian-Kasimovian Boundary has extensively evaluated conodonts and fusulinoideans as indices for definition of the base of the Kasimovian and has concluded that conodonts present the best potential. Fusulinid workers have conceded that problems of provincialism across the boundary interval preclude the use of that group to define the boundary.

The first appearance datums (FADs) of *Idiognathodus sagittalis* Kozitskaya, 1978 and *Idiognathodus turbatus* Rosscoe and Barrick, 2009 have good potential as markers for the base of the Kasimovian (Ueno and task group, 2011). Their occurrence (near base of Khamovnikian regional Russian Substage, the second substage of the Kasimovian in current definition) is approximately one substage higher than the traditional base of the Kasimovian (base of Krevyakinian Substage). In 2013, a slightly lower level defined by the occurrence of *Idiognathodus heckeli* Rosscoe and Barrick, 2013, which is considered as the direct ancestor of *I. turbatus* is newly proposed as a more appropriate position of the potential base of the Kasimovian.

In 2013 and 2014, Yuping Qi and colleagues discovered a conodont evolutionary lineage of *Idiognathodus swadei – I. heckeli – I. turbatus* in the Moscovian–Kasimovian boundary interval of the Naqing section, southern Guizhou province and during future studies they will consider the FAD of *Idiognathodus heckeli* as the potential boundary marker. In 2013 and 2014, sedimentologic and stable-isotope geochemical investigations at the Naqing and Narao sections were initiated by Chen Jitao and Isabel Montanez.

Kasimovian-Gzhelian boundary

Members of the Task Group to Establish the Kasimovian-Gzhelian Boundary plan to use the FAD of the conodont *Idiognathodus simulator s.s.* (Ellison, 1941) in the lineage *Idiognathodus eudoraensis - I. simulator s.s.* to define the boundary (Heckel *et al.,* 2008; Barrick *et al.*, 2008).

The search for a suitable candidate section for the GSSP has started with the investigation of three sections: the Usolka section in the southern Urals of Russia (Chernykh *et al.* 2006) and the Naqing and Narao sections in Guizhou Province, South China. In 2013-2014, the Usolka section, once proposed as a potential candidate of GSSP for the base of the Gzhelian Stage (Davydov *et al.*, 2008), was extensively excavated to better expose the boundary level. Guzel Sungatullina (Kazan University, Russia) is investigating the conodonts from Usolka and Alexander Alekseev anticipates her results will permit the Usolka section to be considered once again as a GSSP candidate for the base of the Gzhelian.

The other potential candidate intervals for the GSSP lie within the Naqing (Nashui) and Narao sections in south China and are undergoing a thorough biostratigraphic, sedimentologic and geochemical investigation. Within the sections, the presence of the lineage containing *I. simulator* has been proven by Yuping Qi and his colleagues. Existing conodont collections from the Kasimovian-Gzhelian boundary interval at Naqing and Narao permit recognition of the boundary but are insufficient to make a complete description of the boundary conodont faunas. Yuping Qi and James Barrick are working on new and larger collections to obtain a more complete understanding of the fauna and enable a better evaluation of the section as a GSSP for the base of the Gzhelian. In 2013 and 2014, sedimentologic and stable-isotope geochemical investigations at the Naqing and Narao sections were initiated by Chen Jitao and Isabel Montanez.

Project Group on Carboniferous Magnetostratigraphy

During the last several years, there was considerable progress in refining and integrating the magnetostratigraphy previously obtained from the Maritime Provinces in Canada and the Mauch Chunk Formation in the Appalachian Basin of the eastern

USA by integrating magnetostratigraphy with palynostratigraphy (Opdyke *et al.*, 2014). An integrated graphical summary compiled from sections and sources described in their study with existing magnetostratigraphic data from lavas in the Asbian-Brigantian substages described in Hounslow *et al.* (2004) demonstrates a clear and validated pattern of polarity changes through the Brigantian, Pendleian and lower Arnsbergian substages (late Viséan and Serpukhovian), from several overlapping sections. Opdyke *et al.* (2014) clearly identify the base of the Kiaman reverse superchron in the *Raistrickia saetosa* biozone (approximately near the base of the Langsettian substage), which they place at ~318 Ma using the 2012 timescale of Davydov *et al.* (2012).

The Project Group on Carboniferous and Permian Nonmarine and Marine Correlations

The project group was established in 2014 and The project group was established in 2014 and held a very successful conference and field meeting in Freiberg, Germany in July 2014. Presentations at the Freiberg meeting indicated reliable correlations between nonmarine and marine successions at stage and system boundaries could be achieved through the use of several methods including palynological studies, U-Pb dating, and stable isotope studies. Marine microfossils fossils, particularly ostracodes, foraminifers and conodonts, could be used to a limited extent in sections where marine and nonmarine strata intertongue.

Radiometric dating

Precise radiometric U-Pb zircon dating (CA and ID-TIMS U-Pb methods) now being undertaken by several groups including the Permian Research Group at Boise State University on ash beds from the latest Devonian and Carboniferous successions in several basins has led to the precise dating and correlation of important Carboniferous events and assisted substantially with calibration of the Carboniferous time scale (Davydov *et al.*, 2012; Schmitz and Davydov, 2012). Since ratification of the Tournaisian-Viséan boundary proposal in 2007, task-group chair George Sevastopulo and his students have been attempting to bracket the absolute age of the Tournaisian-Viséan boundary in Europe by using the ID-TIMS U-Pb method of dating zircons from ash bands and plan to continue with that work.

8. Objectives and work plan for next 4 years (2015-2018)

Within the next two years, we think it will be possible to select the defining events for all of the stage boundaries with the possible exception of the base of the Tournaisian and then progress toward selecting sections for the GSSPs. Most task groups have either selected an event to define their respective boundary and held a successful vote on it (Kasimovian-Gzhelian task group) or have located an event and are preparing proposals in preparation for taking the proposal to ballot (Viséan-Serpukhovian, and Moscovian-Kasimovian task groups).

The joint Devonian-Carboniferous Boundary GSSP Reappraisal Task Group

The main four-year goal of the Joint Devonian-Carboniferous Boundary GSSP Reappraisal Task Group is the selection of an event for defining the base of the Carboniferous because the current definition, the FAD of *Siphonodella sulcata* is apparently deficient. Following selection of the event, suitable candidate sections for the GSSP must be located.

Since the project was initiated in 2008, substantial progress has been made on evaluating potential conodont event markers. Corradini and Kaiser (2009) re-evaluated the *Siphonodella praesulcata* - *Siphonodella sulcata* lineage used to define that boundary and Corradini *et al.* (2010; 2011) along with other conodont experts have studied the protognathodids, the other conodont group that had potential for boundary definition. It appears that neither the siphonodellids nor the protognathodids are suitable for D-C boundary definition. There is, however, some hope the siphonodellid lineage can still be used because considerable disagreement exists among conodont specialists about its utility and the conclusions of Kaiser and Corradini require additional testing.

In the Devonian-Carboniferous boundary GSSP section at La Serre, seven morphotypes in the transition from *S. praesulcata* to *S. sulcata* have been identified (Corradini and Kaiser, 2009; Kaiser, 2009) but conodonts within the transition are reworked and no correlation exists between the stratigraphic level and individual morphotypes. The task group plans to determine if a correlation exists between the morphotypes and stratigraphic level in other D-C boundary sections, where reworking is not an issue.

A suitable section for the GSSP must be located because recent studies at La Serre indicate the lack of the phylogenetic transition from *S. praesulcata* to *S. sulcata* in that section. In addition, the base of the bed (84b) containing the FAD of *S. sulcata* immediately overlies an erosion surface and major lithofacies facies change (Corradini and Kaiser, 2009; Kaiser, 2009). Several sections, particularly those in south-central China, which had been proposed as GSSP candidates prior to selection of the La Serre section, will be carefully re-examined.

The task group plans to explore the possibility of using either a sedimentological or geochemical event such as a component of the multiphase Hangenberg

extinction event (Kaiser, 2005; Cramer *et al.*, 2008) for boundary definition. The event presents potential for correlation into both shallow and relatively deep-water marine facies; consequently, the task group wants to know how the phases of the Hangenberg are represented in different facies and how well they can be correlated globally.

Tournaisian-Viséan Boundary

By 2003 work by the Task Group to Establish the Tournaisian-Viséan Boundary progressed to the point that a proposal for the GSSP in south China was published (Devuyst *et al,* 2003). The principal work of the task group has come to completion and the task-group chairman George Sevastopulo plans to complete the final report within the fiscal year.

Viséan-Serpukhovian Boundary Task Group

The Task Group to Establish the Viséan-Serpukhovian Boundary plans to use the FAD of *Lochriea ziegleri* in the conodont lineage *Lochriea nodosa* - *Lochriea ziegleri* for boundary definition. The task group plans to complete a proposal for submission to the task group and SSCS membership for a vote on either accepting or rejecting the FAD of *L. ziegleri* for GSSP definition. Two sections, Verkhnyaya Kardailovka (Nikolaeva, 2013) and Naqing (Qi *et al.*, 2013), present the best potential for the GSSP, and the ongoing integrated biostratigraphic, sedimentological and geochemical studies of those sections will continue to project completion. Most of the field work has been completed at both localities and the remaining objective is to complete the sample study and compile the final synthesis. Identification of the *L. nodosa-L. ziegleri* lineage and recognition of associated conodont, ammonoid, ostracode, and foraminiferal zones in the richly fossiliferous section near Verkhnyaya Kardailovka in the southern Urals establishes that section as a strong candidate for the GSSP. In the Naqing section in southern Guizhou Province, China the *Lochriea* lineage has been intensively studied and the FAD of *L. ziegleri* precisely located. Field work is essentially complete at Naqing and the remaining objective is to complete the analytical work and prepare the final synthesis for publication.

The *Lochriea* lineage has not been found North America but specimens of *Lochriea ziegleri* and other species within the genus have been discovered. In order to identify correlatable faunal zones that can closely bracket the boundary interval on that continent, a global study of conodonts, ammonoids, foraminifers, and corals across the boundary interval will continue.

Bashkirian-Moscovian Boundary Task Group

The high-priority plans for the Task Group to Establish the Bashkirian-Moscovian Boundary during the next four years are to select an event marker for the Bashkirian-Moscovian boundary and then to look for GSSP candidate sections. Two conodont lineages show substantial potential for boundary definition and their evaluation requires immediate completion: 1) derivation of *Declinognathodus donetzianus* from *D. marginodosus*, and 2) the lineage containing *Diplognathodus ellesmerensis*, which appears at the base of the Moscovian in the Naqing section (Nashui) in Guizhou Province, China (Qi *et al.*, 2007, 2009) and has been widely recognized globally.

In former years, it was thought that *Diplognathodus coloradoensis* Murray and Chronic, 1965 was the immediate ancestor of *D. ellesmerensis*; however, additional work has demonstrated it has a different ancestor and that relationship requires evaluation.

The carbonate-dominant Naqing section in Guizhou Province is one of the best candidates for the GSSP at the base of the Moscovian because the conodonts being considered for boundary definition are abundant and their first occurrences precisely located. Foraminifers are also present and have been thoroughly investigated (Groves, 2010). Work on the sedimentology, stable-isotope geochemistry, and geophysical characteristics of the boundary interval at Nashui are less advanced than the paleontological investigations and will be the focus of the team's work in 2015 and 2016. In order to place the important Nashui section into its sedimentological and paleoenvironmental context and to determine the relationship of shallow-water coral and foraminiferal zones to the deeper-water conodont markers within the Bashkirian-Moscovian transition in south China, the investigation of two reference sections - the Zhongdi, and the Luokun sections - will continue.

Because substantial work still is still required before a GSSP can be selected, 2016 is the earliest likely completion date.

The Moscovian-Kasimovian Boundary and Kasimovian-Gzhelian Boundary Task Groups

Moscovian-Kasimovian Stage Boundary

The high-priority plans for the Task Group to Establish the Moscovian-Kasimovian Boundary are to select an event marker for the Moscovian-Kasimovian boundary and then to search for GSSP candidate sections. Task-group members, who attended the 2008 Oviedo meeting, reached unanimous agreement to focus future work on two conodont species as the potential biostratigraphic marker by which the base of the Kasimovian can be selected and correlated globally. The first is *Idiognathodus sagittalis*, based on material from the Donets Basin (Ukraine) and also identified from the

Moscow region and southern Urals of Russia, and the Cantabrian Mountains (Spain). A potential ancestor-descendent lineage from *I.* aff. *sagittalis* n. sp. to *I. sagittalis* may be present in the Moscow region. The second potential marker is *Idiognathodus turbatus* based on material from the Mid-continent region of the U.S.A., and also recognized in the Moscow Basin, the southern Urals, and the Donets Basin. A lineage from *Idiognathodus swadei* to *I. turbatus* has been described from the U.S. Midcontinent and a new option that was presented in 2013, is to use the first occurrence of *Idiognathodus heckeli* Rosscoe and Barrick, 2013 in that lineage. *I. heckeli,* the precursor species to *I. turbatus*, might be more appropriate marker because its first appearance is closer to that of the traditional definition of the Kasimovian than that of either *Idiognathodus sagittalis* or *Idiognathodus turbatus*. *Idiognathodus heckeli* is also present in the Naqing section in Guizhou Province of South China, which would allow that section to serve as the GSSP for the base of the Kasimovian. While the event marker for the Moscovian-Kasimovian boundary still needs to achieve consensus, continued assessment of the lineages and clarification of the taxonomy of species involved will hasten the process. The task group will continue to evaluate the utility of the three lineages and potential GSSP candidate sections.

Kasimovian-Gzhelian Boundary

Members of the Task Group to Establish the Kasimovian-Gzhelian Boundary plan to use the conodont lineage *Idiognathodus eudoraensis - I. simulator s.s.* to define the boundary at the first appearance of *I. simulator s.s*. Now that an event maker has been selected, task-group members will proceed on selecting a suitable section for the GSSP. So far only the Usolka section in the southern Ural Mountains of Russia has been proposed as a candidate section for the GSSP (Davydov *et al.*, 2008).

The widespread disconformities within the Kasimovian-Gzhelian transition across most of the shelf regions presents a substantial problem for selecting a section for the GSSP**,** but work on the essentially complete carbonate-slope sections in the southern Urals (Usolka River section) and on the slope deposits in the Nashui section, are providing more appropriate sections for a potential GSSP. Conodont studies are well advanced at the two localities, but sedimentologic, geochemical and geophysical studies at the sections are at an early stage and require completion. Guzel Sungatullina (Kazan University, Russia) is restudying the conodonts across the boundary within the Usolka section. Alexander Alekseev expects the results of Guzel's study will be sufficient to propose using the Usolka section as a potential GSSP candidate for the base of the Gzhelian.

Therefore, 2014 - 2016 is probably the earliest a GSSP for the boundary will be selected and approved.

Magnetostratigraphy, chemostratigraphy, and radiometric dating

The SCCS executive is hopeful that ongoing work in chemostratigraphy and magnetostratigraphy will identify events that can be used to supplement the boundaries that will be defined by means of faunal events, and will eventually provide the basis for correlating these boundaries into the northern-hemisphere Angara region and the southern-hemisphere Gondwana region, where the pan-tropical biotas are replaced by provincial cold-climate communities. We are also hopeful that new, precise radiometric dating on biostratigraphically well-constrained marine successions, such as are being reported from the Pennsylvanian of the southern Urals by the Boise State group will both narrow the age disparities that currently exist within much of the Carboniferous and also provide better correlation with more precise modern radiometric dates that will hopefully be obtained from the Angara and Gondwana regions.

9. Organization and subcommission membership

9a. Names and addresses of current officers and voting members

In addition to the three executive voting members, the SCCS has 16 rank-and-file voting members and approximately 280 corresponding members (see latest issue of Newsletter on Carboniferous Stratigraphy for contact information).

9b. Working groups/task groups and officers

The SCCS has six current task groups and two exploratory project groups:

Task Groups and officers

The joint Devonian-Carboniferous Boundary GSSP Reappraisal Task Group [base of Carboniferous is also the base of the Lower Mississippian Series and Tournaisian Stage] is a task group chaired by Markus Aretz (France; aretz[at]get.obs-mip.fr). Carlo Corradini is the Vice-chairman. Aretz has summarized the recent work of the group through October 31st 2014 in the 2014 Annual report.

Task Group to establish the Tournaisian-Viséan Boundary [which is also the base of the Middle Mississippian Series] is chaired by George Sevastopulo (Ireland; gsvstpul[at]tcd.ie). Using e-mail communications from the chairman, the recent activities of the group are summarized herein through October 31st 2014.

Task Group to establish the Viséan-Serpukhovian Boundary [which is also the base of the Upper

Mississippian Series] is chaired by Barry Richards (Canada; barry.richards[at]canada.ca), who summarized the recent work of the group through October 31st, 2013 in the 2014 Annual report.

Task Group to establish the Bashkirian-Moscovian Boundary [which is also the base of the Middle Pennsylvanian Series] is chaired by Alexander Alekseev (Russia; aaleks[at]geol.msu.ru), who summarized the recent work of the group through October 31st, 2013 in the 2014 Annual report.

Task Group to establish the Moscovian-Kasimovian Boundary [which is also the base of the Upper Pennsylvanian Series], and the Kasimovian-Gzhelian Boundary is chaired by Katsumi Ueno (Japan; katsumi[at]fukuoka-u.ac.jp). Ueno summarized the recent work of the group through October 31st, 2013 in the 2014 Annual report.

Project Group on Carboniferous magnetostratigraphy is chaired by Mark Hounslow (United Kingdom; m.hounslow[at]lancaster.ac.uk), who summarized the recent work of the group in the 2014 Annual report.

The Project Group on Carboniferous and Permian Nonmarine and Marine Correlations is chaired by Jörg W. Schneider (Germany; Joerg.Schneider[at]geo.tu-freiberg.de). The project group was established in 2013 and their recent work is summarized in the 2014 Annual report.

Interfaces with other international projects

The SCCS works closely with the subcommissions and task groups on Devonian (SDS) and Permian Stratigraphy (SPS) to establish the common boundaries with the Carboniferous. The SCCS expects to cooperate with the NSF-sponsored Chronos initiative, which has a website at www.chronos.org, and with the NSF-sponsored PaleoStrat community digital information system for sedimentary, paleontologic, stratigraphic, geochemical, geochronologic, and related data, hosted at Boise State University, and with a website at www.paleostrat.org. It also has established a working relationship with the Permian Research Group at Boise State, which has initiated a program of obtaining precise ID-TIMS U-Pb radiometric dates from biostratigraphically constrained uppermost Devonian to Permian successions.

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TASK/PROJECT GROUP REPORTS 2014-2015

REPORT OF THE JOINT DEVONIAN–CARBONIFEROUS BOUNDARY GSSP REAPPRAISAL TASK GROUP

Markus Aretz and Task Group

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The current work and results of task group for the revision of the Devonian-Carboniferous Boundary have been presented and discussed in formal and informal discussions with members of the task group and interested researchers at three international meetings: Strati 2015, Graz/Austria (Aretz & Corradini 2015), 18th International Congress on Carboniferous and Permian, Kazan/Russia (Aretz, Corradini & Task Group 2015), and IGCP 596 - SDS Symposium, Brussels/Belgium (Corradini, Aretz & working group 2015).

The task group plans to hold a workshop in summer next year in France or Italy to discuss the gathered data and to propose and eventually decide on the new boundary criterion.

The Italian task group members **Carlo Corradini** and **Claudia Spaletta** report that their research related to the DCB were mainly focused on the revision of conodonts from the the latest Devonian and earliest Mississippian (CORRADINI *et al.*, 2015, and submitted). All genera occurring in that time frame were considered and a new zonation across the boundary has been proposed. On the basis of conodonts we suggest to consider the FAD of *Pr. kockeli* as possible new criterion to define the boundary. A new section across the DCB in Sardinia was studied (MOSSONI *et al.*, 2015).

The Czech group of researchers working on the DCB (including task group members **Ondrej Babek** and **Jiri Kalvoda**) report that the research grant of Czech Grant Agency on the high-resolution multiproxy stratigraphic analysis of the DCB in Europe was completed at the end of the year 2014. The main publication outputs are KALVODA et al; 2015, KUMPAN *et al.* 2014a, 2014b, 2015. Before completion is a manuscript: Bábek, O., Kumpan, T., Kalvoda, J., Matys Grygar, T. Devonian/Carboniferous boundary glacioeustatic fluctuations in a platform-to-basin direction: A geochemical approach of sequence stratigraphy in pelagic settings.

Task group member **Thomas Becker** provided a very detailed report on the activities of the Münster Group (R.T. Becker, S. Hartenfels, Z.S. Abousalam) and collaborators (T. Kumpan, O. Babek, J. Kalvoda, D. Weyer, S.I. Kaiser, M. Aretz, Ma Xueping, Zong Pu, Wang Zhihong, H.-G. Herbig, H. M. Weber, C. Hartkopf-Fröder & H. Tragelehn) for 2014-2015. The results of have been published in a series of papers.

1. A joint extensive review of global D/C boundary successions (more than 100) by KAISER *et al.* (2015) concentrated on the extinction, sedimentary and geochemical patterns of the global Hangenberg Crisis, which represent a 1st order global ecosystem turnover in the same scale as the so-called "Big Five" mass extinctions. A crisis scenario was developed, which outlined globally recognizable (with regionally variable precision) lower, middle, and upper crisis intervals, which have significant correlation potential. Possible crisis triggers are discussed in detail, which favor climatically driven open marine eutrophications and productivity blooms that subsequently may have caused or intensified the sudden global cooling, followed by a phased but mostly autocyclic return to "normal" conditions. But there is also a focus on the many remaining open questions to be followed in order to test the current models.

2. A second review by BECKER *et al.* (2016) summarized the biostratigraphic scales and the lithostratigraphy around the D/C boundary in the Rhenish type pelagic and Ardennes type neritic D/C successions. The current options for a revised boundary definition are reviewed and evaluated in terms of pro and contra aspects. Currently, the base of the Hangenberg Black Shale has the best options for international correlation since it can be recognized by more methods and in more regions than other levels.

3. Revisions of the main ammonoid group that crossed the D/C boundary and Hangenberg Crisis, the Prionoceratidae (FISCHER & BECKER 2014), showed a much higher pre-crisis diversity than previously assumed (but in agreement with recent parallel studies by KORN *et al.* 2014). But this was punctuated by the sharp extinction in the course of the black shale event. It seems that two prionoceratid lineages survived and new data (ZONG *et al.* 2014, BECKER *et al.* 2015, 2016) confirmed that the re-radiation, the onset of Acutimitoceras (Stockumites), started either immediately after the extinction level (Xinjiang) or immediately after the hypoxic/anoxic interval (southern Tafilalt, Morocco, new Oberrödinghausen specimens). Therefore, the black shale extinction event is an acceptable D/C level from an ammonoid point of view (although it would result in basal Carboniferous cymaclymeniids).

4. It seems that the level of the Hangenberg extinction level and crisis interval has widely been misplaced stratigraphically in the Great Basin of western North America (Nevada-Utah). As first suggested by BECKER (1993), the widespread "conchostracan shale" is most likely a *Guerichia*-rich, transgressive equivalent of the Hangenberg Black Shale (lower crisis interval), followed by the equally widespread oncolithic, often brachiopod-rich unit with the regionally oldest Ac. (Stockumites), the regressive middle crisis interval.

5. Further sampling at Drewer, Wocklum (Borkewehr) and Oberrödinghausen (KUMPAN *et al.* 2015, BECKER *et al.* 2015, 2016) provided more precision concerning the development of hypoxia, extinctions, and re-radiation of ammonoids and conodonts in these classical Rhenish D/C sections. The marker clymeniid Postclymenia evoluta clearly crosses the main ammonoid extinction and, for the first time, has been found in the Hangenberg Blackshale of Drewer (where it is much more common in the basal crisis interval Drewer Sandstone) and in the basal (green) Hangenberg Shale of Oberrödinghausen.

The Münster group has ongoing work related to the DCB in the Rhenish Massif, in Morocco, Belgium and China.

In Belgium, task group member **Eddy Poty** and his co-workers continues their studies of the shallow water sections straddling the DCB in the Namur-Dinant Basin (POTY *et al.* 2015).

The Canadian task groupe member **Barry Richards** continued with work on the Exshaw/lower Banff succession, which spans the Famennian-Tournaisian boundary. So far in this project, his activities in addition to regional stratigraphic to sedimentologic studies and U-Pb dating have involved the search for geochemical evidence for the Hangenberg event in the sections. We have been looking at stable-carbon-isotope trends ($\delta^{13}C_{org}$) across the D/C boundary in black-shale-dominated sections that must contain the D/C boundary based on high-resolution radiometric dating and conodonts within the *Palmatolepis gracilis expansa* to

Siphonodella duplicata zones. So far he has not found any significant excursions in the sections similar to those documented for the phases of the Hangenberg in Western Europe. He still has several other sections he needs to complete the carbon isotope analyses for. So far he has only used organic carbon from the black shale for the carbon isotope analyses but in the current fiscal year he will try the carbon trends for carbonates to see what they reveal.

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REPORT OF THE TASK GROUP TO ESTABLISH A GSSP FOR THE TOURNAISIAN–VISÉAN BOUNDARY

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Following approval of the proposed GSSP (Devuyst *et al.,* 2003) at Pengchong in southern China, by the SCCS in late 2007 and its ratification by the ICS and IUGS, task-group member François-Xavier Devuyst had been preparing the final report about the Tournaisian-Viséan boundary GSSP but the task-group chairman George Sevastopulo has taken over that role. Substantial progress has been made with writing the final report on the base of the Viséan and Sevastopulo plans to complete a draft during the 2015 fiscal year. Essentially the report provides a brief resume of the GSSP and then lists the successful attempts to identify the boundary in Eurasia by Jiri Kalvoda and others, and discusses the problems of identifying (and best approximation to) the boundary in North America and Gondwana. It also includes contributions by relevant paleontological experts on the up-to-date knowledge of the ranges of different fossil groups over the boundary interval, which is useful because many taxa that were considered to be of early Viséan age are actually restricted to the latest Tournaisian or first occur there.

Work plans 2015

The task group plans to continue with preparation of the final manuscript for the project. George Sevastopulo, the task group chairman, is leading that work.

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REPORT OF THE TASK GROUP TO ESTABLISH A GSSP CLOSE TO THE EXISTING VISÉAN–SERPUKHOVIAN BOUNDARY

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Introduction

An index for boundary definition has been selected, but not voted on by the task group and SCCS for final approval, and work is well advanced at the two prime GSSP candidate sections: the Verkhnyaya Kardailovka in the southern Ural Mountains of Russia and the Naqing (Nashui) section in southern Guizhou Province, China. In the Cantabrian Mountains of northwest Spain, work continued on the Millaró and Vegas de Sotres sections, two other potential candidate sections for the GSSP. For boundary definition, the group is using the first evolutionary occurrence of the conodont *Lochriea ziegleri* Nemirovskaya, Perret & Meischner, 1994 in the lineage *Lochriea nodosa* (Bischoff, 1957) –*Lochriea ziegleri. L. ziegleri* appears in the Brigantian Substage of NW Europe somewhat below the current base of the Serpukhovian as defined by its lectostratotype section in the Zaborie quarry near the city of Serpukhov in the Moscow Basin, Russia (Kabanov *et al.*, 2009, 2012, 2013).

The most important accomplishments in 2014 were: 1) the completion of a manuscript by Nemirovska *et al.* (in progress) titled "Conodonts of the genus *Lochriea* near the Viséan/Serpukhovian boundary (Mississippian) at the Naqing section, Guizhou Province, South China". That study enables confirmation and refinement of known lineages within the genus, and two lineages are proposed: a) the noded *Lochriea* species *L. mononodosa–L. nodosa–L. ziegleri, L. senckenbergica* and *L. multinodosa*, and b) the ridged *Lochriea* species *L. monocostata–L. costata–L. cruciformis*. 2) the publication of a paper about the conodonts of the

genus *Lochriea* in Ireland and recognition of the Viséan-Serpukhovian boundary (Barham *et al.*, 2014), and 3) the publication of two papers about the upper Viséan and Serpukhovian in the Moscow Basin of Russia: a) one about the sequences, disconformities and biostratigraphy (Kabanov *et al.*, 2014a) and b) a second about the geochemistry and magnetic susceptibility in the type area of the Serpukhovian Stage in the Moscow Basin, Russia (Kabanov *et al.*, 2014b).

Additional progress in southern Guizhou province, China

A comprehensive study on the biostratigraphy, sedimentology and geochemistry of the upper Viséan to Serpukhovian succession in South China is being undertaken in order to obtain a detailed understanding about the evolutionary change of the biota and global correlations across the Viséan/Serpukhovian boundary. The studied sections include the limestone-dominated, shallow-marine Yashui section and deep-water (slope) Naqing, Narao, Luokun, and Dianzishang sections. Detailed conodont and foraminiferal biostratigraphy across the Viséan/Serpukhovian boundary intervals in the Luokun and Narao sections is being done at a bed-by-bed level of detail. Foraminiferal stratigraphy across the Viséan/Serpukhovian boundary intervals in the sections is being studied intensively by Qingyi Sheng and Paul Brenckle. Preliminary stable carbon isotope work reveals a prominent negative carbon isotope excursion shortly above the FAD of *Lochriea ziegleri* in the Naqing (Buggish *et al.*, 2011), Narao and Luokun sections.

An important discovery made at the Naqing, Narao and Luokun sections was the discovery of several volcanic ash beds in the upper Viséan and another in the lower Serpukhovian. Numerous zircons have been extracted from the ash samples and are being processed in the U.S.A. by Jitao Chen and Isabel Montanez with the ID-TIMS U-Pb age dating method.

Additional progress in Russia

Moscow Basin

The conodont record in the upper Viséan and Serpukhovian of the Moscow Basin was revised. In the Novogurovsky quarry section (Tula Region near Moscow), *Lochriea* aff. *ziegleri* Nemirovskaya, Perret & Meischner, 1994 was documented from the lower Venevian Substage and *Lochriea ziegleri* was recorded in the upper Venevian (Kabanov *et al.*, 2014a). These results are compatible with those of Skompski *et al.* (1995), who recorded *L. ziegleri* from a correlative stratigraphic position in the middle Brigantian (upper Viséan) at several localities in Western Europe.

South Urals

Biostratigraphic, sedimentologic and geochemical studies continued at the Verkhnyaya Kardailovka section in the southern Urals. The conodont work resulted in the placing the FAD of *Lochriea ziegleri* at 19.63 m above the base of the section, which is 7 cm lower than previously reported by Nikolaeva *et al.* (2014). Studies of conodont biofacies using a quantitative analysis of the relative abundance of *Gnathodus bilineatus* (Roundy) (a relatively deep-water species), *G. girtyi* Hass (a relatively shallow water species), and *Vogelgnathus* (unknown ecology) suggest maximum water depths across the boundary interval were attained during deposition of the 19.00 – 19.20 m interval in the section. Sedimentologic considerations place it somewhat lower (16.45 m) at the transition from dark-grey, laminated pelagic limestone to the overlying light-grey, nodular, pelagic limestone. Michael Joachimski has completed the preliminary phase of his stable oxygen isotope study using elements of the conodont *Gnathodus bilineatus* (Roundy) in 14 samples spanning the upper Viséan/Serpukhovian boundary interval. The δ^{18} O show an upward shift to heavier values through the boundary interval with a more rapid upward rate of increase at the level 19.43 – 19.53 m, close to the transition from the thin-bedded to nodular pelagic limestones.

Work plans for 2015

The task group has determined that the FAD of the conodont *Lochriea ziegleri* in the lineage *Lochriea nodosa–Lochriea ziegleri* is the best index for boundary definition and is drafting a proposal for discussion at a workshop associated with the XVII ICCP in Kazan, Russia in August 2015. During the 2015 fiscal year, the team will continue to direct its attention toward selecting the best candidate section for the GSSP. The best two candidate sections are the Naqing (Nashui) section by the village of Naqing in southern Guizhou Province, China and the Verkhnyaya Kardailovka section on the Ural River in southern Russia.

Activities in South China

The deep-water (slope), carbonate-dominant Naqing section in southern China is an excellent candidate for the GSSP at the base of the Serpukhovian because the *L. nodosa–L. ziegleri* lineage is well defined and the FAD of *L. ziegleri* has been precisely located. The section also contains volcanic ash layers near the boundary level. The conodont studies for the locality are essentially complete and the FAD of *L.* ziegleri has been precisely located (Qi *et al.*, 2010; 2013). Qi Yuping and Tamara Nemyrovska plan to complete their manuscript on the systematics and phylogeny of conodonts within the genus *Lochriea* from the Naqing section. Paul Brenckle is continuing with the study of foraminifers in the Naqing section and

several other sections in the region including the important Yashui and Dianzishang sections (see Groves *et al.* 2012).

Work on the sedimentology, stable-isotope geochemistry (see Buggisch *et al.*, 2011), and geophysical characteristics of the boundary interval are less advanced than the paleontological investigations and will be the focus of the team's work in the next two fiscal years. To place the Naqing section into its sedimentologic and paleoenvironmental context and to determine the relationship of shallow-water coral zones to the deeper water *L. nodosa* - *L. ziegleri* transition in south China, the investigation of four reference sections - the Yashui, Dianzishang, Luokun, and Narao sections - will continue.

Activities in Southern Urals, Russia

With conodonts of the *L. nodosa-L. ziegleri* transition, abundant ammonoids, and moderately common foraminifers, the Kardailovka section, a deep-water, basinal-carbonate succession on the Ural River near the village of Verkhnyaya Kardailovka in the Urals remains the other strong candidate for the Viséan-Serpukhovian boundary GSSP. Conodonts, foraminifers and ammonoids in section have been studied in detail (Nikolaeva *et al.*, 2009; Pazukhin *et al.*, 2010) but additional work across the boundary level is required. Sufficient conodont work been done to precisely locate the position of the FAD of the conodont *L. ziegleri*.

Work on the sedimentology, stable-isotope geochemistry and geophysical characteristics of the section are somewhat less advanced than the paleontological work and will be a focus of the team's investigations in 2015. The team will be showing the section on a fieldtrip associated with the XVIII International Congress on the Carboniferous and Permian in Kazan, Russia in August 2015 and plans to have a sedimentologic study of the section up to the base of the Bashkirian completed for that event. The Kardailovka section contains numerous volcanic ash layers near the boundary level and the task group is having the most important ashes dated using the U-Pb isotope dilution thermal ionization mass spectrometry (ID-TIMS) methodology.

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REPORT OF THE TASK GROUP TO ESTABLISH A GSSP CLOSE TO THE EXISTING BASHKIRIAN–MOSCOVIAN BOUNDARY

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Introduction

During the 2014 fiscal year, continued progress was made toward the selection of a marker species and suitable section for the GSSP at the base of the Moscovian Stage. One fusulinid species *Depratina prisca* (Deprat) and two conodont species *Declinognathodus donetzianus* Nemirovskaya, 1990 and *Diplognathodus ellesmerensis* Bender, 1980 appear to have substantial potential for definition of a boundary position close to the original base of the type Moscovian but the task group thinks the FAD of the conodont *D. ellesmerensis* has the best potential. *D. ellesmerensis* is easily recognized by conodont workers and has been recovered from China, Western and Eastern Europe (Moscow Basin and South Urals), boreal Canada, and South America. That makes it one of the most widely recovered conodont species in the Upper Carboniferous. In former years it was thought that *Diplognathodus coloradoensis* Murray & Chronic, 1965 was the immediate ancestor of *D. ellesmerensis*; however, additional work on ancestry of *D. ellesmerensis* is required. Several candidate sections for the GSSP are being studied but the Naqing section in southern Guizhou province of South China appears to have the best potential (Qi *et al.*, 2010, 2013).

Moscow Basin

The recent suggestion (Goreva & Alekseev, 2012; Alekseev & Goreva, 2013) to shift the base of the Moscovian one substage higher - from the base of the Vereian regional Substage (lowermost Moscovian substage of stratotype in Moscow Basin) to the base of Kashirian regional Substage using the first appearance of the conodont *Neognathodus bothrops* Merrill, 1972 - received negligible support from the task group and will not receive further evaluation.

Guizhou Province, South China

Task-group members Qi Yuping, Tamara Nemyrovska, and Lance Lambert continued to study the Bashkirian/Moscovian interval in the deep-water (slope), limestone-dominated Naqing (Nashui) section in South China. All conodont genera known to have numerous species in the late Bashkirian to early Moscovian are recorded in the Naqing section and nearby sections. The conodont genera include *Declinognathodus, Diplognathodus, Gondolella, Idiognathodus, Idiognathoides, Mesogondolella, Neognathodus,* and *Neolochriea*. In the Naqing section, many species of these genera provide a succession of conodont chronomorphoclines throughout the Bashkirian/Moscovian boundary interval. They demonstrate that deposition was remarkably continuous through the turbidite-dominated Bashkirian-Moscovian boundary interval boundary interval, which is a major criterion for selecting a GSSP. More specimens of *Diplognathodus ellesmerensis* and its ancestral forms were found from both the Naqing section and the Luokun section in Guizhou during the last fiscal year. The lineage of *D. ellesmerensis* from its ancestral species is being intensively studied and its evolutionary first occurrence would provide an almost ideal GSSP to define the base of the global Moscovian Stage. Jitao Chen is conducting integrated research on sedimentology and stable-isotope geochemistry for the Bashkirian-Moscovian boundary interval in the Naqing section, with Isabel Montanez.

Work plans for 2015

The task group plans to continue evaluating conodont lineages suitable for definition of the Bashkirian-Moscovian boundary and it is anticipated that during the 2015 fiscal year a lineage and taxon suitable for boundary definition will be selected. The group also plans to continue its search for suitable GSSP candidate sections particularly in South China and the southern Urals.

A major effort will be devoted to the continued study of the conodonts within the Bashkirian-

Moscovian transitional interval in the Naqing (Nashui) section and nearby sections in southern Guizhou Province, South China. Special attention will be directed toward the study of the lineage containing *Diplognathodus ellesmerensis*, the taxon considered to have the best potential for boundary definition. Qi Yuping, Tamara Nemyrovska, and Lance Lambert are doing the detailed taxonomy work on the conodonts from the Bashkirian-Moscovian boundary interval in the Naqing section. In former years, it was thought that *Diplognathodus coloradoensis* was the immediate ancestor of *D. ellesmerensis*; instead, the ancestor is likely to be a new species and its taxonomic status needs to be proven. *D. ellesmerensis* appears a little above the FAD of *Declinognathodus donetzianus* Nemirovskaya, 1990 in the Donets Basin, Ukraine. If the ancestry of *D. ellesmerensis* is established in time, the group will plan to prepare a proposal for using this taxon for boundary definition and hold discussions and possibly a vote during the business meeting at the XVIII International Congress on the carboniferous and Permian in Kazan, Russia in 2015.

Another priority for the task group is to make preparations for the showing of the Basu River section (Kulagina *et al.*, 2009) in the South Urals of Russia on a fieldtrip for the XVIII International Congress on the Carboniferous and Permian in Kazan, Russia in August 2015. Kulagina *et al.* had proposed the Basu River section as potential candidate section for the GSSP at the base of the Moscovian Stage.

Work on the sedimentology, stable-isotope geochemistry, and geophysical characteristics of the boundary interval in the Naqing and nearby sections are less advanced than the paleontological investigations and need to be a focus of the team's work in 2015.

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REPORT OF THE TASK GROUP TO ESTABLISH THE MOSCOVIAN–KASIMOVIAN AND KASIMOVIAN–GZHELIAN BOUNDARIES

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Introduction

In the 2014 fiscal year, the search continued for an index within an evolutionary lineage for definition of the base of the Kasimovian. For that boundary, the use of the FAD of the conodont *Idiognathodus heckeli* Rosscoe & Barrick, 2013 shows great potential and is being tested prior to

final approval. The first appearance datum (FAD) of a conodont has been formally selected for defining the base of the Gzhelian Stage (Heckel *et al.*, 2008; Villa *et al.*, 2009) and the search for a suitable section for the GSSP continued.

MOSCOVIAN-KASIMOVIAN BOUNDARY

As potential marker events for defining the base of the Kasimovian Stage, Villa and the task group (2008) proposed using the FADs of the conodont *Idiognathodus sagittalis* Kozitskaya, 1978 or *Idiognathodus turbatus* Rosscoe & Barrick, 2009a. Their occurrence (near base of Khamovnikian Substage, the second substage of the Kasimovian in current definition) is approximately one substage higher than the traditional base of the Kasimovian (base of Krevyakinian Substage). A new option, discussed below, is to use the first occurrence of *Idiognathodus heckeli* Rosscoe & Barrick, 2013, which is closer to the traditional base.

Progress in North America

Rosscoe & Barrick (2013) documented in detail the morphological transition from *Idiognathodus swadei* Rosscoe & Barrick, 2009a to *Idiognathodus heckeli* Rosscoe & Barrick, 2013 (the transitional form) to *I. turbatus* in the North American Midcontinent succession. The steps in this lineage occur in the offshore-marine intervals within a succession of successive cyclothems resulting from eustasy (Rosscoe & Barrick, 2009b). Rosscoe & Barrick suggested that using the FAD of *I. heckeli,* the precursor species to *I. turbatus*, would be more appropriate for boundary definition than use of *I. turbatus*, because it will bring the stage base closer to the traditional base of the Kasimovian.

Progress in South China

The morphological transition discussed above also occurs in the condensed, deep-water (comprises limestone slope turbidites) Naqing (Nashui) section of southern Guizhou province in South China. A conodont evolutionary lineage of *Idiognathodus swadei* – *I. heckeli* – *I. turbatus* was established in the Moscovian–Kasimovian boundary interval of the Naqing section, southern Guizhou province (Qi *et al.*, 2013). *I. heckeli*, with a complete eccentric groove on the platform, was named by Rosscoe and Barrick (2013) based on materials from North America, and was suggested to be a suitable bio-marker for the base of the Kasimovian. The Naqing section was studied intensively during the last five years and the exact FADs of *I. turbatus* and *I. heckeli* established on bed-by-bed collections. The documentation of this lineage containing *I. heckeli* in the limestone-dominant Naqing section, which appears to lack substantial breaks resulting from either erosion or nondeposition, makes it a good potential candidate section for the GSSP at the base of the Kasimovian.

The conodont and fusulinid biostratigraphy of the nearby Narao section, deposited in somewhat shallower slope settings than the Naqing section, is being intensively studied.

Progress in Russia

During 2014, Alekseev and Goreva continued their studies of the *Idiognathodus turbatus* and *I. sagittalis* as a possible markers for the base of the Kasimovian Stage. Their lineages are diverse, but mainly evolving in relatively deeper water settings, as in the Stsherbatovka section in Oka–Tsna Swell (Ryazan Region, Russia). Alekseev and Goreva started describing conodonts from the Afanasievo section and Perkhurovo and Ilinsky Pogost bore-holes, which cover together the lower half of the Kasimovian in its type area in the Moscow Basin. They plan to show the Afanasievo section as the Kasomovian Neostratotype during a field trip of the August 2015 XVIII ICCP in Kazan. At this moment, they considered that the mid-Khamonvnikian Substage is the best potential level for the fixation of the base-Kasimovian boundary.

KASIMOVIAN-GZHELIAN BOUNDARY

After fixing the base of the Gzhelian Stage by using the first appearance datum of the conodont *Idiognathodus simulator* (Ellison, 1941) *s.s.* in its potential lineage *Idiognathodus eudoraensis* - *I. simulator* (Heckel *et al.*, 2008; Villa *et al.*, 2009), the task group is directing research toward selecting a section for the GSSP.

Progress in Russia

For the base of the Gzhelian, conodonts from the Usolka section (South Urals) is being studied in detail by Guzel Sungatullina (Kazan Federal University, Russia). The section was once proposed as a potential candidate of GSSP for the base of the Gzhelian Stage (Davydov *et al.*, 2008). Later the boundary interval became covered by soil and vegetation and was poorly exposed in 2009 when members of the SCCS inspected it. In 2013-2014, the Moscovian – basal Gzhelian interval at Usolka was newly exposed and about 70 new conodont samples collected. Because the rocks are siliceous, the processing of samples for conodonts is proceeding slowly, but the first results show that conodont zones similar to those established in the Moscow Basin are possibly recognizable in the Usolka section. In this section, the basal Gzhelian contains forms close to *Idiognathodus simulator*, but its ancestor *I. eudoraensis* has not been found. Alexander Alekseev expects the results of Gusel's study to be sufficient to propose using the Usolka section as a potential GSSP candidate for the base of the Gzhelian. The Usolka section will be demonstrated during a field trip of XVIII ICCP in 2015.

Progress in South China

Detailed investigations on conodonts across the Kasimovian–Gzhelian boundary interval in the Naqing section and nearby Narao section in southern Guizhou was conducted by Wang Qiulai and Qi Yuping in 2014. Many additional conodont specimens were obtained from new collections from both sections. The conodont fauna from Narao is enriched and more diverse than that of the Naqing section. In the Naqing section, *I. simulator* first appears in 255.55-255.75 m level and ranges upwards in a 3 m thick stratigraphic interval with its possible morphological variations. The underlying 1.5 m thick interval (254~255.55 m level), previously considered to be barren, yielded some small conodont specimens, thereby enabling the recognition of a continuous evolutionary lineage from *I. eudoraensis* to an unnamed new species, then to *I. simulator* in the section. Recently, Wang Qiulai (2013: unpublished Master thesis) established a new conodont succession across the Kasimovian–Gzhelian boundary of the Naqing section, including the *I. guizhouensis* Zone, *I. eudoraensis* Zone, *Streptognathodus zethus* Zone, *I. simulator* Zone, *I. nashuiensis* Zone, and *S. virgilicus* Zone in ascending order.

The Narao section contains abundant and diverse conodont specimens across the boundary interval. In that section, *I. simulator* first occurs at the 229.61 m level and ranges upwards in about a 4 m thick stratigraphic interval. Qi and his colleagues are going to continue with detailed studies in the coming years to better understand both conodont and fusulinid evolutionary changes across the Kasimovian–Gzhelian boundary interval in the Narao section. Sedimentologic and stable-isotope geochemical investigations are being done by Chen Jitao and Isabel Montanez on both the Moscovian–Kasimovian and Kasimovian–Gzhelian boundary intervals in the Naqing and Narao sections.

Work plans

Until the 2013 fiscal year, the task group had concluded the first appearance datums (FADs) of either *Idiognathodus sagittalis* Kozitskaya, 1978 or *Idiognathodus turbatus* Rosscoe & Barrick, 2009a had the best potential as a marker for the base of the Kasimovian (Villa & task group, 2008; Ueno & task group, 2011). Now, a slightly lower level defined by the first occurrence of *Idiognathodus heckeli* Rosscoe & Barrick, 2013, which is considered as the direct ancestor of *I. turbatus* is newly proposed as a more appropriate position of the potential base of the Kasimovian. The group will plan to prepare a proposal for using *I. heckeli* taxon for boundary definition and vote on it or at least discuss the proposal during their business meeting at the XVIII International Congress on the Carboniferous and Permian in Kazan, Russia in 2015.

After such a proposal is made and voted on, additional taxonomic work and comparison of morphotypes from different regions can be continued.

Activities in southern China

During the last several years, Qi Yuping & James Barrick intensively studied conodonts from the uppermost Moscovian to lower Gzhelian slope carbonates in the Naqing (Nashui) section, southern Guizhou Province (Qi *et al.*, 2007; Barrick *et al.*, 2010). A conodont evolutionary lineage of *Idiognathodus swadei – I. heckeli – I. turbatus* was established in the Moscovian–Kasimovian boundary interval of the Naqing section, southern Guizhou province (Qi *et al.*, 2013) and during future studies they will consider the FAD of *Idiognathodus heckeli* as the potential boundary marker. They will continue with intensive studies to provide more detailed information on the conodont succession across the Moscovian-Kasimovian boundary in the Naqing section and several other limestone-dominated, turbiditic sections in the region as a potential GSSP candidate sections. Work on the sequence stratigraphy, sedimentology, stable-isotope geochemistry, and geophysical characteristics of the Moscovian-Kasimovian boundary interval at Naqing is less advanced than the paleontological investigations and will be a focus of the team's field work in 2015 and future years.

To place the Naqing section into its sedimentological and paleoenvironmental context and determine the relationship of shallow-water coral, conodont and foraminiferal zones to the deeper-water conodont markers within the Moscovian-Kasimovian transition in south China, the investigation of reference sections including the Zhongdi (Ueno *et al.*, 2007), Luokun, and Narao sections will continue. Foraminifers are more abundant and better preserved than at Naqing and it is anticipated that a better correlation between conodonts and foraminifers can be achieved by the study of the other sections.

Activities in Moscow Basin, Russia

The task group will continue to study the conodonts *Idiognathodus turbatus* and *I. sagittalis* as possible markers for the base of the Kasimovian Stage in the Moscow Basin. They are going to show the Afanasievo section (Goreva *et al.*, 2009) as the Kasomovian Neostratotype during a field trip for the XVIII ICCP in 2015. At this moment, they considered that the mid-Khamonvnikian Substage is the best potential level for the fixation of the base-Kasimovian boundary.

Kasimovian-Gzhelian boundary Since 2007, when the task group voted in favor of using the first appearance of the conodont *Idiognathodus simulator*

(Ellison, 1941) in the lineage *Idiognathodus eudoraensis* - *I. simulator* as the boundary-defining event (Heckel *et al.*, 2008), the search for a suitable section for the GSSP has been the task-group's main objective, and will continue to be so in 2015.

Activities in Russia

The Usolka section in the southern Ural Mountains of Russia had been proposed as a candidate section for the GSSP at the base of the Gzhelian (Chernykh *et al.,* 2006; Davydov *et al.*, 2008) but examination by members of the SCCS on a field trip to the locality in 2009 revealed the section required substantial new lithostratigraphic, sedimentologic and conodont-based biostratigraphic work before it could be considered as a candidate section. During 2013-2014, the section was extensively excavated to improve exposure and was resampled for conodonts. Guzel Sungatullina (Kazan University) has been reevaluating the conodonts from the newly-exposed Usolka section and will continue that work in 2015. Alexander Alekseev anticipates her results will permit the Usolka section to be considered as a GSSP candidate for the base of the Gzhelian.

Activities in China

Yuping Qi and colleagues will continue their intensive investigation across the proposed Kasimovian-Gzhelian boundary level in the Naqing and Narao sections in Guizhou Province, south China. At the Naqing and Narao sections in Guizhou Province, south China, Qi and his colleagues are going to continue with detailed studies in the coming years to better understand both the conodont and fusulinid evolutionary changes across the Kasimovian–Gzhelian boundary interval. Sedimentologic and stable-isotope geochemical investigations are being done by Chen Jitao and Isabel Montanez.

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REPORT OF THE PROJECT GROUP ON CARBONIFEROUS MAGNETOSTRATIGRAPHY

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Introduction and general activities

The magnetostratigraphy project group was formed in 2004 and chaired by Mark Hounslow to research the potential for identifying correlatable magnetostratigraphic events in the Carboniferous. Hounslow (2009) reported on some aspects of this approach in the 2009 issue of the Newsletter on Carboniferous Stratigraphy. Progress by the magnetostratigraphy project group has been hampered by a shortage of members and lack of integration with the activities of the other SCCS task groups.

There has been considerable progress in refining and integrating the magnetostratigraphy previously obtained from the Maritime Provinces in Canada and the Mauch Chunk Formation in the Appalachian Basin of the eastern USA by integrating magnetostratigraphy with palynostratigraphy through the work of Opdyke *et al.* (2014). An integrated graphical summary compiled from sections and sources described in their study with existing magnetostratigraphic data from lavas in the Asbian-Brigantian substages described in Hounslow *et al.* (2004) demonstrates a clear and validated pattern of polarity changes through the Brigantian, Pendleian and lower Arnsbergian substages (late Visean and Serpukhovian), from several overlapping sections. The data are predominantly from red-bed alluvial facies, with the sub-stage divisions related to the spore zones of eastern Canada (Utting *et al.* 2010). The Asbian-Brigantian boundary is not well defined, but occurs in the lower part of the Mauch Chunk sections measured. The position of this boundary, proposed by Opdyke *et al.* (2014) appears to approximately concur with the polarity pattern across this boundary seen in the British lava successions (data reviewed in Hounslow *et al.* 2004).

Opdyke *et al.* (2014) clearly identify the base of the Kiaman reverse superchron in the *Raistrickia saetosa* biozone (approximately near the base of the Langsettian substage), which they place at ~318 Ma using the 2012 timescale of Davydov *et al.* (2012). This date agrees closely with the base of the Kiaman Superchron identified in Australia where the normal polarity Wanganui Andesite Member (U-Pb date of 319.2 ± 2.8 Ma), is succeeded by the reversed polarity (within the base of the Kiaman Superchron) Peri–Eastons Arm Rhyolite (U-Pb date of 317.8 ± 2.8 Ma; Opdyke *et al.* 2000).

The new work shows potential to link the boundaries of the polarity chron MI12, in the late Brigantian to the Serpukhovian Task Group's debate about the definition of the GSSP at the base of the Serpukhovian. It is clear that the geomagnetic polarity stratigraphy as published in the 2012 timescale volumes (Davydov *et al.*, 2012) bears little resemblance to the detailed work of Opdyke *et al.* (2014), which brings into question the reliability of the old Russian data (reviewed by Hounslow *et al.* 2004), on which the 2012 polarity timescale was constructed.

New palaeomagnetic and magnetostratigraphic data from Billefjorden on Spitsbergen across the Serpukhovian-Bashkirian boundary (Iosifi & Khramov, 2013), bears some similarity to the polarity pattern shown in Fig. 1 of Hounslow (in progress), with normal polarity dominating the lower Bashkirian. Unfortunately, insufficient section stratigraphic details, limits any more direct comparisons. The Serpukhovian-Bashkirian interval has also recently been studied in the Tengiz reservoir (Kazakhstan), where a geomagnetic polarity stratigraphy has contributed to a detailed chronostratigraphic sub-division of the reservoir units (Ratcliffe *et al.* 2013). Hopefully this work will eventually be published, and develop the magnetostratigraphic pattern through the Mississippian - Pennsylvanian boundary.

Work plans

During the last several years there was considerable progress in refining and integrating the magnetostratigraphy previously obtained from the Maritime Provinces in Canada and the Mauch Chunk Formation in the Appalachian Basin of the eastern

USA by integrating magnetostratigraphy with palynostratigraphy through the work of Opdyke *et al.* (2014). The project group's main efforts will be to extend the pattern established in Canada and the USA, to fill the data gap occupied by the Mississippian-Pennsylvanian disconformable boundary in North American sections, and to extend the polarity pattern down into the Viséan and Tournaisian. The project group is planning for a United Kingdom-based project that will include Andy Biggin of Liverpool and Mark Hounslow of Lancaster to undertake some of this task as part of a bigger geodynamo modelling project. The group plans to start the project in early 2016. Kate Ziegler [ZGC, New Mexico] is planning on some re-evaluation of the Pennsylvanian –Permian boundary strata in central New Mexico by searching for an original hematite magnetization.

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REPORT OF THE NONMARINE-MARINE CORRELATION WORKING GROUP

Joerg W. Schneider and Task Group

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The number of nonmarine Carboniferous and Permian stratigraphers is very low compared to that of marine stratigraphers working on this time interval. In order to obtain more man power for the Nonmarine-Marine Correlation Working Group (NMCG), the chairs of the Subcommissions on Carboniferous (SCCS) and on Permian Stratigraphy (SPS), Barry Richards and Shuzhong Shen, agreed to organize a joint working group to study the global correlation between Carboniferous and Permian marine and nonmarine deposits. This agreement was made during a business meeting of the SCCS and the SPS linked to the International Meeting on the "Carboniferous-Permian Transition" at the National Museum of Natural History and Science, Albuquerque that was held from 19 to May 25, 2013 and organized by Spencer Lucas (Lucas *et al.*, 2013).

As the kickoff for this now extended working group, a Field Meeting on Carboniferous and Permian Nonmarine-Marine Correlation was held at the Technical University Bergakademie Freiberg in Germany from July 21 to July 27, 2014. The aim of the meeting, organized by Joerg W. Schneider, Olaf Elicki, Stanislav Oplustil, and Spencer Lucas, was to bring together all colleagues who are interested in the correlation of Carboniferous, Permian and Early Triassic continental deposits with the global marine time scale (Elicki *et al.*, 2014; Schneider *et al.*, 2014). About 70 participants from Western and Eastern Europe, North and South America, North and South Africa, and Asia joined the meeting (Fig. 1). Two days of the meeting were devoted to scientific presentations, followed by five days of field excursions to the most important Carboniferous and Permian outcrops in eastern Germany and the Czech Republic, including Permian-Triassic transitional outcrop sections. The Czech part of the excursion was prepared and guided by the team of Stanislav Oplustil, Charles University, Prague, and the German part by the team of Joerg W. Schneider, Technical University Bergakademie Freiberg. The excursions were supported by Stanislav Stamberg, Museum

Hradec Kralove, Ronny Rößler, Museum of Natural Science and Petrified Forest Chemnitz, and Ralf Werneburg, Museum of Natural History Schleusingen.

Fig. 1.: Group photo during the Field Meeting on Carboniferous and Permian Nonmarine-Marine Correlation (CPC 2014), held at the Technical University Bergakademie Freiberg in Germany from July 21 to July 27, 2014.

On July 21, after the scientific session in Freiberg a joint SPS and SCCS business meeting together with a meeting of the "Sino-German Cooperation Group on Late Palaeozoic Palaeobiology, Stratigraphy and Geochemistry" was held. The meeting was chaired by Barry Richards for the SCCS, by Joerg W. Schneider for the SPS, and Hans Kerp for the Sino-German Cooperation Group. The most important outcomes of the meeting were firstly that the workers from the various continental basins should be challenged to promote their detailed local and regional knowledge toward the global aims of the SCCS and SPS. Reports on methods, results and perspectives of nonmarine as well as nonmarine – marine intra-basinal and inter-basinal correlations as well as of global correlations should be summarized in nonmarine-marine correlation charts (see below, Fig. 4). A second important outcome was the decision to establish cooperative research proposals to achieve the central goals of the working group. It was agreed that the proposals must be suitable for raising funds from various national and international sources for the realisation of our scientific goals. Fortunately, first activities of the second point have already been realised in 2014 as outlined below.

From September 6 to 18 a collaborative field work that included a meeting of the Sino-German Cooperation Group and a SPS workshop chaired by Shuzhong Shen, Joerg W. Schneider, Hans Kerp and supported by the Vice Chair of the SCCS, Xiangdong Wang, was carried out in northwest China, Xinjiang Uyghur Autonomous Region. The fieldwork and the meeting focused on Late Permian and Permian/Triassic boundary nonmarine-marine correlations. The fieldwork during these two weeks and the preceding four weeks of fieldwork of a Sino-German team (PhD students from Nanjing and Freiberg) in South and North China were very successful. A wealth of samples around the PT-boundary for conchostracan and fossil plant biostratigraphy, isotopic ages and geochemistry was recovered from the excellent outcrops (Fig. 2) for collaborative studies.

Fig. 2.: Continental Permian-Triassic transitional profile at Dalongkou in NW China, Xinjiang Uyghur Autonomous Region, sampled for conchostracan biostratigraphy, paleobotany and geochemistry during field work of the Sino-German cooperation group in September 2014.

In direct alignment with the goals of the Nonmarine-Marine Correlation Working Group the international "Kazan Golovkinsky Stratigraphic Meeting" was held from the 20 to 23 of October 2014 at the Kazan Federal University, Russian Federation, Republic of Tatarstan. The meeting was dedicated to "Carboniferous and Permian Earth systems, stratigraphic events, biotic evolution, sedimentary basins and resources" (Nurgaliev *et al.*, 2014). Participants from Tatarstan, other federal republics of Russia, Germany, South and North Africa as well as France presented and discussed the latest results on marine and nonmarine Carboniferous and Permian biostratigraphy. During the meeting a further business meeting of the SCCS and the SPS was held, chaired by Alexander S. Alekseev, the chairman of the Russian Commission on Carboniferous Stratigraphy, and J.W. Schneider. Additionally, a meeting of the organizing committee of the XVIII International Congress on the Carboniferous and Permian (ICCP 2015) in Tatarstan, Russia, chaired by Vladimir V. Silantiev, the congress secretary, and Alexander S. Alekseev, was held. Preceding the meeting, five days of fieldwork and sampling for biostratigraphy and isotopic ages have shown the high quality of the outcrops in the Volga-Kama region of Tatarstan for the solution of the global Middle-Late Permian nonmarine-marine correlation problem (Fig. 3). Additionally, the excellent preparation and documentation of the outcrops on the East European platform for the ICCP 2015 excursions was

demonstrated. This congress, for the first time held in the name-giving area of the Permian System, will be surely a very stimulating highlight for the tasks of the SCCS and SPS.

Fig. 3.: Outcrop of Middle to Late Permian fossiliferous continental deposits at the Monastery Ravine on the right bank of Volga River near Tetyushi town (180 km south of Kazan) in the Volga-Kama region of the East European Platform. V. Davydov, V. Golubev, and M.Arefiev sampling volcanic ashes.

Summarizing the results of the last few years, the present state of nonmarine-marine correlation is demonstrated by Schneider *et al.* (2014). It is shown that starting from the early Kasimovian, i.e. the base of the Late Pennsylvanian, to the Sakmarian/Artinskian transition in the Middle Cisuralian, several good and reliable direct biostratigraphic correlations between mixed marine-continental and purely continental profiles in North America and Europe do exist. They are also partially well supported by some isotopic ages. But, beginning in the Middle Cisuralian and lasting up to the Early Lopingian, no link of Euramerican continental deposits to the marine standard scale exists thus far. This lack of data is mainly caused by the transition from wet to dry red beds during the Kungurian (Schneider *et al.*, 2010; Oplustil *et al.*, 2013) and a thereby mostly restricted fossil content apart from tetrapod tracks and conchostracans. Additionally, most Euramerican continental profiles are very incomplete, and interrupted by several hiatuses. A solution of this problem could most likely be found on the Russian Platform in the Ural foreland. As shown by Sennikov & Golubev (2006, 2012), Newell *et al.* (2010), and Silantiev (2014), the sections in the Vladimir region west of Moscow provide a biostratigraphically well subdivided and uninterrupted sedimentary record from the late Early Permian (Kungurian) to the Middle Triassic (Ladinian). Correlations to the marine scale are tentative thus far. Fortunately, just recently in similar late Cisuralian to middle Lopingian sections of the Volga-Kama region near Kazan, volcanic ash horizons were discovered (pers. com. V. Davydov), which will enable more reliable correlations to the marine time scale. The correlation of the various continental basins with those sections on the Russian platform will be one of the most promising future tasks of the working group.

As discussed during the Freiberg meeting this year, the best way to promote nonmarine-marine correlations will be the joint compilation of annotated correlation charts (see e.g., Roscher & Schneider, 2005) by all interested colleagues. The result should be a joint publication of all contributors by the end of 2015 as was done by Menning *et al.* (2006). To start the work, a preliminary correlation chart of several basins is presented here (Fig. 4). We know this chart is wrong in many details, but it should provoke the researchers of the respective basins to contribute his/her detailed knowledge and to improve the interbasinal correlations and the correlation with the international chronostratigraphic scale. Those colleagues who are interested in the compilation of the correlation chart should contact Joerg W. Schneider via e-mail. He will send a CorelDraw and/or an Adobe Illustrator file of the chart for improvements as well as an example for the argumentation of correlations as demonstrated, e.g., in Roscher & Schneider (2005). Let us start now!

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Abstract volumes of the Freiberg CPC-2014 Meeting as well as the Kazan Golovkinsky-Meeting 2014 and the CPC-2014 Excursion Guide are available as pdf´s under the following links:

http://tu-freiberg.de/sites/default/files/media/palaeontologie---stratigraphie-1722/schneidj/cpc-2014_bookofabstracts.pdf

http://tu-freiberg.de/sites/default/files/media/palaeontologie---stratigraphie-1722/schneidj/cpc-2014_excursionguide.pdf

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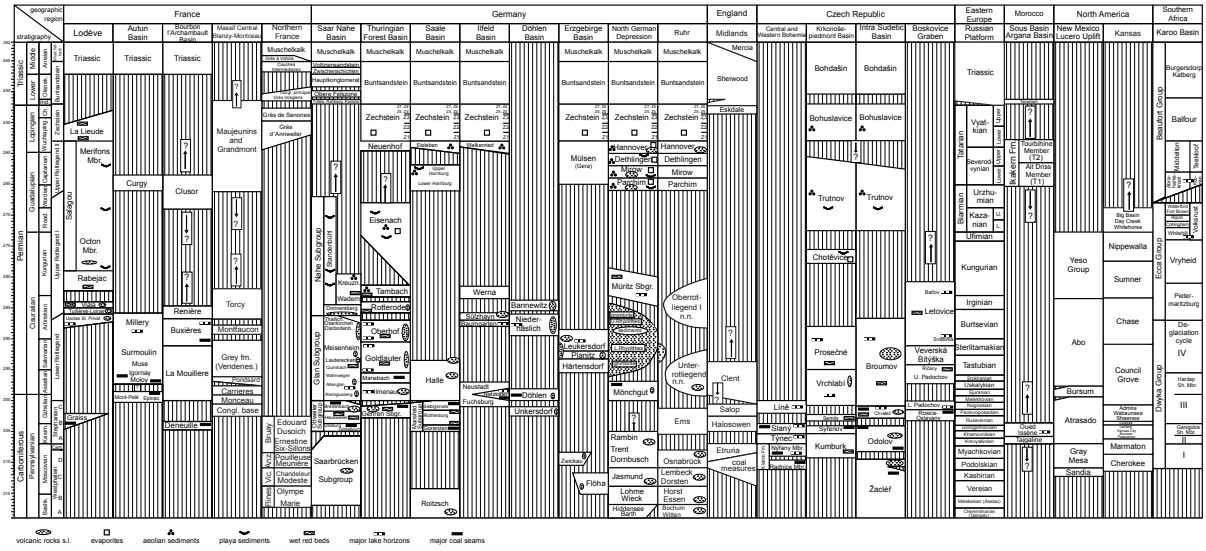

Fig. 4.: Example of a nonmarine-marine correlation chart. It should provoke the researchers of the respective basins to contribute his/her detailed knowledge and to improve the interbasinal correlations and the correlation with the international chronostratigraphic scale. If you are interested in the joint compilation and publication of a global nonmarine-marine late Carboniferous to Early Triassic correlation chart, please ask JWS (Joerg.Schneider[at]geo.tu-freiberg.de) a for CorelDraw or Adobe Illustrator file of the chart and for the annotations of your correlations.

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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)

DEFINING NORTH AMERICAN PENNSYLVANIAN STAGES

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Abstract

In North America, the Pennsylvanian Subsystem is divided into three provincial series and five provincial stages. This chronostratigraphy is widely used, but little effort has been made to define boundary stratotypes for the North American Pennsylvanian stages. A brief review of their history and the status of their boundary stratotypes indicates the need to formalize this useful secondary standard for Pennsylvanian time.

Introduction

Globally, the Carboniferous System is divided into Mississippian and Pennsylvanian Subsystems (Heckel & Clayton, 2006), which in North America are subdivided into provincial series and stages that were originally defined in the mid-continent of the USA (Figs. 1-2). This provincial timescale can be correlated primarily by ammonoid, conodont and fusulinid biostratigraphy to the standard global subdivisions (sgcs = standard global chronostratigraphic scale) of the Carboniferous (e. g., Davydov *et al.,* 2004, 2010; Heckel & Clayton, 2006; Ogg *et al.,* 2008; Schmitz & Davydov, 2012). However, the vast majority of geologists that work in North America use the provincial series and stages, not the sgcs.

This Pennsylvanian provincial timescale provides a robust basis for correlation of the North American Pennsylvanian rocks and thus is a valuable secondary standard *sensu* Cope (1996). However, the origins of the North American chronostratigraphic units are obscure to many geologists. Most of them still lack precisely-defined boundaries, and their stratotypical sections pose problems such as unconformities and unfossiliferous facies that render them somewhat problematic for correlation (e.g., Sutherland & Manger, 1983; Lane & West, 1984; Boardman *et al.,* 1989). Indeed, correlation to the sgcs (Fig. 2) is still somewhat imprecise, though well enough established that events calibrated by the provincial stages of the Pennsylvanian can be correlated to the sgcs with some certainty.

North American Pennsylvanian Series and Stages

Williams (1891) introduced the term Pennsylvanian, and its type strata are exposed in the coalfields of Pennsylvania. These are largely nonmarine rocks correlated primarily by fossil plant biostratigraphy. The need for a Pennsylvanian timescale based on marine strata and fossils in North America forced attention westward to the mid-continent, especially to Iowa, Kansas, Oklahoma and Arkansas (Fig. 1).

Initial efforts attempted to divide the Pennsylvanian Subsystem into four or five series (Bend, Des Moines, Pottawatomie and Virgil: Moore, 1933; or Morrowan, Desmoines, Missouri and Virgil: Moore, 1937; or Morrow, Lampasas, Des Moines, Missouri and Virgil: Moore *et al.*, 1944) but finally resolved into five "series," the Morrowan, Atokan, Desmoinesian, Missourian and Virgilian (Cheney, 1940). Although the original subdivisions of the Pennsylvanian were labeled series they have long been considered stages (e.g., Heckel & Clayton, 2006). They were originally conceived of as time-rock units with boundaries placed at distinct unconformities.

From 1930 through the mid-1940s, a serious effort was made to standardize Pennsylvanian chronostratigraphic nomenclature in the United States, headed by committees of the National Research Council (final report: Moore *et al.,* 1944) and of the American Association of Petroleum Geologists (final report: Cheney *et al.,* 1945). Moore & Thompson (1949) coined names for the Pennsylvanian series (Ardian, Oklan and Kawvian), but these have not been used, so the Pennsylvanian series in North America are simply referred to as Lower, Middle and Upper Pennsylvanian (Fig. 2). Moore & Thompson (1949) also advocated that the previously used series terms (Morrowan, Atokan, etc.) be regarded as stages, and that is the way they have since been labelled.

Here, I briefly review the origin of the North American Pennsylvanian stage terms, and the current status of their boundary definitions. My goal is to argue that it is time to agree on boundaries for these stages and to advance some possibilities.

Morrowan base

Adams and Ulrich (1904) named the Morrow Formation for a shaley unit in southeastern Arkansas and eastern Oklahoma (Fig. 1). Harlton (1930) first

Fig.1. Map of the United States showing principal locations discussed in the text. They are: Ar = Arrow Canyon; At = type area of Atokan; D = type area of Desmoinesian; De = type area of Derryan; M = type area of Morrowan; Mi = type area of Missourian; N = Nowata County, Oklahoma; V = type area of Virgilian.

referred to the Morrowan as a series. The Morrowan Stage was based on these strata, which are ~100 m of fossiliferous shale, sandstone and limestone. The primitive fusulinids *Millerella* and *Eostafella* (to the exclusion of more advanced, normal long-axis fususlinids) have long been deemed characteristic of the Morrowan, and the stage has thus been equated to the Zone of *Eostafella-Millerella* (e.g., Douglass, 1977; Wilde, 1990, 2006). Correlation of the Morrowan to the sgcs based on ammonoids, conodonts and non-fusulinid foraminiferans indicates it is lower to middle Bashkirian (Fig. 2).

The mid-Carboniferous boundary (base of Pennsylvanian, which in North America = base of Morrowan) has a formally-defined GSSP (global stratotype section and point) at Arrow Canyon, Nevada (Fig. 1), with its primary signal the FAD (first appearance datum) of the conodont *Declinognathodus noduliferus* (Lane *et al.,* 1999). It could be argued that this formally defines the base of the Morrowan. However, it does not precisely correspond to fusulinid-based concepts of the Morrowan (Lane *et al.,* 1999). This mismatch of a Morrowan base identified by conodonts versus a younger base using fusulinids merits discussion and evaluation.

Atokan base

The Atoka Formation of Taff & Adams (1900) is a very thick succession (more than 2100 m) of sandstone and shale in eastern Oklahoma and western Arkansas (Fig. 1). Spivey & Roberts (1946), working in central Texas, proposed that the Atokan Series refer to post-Morrowan and pre-Desmoinesian strata that fit into a post-*Millerella* and pre-*Fusulina (= Beedeina)-Wedekindellina* interval in the fusulinid zonation. Moore & Thompson (1949) used Atokan as a stage. The Atoka Formation strata are sparsely fossiliferous, but based on their fusulinid record, they became the basis of the widely used Atokan Stage (see articles in Sutherland & Manger, 1984). Thus, the Atokan has long been perceived to encompass three fusulinid zones (in ascending order): the Zones of *Eoschubertella-Pseudostaffella*, *Profusulinella* and *Fusulinella* (e.g.,

Douglass, 1977; Wilde, 1990, 2006). Conodont and ammonoid correlations indicate that the Atokan is equivalent to the lower Bashkirian-lower Moscovian on the sgcs (Fig. 2).

Thompson (1942) described the Derryan Series based on beautifully exposed and richly fossiliferous strata in the Derry Hills of southern Sierra County, New Mexico (Fig. 1). Although the Derryan formerly had currency as an alternative to the Atokan Series, this unit has faded from the scene. Its lower boundary posed intractable problems and its relatively thin type section (< 60 m) is also a drawback of the Derryan that made it inferior to the Atokan as a chronostratigraphic unit (Sutherland & Manger, 1983, 1984; Lucas *et al.,* 2012).

The need for an Atokan stratotype has long been identified (Sutherland & Manger, 1984), and Langehmeim *et al.* (1984) proposed a candidate section, though no further action has been taken. I favor a base of the Atokan at the first appearance datum (FAD) of *Eoschubertella* with a boundary stratotype section at Arrow Canyon, Nevada. Clearly, further work and discussion is needed.

Desmoinesian base

Keyes (1893) named the Des Moines beds for sandstone, shale, clay and coal beneath the Missouri Formation along the Des Moines River in central

Iowa. The unit was later called the Des Moines Group and is now the Desmoines Supergroup (Ravn *et al.,* 1984). It is as much as 250 m of cyclically-bedded shale, limestone, coal and sandstone.

Moore (1932) used the term Desmoinesian Series, and it has long been equated with the fusulinid Zone of *Beedeina* (formerly *Fusulina*) (e.g., Moore & Thompson, 1949). Its lower and middle parts are distinguished by the co-occurrence of the fusulinids *Beedeina* and *Wedekindellina,* and the upper part lacks *Wedekindellina.* Species of these two genera have been used to define various Desmoinesian fusulinid zones (Wilde, 1990, 2006). Ammonoids and conodonts equate the Desmoinesian to the middle-late Moscovian-early Kasimovian (Boardman *et al.,* 1994; Barrick *et al.,* 2004) (Fig. 2). The first appearance of the conodont *Idiognathodus obliquus* is very close to the base of the traditional Desmoinesian (= FAD of *Beedeina*) and might be used to define its base (Lambert, 1992; Boardman *et al.,* 1994; Heckel, *in* Menning *et al.*, 2006).

Wahlman (2013) recently proposed to relocate the base of the Desmoinesian below the LO of *Beedeina*, at the base of the *Fusulinella iowensis* zone. He did this based on conodont biostratigraphy, stating that "*Fusulinella iowensis* is now considered to be Desmoinesian in age, based on its occurrence with Desmoinesian conodonts" (Wahlman, 2013, p. 76). I view this differently, as there are no *a priori* Desmoinesian conodonts, and I believe that the long used LO of *Beedeina* provides the best primary signal by which to correlate the base of the Desmoinesian. At present, I am working with others (Allen, Barrick, Krainer, Vachard) to propose a possible boundary stratotype for the Desmoinesian base in southern New Mexico.

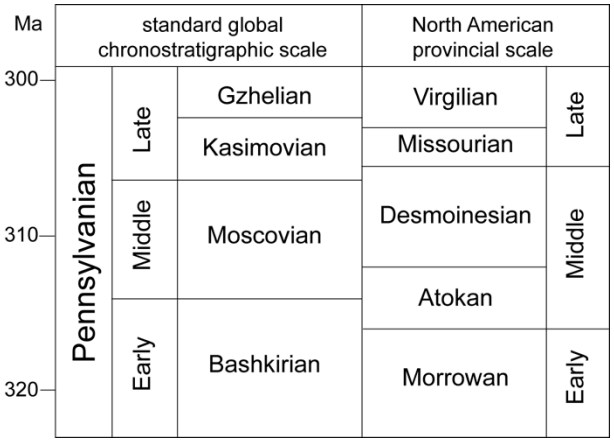

Fig 2. Correlation of North American Pennsylvanian provincial timescale to standard global chronostratigraphic scale and the latest estimate of a numerical timescale for the Pennsylvanian (correlation after Heckel & Clayton, 2006; numbers after Davydov *et al.,* 2010; Schmitz & Davydov, 2012).

Missourian base

The Missourian is based on Keyes (1893) term Missouri "terrane" in Iowa, named after the Missouri River in northwestern Missouri. This interval is ~ 150-200 m of cyclically-bedded limestone, shale and sandstone. Moore (1931, 1932) used the term as a series. It is considered by many to be approximately equivalent to the lower part of the fusulinid zone of *Triticites*, although *Triticites* actually appears well above the base of the Missourian. The fusulinid *Eowaeringella* first appears close to the base of the Missourian, and as many as four fusulinid zones have been proposed to subdivide the Missourian (Wilde, 1990, 2006). Missourian time encompasses three ammonoid zones and five conodont zones (Boardman *et al.,* 1994; Barrick *et al.,* 2004). It correlates to much of the Kasimovian of the sgcs (Fig. 2).

The base of the Missourian can be characterized by various extinction events, including that of the fusulinid *Beedeina*, the chonetid brachiopod *Mesolobus* and the conodont *Neognathodus*, as well as origination events including the first appearances of the fusulinid *Eowaeringella* and the ammonoid *Pennoceras* (Boardman *et al.*, 1989). One currently advocated definition of the Missourian base is that it is equivalent to the first appearance of the conodont *Idiognathus eccentricus* in the Exline cyclothem of the mid-continent (Heckel *et al.,* 2002, 2007).

Heckel *et al.* (2002) presented a fairly rigorous proposal for a basal Missourian boundary stratotype (they called it a "reference section") at Little California Creek in Nowata County, Okalhoma. The boundary here is identified by the FAD of the conodont *Idiognathus eccentricus.* To my knowledge, there has been no further discussion or evaluation of this proposal.

Virgilian base

Moore (1931, 1932) introduced the term Virgil Series to refer to the uppermost Pennsylvanian rocks in Kansas. He coined the name for the town of Virgil in Greenwood County, southeastern Kansas, where a stratigraphic section of Virgilian age is exposed. This section - the Douglas, Shawnee and Wabaunsee groups - is ~ 420 m of cyclically-bedded limestone, shale and sandstone.

The Virgilian base was originally taken to be the unconformity at the base of the Stranger Formation, which is the top of the Missourian locally. However, biostratigraphic criteria to correlate the base of the Virgilian long remained unstated, despite acceptance of this boundary. Boardman *et al.* (1989) appear to be the first to have suggested such criteria, in particular using the FAD of the conodont *Streptognathodus zethus* to mark the base of the Virgilian.

Heckel (1999) has used the FAD of the conodont *Streptognathodus zethus* in the Cass cyclothem to define the base of the Virgilian (also see Heckel *et al.,* 2007). The FAD of the fusulinid *Waeringella* is close to the base of the Virgilian, and the stage is equated with the upper part of the fusulinid zone of *Triticites* (e. g., Douglass, 1977; Wilde, 1990, 2006). The Virgilian encompasses two ammonoid zones and five conodont zones (Boardman & Work, 2004), and the Virgilian and Gzhelian are approximately coeval (Fig. 2). Clearly, a proposal for a boundary stratotype of the Virgilian base is possible in Kansas, but has not been advanced.

Wolfcampian base

Almost two decades ago, the GSSP for the base of the Permian System (base of the Asselian Stage) was defined at Aidaralash Creek near Aktobe in western Kazakhstan (Davydov *et al.*, 1998). Most workers agree that this definition moved the Carboniferous-Permian boundary upward into the lower part of the Wolfcampian provincial series/stage (long regarded as lowest Permian) of North America. There have been diverse efforts to fix the "mismatch" caused by having the system base within a stage, instead of corresponding to the base of the stage.

For example, Baars *et al.* (1992, 1994a, b) proposed to expand the Virgilian to encompass the older part of the Wolfcampian, so that the Virgilian-Wolfcampian boundary still corresponds to the Carboniferous-Permian boundary. However, some fusulinid workers oppose the simple solution of moving the Virgilian-Wolfcampian boundary upward. Ross & Ross (1994) advocated erecting a new unit, the Bursumian Stage, between the top of the traditional Virgilian and the new systemic boundary. However, the rocks proposed as a stratotype, in south-central New Mexico, have serious shortcomings to define such a chronostratigraphic unit (Lucas *et al.,* 2002). Thus, Wilde (2002) rejected the Bursumian Stage primarily because its boundaries could not be precisely defined in the Orogrande basin of southern New Mexico, where the Bursum lithosome crops out. Instead, Wilde (2002, 2006) proposed the Newwellian as a substage of the Wolfcampian, based on fusulinid biostratigraphy in the Horquilla Formation in the Pedregosa basin of southwestern New Mexico, where precise boundaries can be defined for an early Wolfcampian subdivision. He also advocated moving the Carboniferous-Permian boundary back to the base of the Wolfcampian.

I have pointed out problems with the Aidaralash GSSP for the base of the Permian, particularly the rarity, problematic taxonomy and evident diachroneity of its primary signal, the FAD of the conodont *Streptognathodus isolatus* (Lucas, 2013a, b). Therefore, like Wilde, I advocate returning the base of the Permian in North America to the base of the Wolfcampian until the problem of the basal Permian GSSP is resolved.

Conclusions

In a volume on a symposium on the Atokan Stage held in 1982, Sutherland & Manger (1984, p. 111) stated that "a general conclusion of the symposium…is that the next step in stabilizing Pennsylvanian chronostratigraphic nomenclature and stratigraphic procedure on a continent-wide basis is to work toward the selection of boundary stratotypes both for the Pennsylvanian System and for its various series [stages]." During the more than 30 years since that was published, boundary stratotypes have been chosen to define the limits of the Pennsylvanian, but little effort has been devoted to defining boundary stratotypes for the North American Pennsylvanian stages. Furthermore, the current mismatch of global Pennsylvanian series and those recognized in North America (Fig.2) has not been addressed.

The North American provincial timescale for the Pennsylvanian is widely and frequently used, and will not go away. It is long past time that the chronostratigraphic units of this timescale have a set of boundary stratotypes. Thus, the proposal, discussion and evaluation of such stratotypes should be pursued to refine a very useful secondary standard of Pennsylvanian chronostratigraphy.

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LATE BASHKIRIAN AND MOSCOVIAN (PENNSYLVANIAN) CONODONT *"STREPTOGNATHODUS" EINORI* NEMIROVSKAYA & ALEKSEEV, 1994, AND RELATED SPECIES FROM THE LUOKUN SECTION, SOUTH CHINA

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Abstract

Troughed conodont species with short carina and ventrally located lobes, distinguished from the lower Moscovian deposits of the Askyn section, South Urals, described as *Streptognathodus einori* by Nemirovskaya and Alekseev, 1994, was found in the Luokun and Naqing sections, South China. It spans the interval here from the middle Bashkirian through the Moscovian. As troughed conodont species with abovementioned features were recently assigned to newly erected genus *Swadelina* Lambert, Heckel and Barrick, we believe that *Str. einori* also belongs to the *Swadelina* genus. *Sw*. *einori* and the other species with similar characters, found in the Bashkirian and Moscovian deposits in the Luokun and Naqing sections such as *Sw*. *subdelicatus*, *Sw*. sp. 1, *Sw*. sp. 2 and *Sw*. *concinna* are all regarded as a closely related group and assigned in this paper to the genus *Swadelina*. Thus the stratigraphic range of the *Swadelina* genus is extended in South China down to the middle Bashkirian while in North America and Europe it is known only within the Moscovian.

Introduction

The limestone-dominant Luokun section is located in southern Guizhou Province 27.6 km from the city of Luodian, Guizhou, South China, and is close (10 km to the west) to the famous Naqing section (Fig. 1). These two sections are lithologically similar and have similar conodont distribution patterns. The conodont studies in the Naqing section started in 1983 (Xiong & Chen, 1983) but the present phase began with the work of Wang & Qi (2002), Wang *et al*. (2004). The Luokun section was discovered and first sampled for conodonts in 2009 (Qi *et al*., 2010; Wang *et al*., 2014).

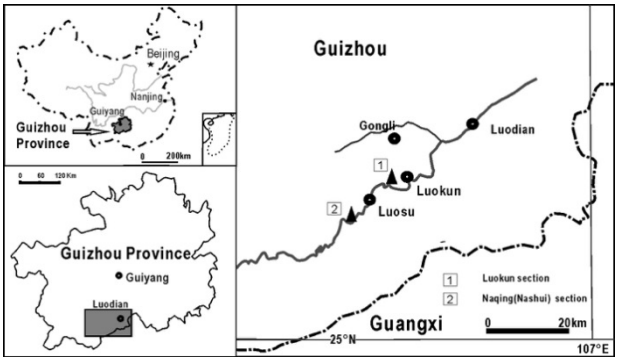

Fig 1. Location map of the Luokun section in southern Guizhou Province, South China.

Recent detailed study of the Pennsylvanian conodonts of the Luokun section provides us a better understanding of the evolution of Moscovian conodonts and their relationship to late Bashkirian and early Kasimovian conodonts. In this paper, we think the conodont species *Swadelina einori* (Nemirovskaya & Alekseev, 1994) and the Moscovian conodonts of the *Swadelina* genus are closely related.

The studied interval (upper Bashkirian and Moscovian) in the Luokun section is characterized by the alternation of lime wackestone, packstone and grainstone, with interlayers of the siliceous limestone. The 93.25 m thick studied interval starts at 112.75 m above the base of the section (upper Viséan) and extends upward to 206.0 m (upper Moscovian). The overlying part of the section is covered. The mid-Carboniferous boundary was located in this section by the discovery of *Declinognathodus noduliferus* (Ellison & Graves, 1941) *s. s.* at 98.1 m above the base of the section (Hu *et al*., 2016). The Bashkirian/Moscovian boundary is probably close to the 121.0 m level and is defined by the first occurrence of *Diplognathodus* aff. *ellesmerensis* Bender, 1980 and the foraminifer *Aljutovella aljutovica* Rauser-Chernousova, 1938. *Declinognathodus donetzianus* Nemirovskaya, 1990, has not been found in the Luokun section.

The conodonts of the studied interval are represented by genera that typify this level in sections elsewhere and include: *Idiognathoides*, *Idiognathodus*, *Neolochriea*, *Neognathodus*, "*Streptognathodus*", *Mesogondolella*, *Gondolella*, *Hindeodus*, *Rhachistognathus*, and *Swadelina*. In the studied interval (upper Bashkirian and Moscovian), *Idiognathoides sinuatus* Harris & Hollingsworth, 1933, *Id. sulcatus sulcatus* Higgins & Bouckaert, 1968, *Id. ouachitensis* (Harlton, 1933) are common only in the upper Bashkirian and lower Moscovian. Their single elements occur in the mid-Moscovian and species of *Idiognathodus* dominate at many levels. Several new species of *Idiognathodus* are common. The species known elsewhere such as *I. sinuosus* Ellison & Graves, 1941, *I. praeobliquus* Nemyrovska, Perret-Mirouse & Alekseev 1999, and *I. obliquus* Kossenko & Kozitskaya, 1978 in Kozitskaya et al. 1978 are rare. Long-ranging species of *Neolochriea*, known elsewhere in the World in only the lower Bashkirian, extend upwards in the Luokun section to the lower part of the upper Moscovian. Species of *Neognathodus* are rare throughout the studied interval but *Neognathodus kanumai* Igo, 1974, *N. medadultimus* Merrill, 1972, *N. roundyi* (Gunnell, 1931), *N. inaequalis* Kozitskaya and Kossenko 1978 in Kozitskaya et al. 1978, and some new forms occur. *Mesogondolella* is represented by *M. donbassica* (Kossenko, 1975), which is common throughout the Moscovian. *Gondolella laevis* Kossenko, 1975 also occurs in the studied interval.

Two specimens of *Rhachistognathus prolixus* Baesemann & Lane, 1985 were found in the lower Moscovian deposits of the Luokun section at 170.3 m. This species is also known from the lower Bashkirian of the Naqing section (Wang & Qi, 2003).

"*Streptognathodus*" is represented by several species. "*Str*." *expansus* Igo & Koike, 1964 and "*Str*." *suberectus* (Dunn, 1966), which might be regarded as one species, are common in the studied interval. The first occurrence of *Swadelina einori* (Plate 1, figs. 4-11) occurs at 112.75 m above the base of the section together with "*Str*." *expansus*.

Swadelina einori was erected as *Streptognathodus einori* from the lower Moscovian deposits of the Askyn section (the Bashkirian stratotype) of the South Urals, Russia (Nemirovskaya & Alekseev, 1994). It was the earliest troughed conodont species found in the lower Moscovian in the South Urals. The presence of a trough along the platform axis of the P_1 elements is a generic feature. Recently the late Desmoinesian troughed conodonts were distinguished as an independent clade (genus *Swadelina*) and were eliminated from the real Kasimovian-Gzhelian *Streptognathodus* species (Lambert *et al*., 2003). We agree with this revision; consequently, we refer *Str. einori* of Nemirovskaya & Alekseev, 1994 to the *Swadelina* genus. The related species found in the Luokun and Naqing sections, such as *Swadelina* sp. 1, *Sw*. sp. 2, *Sw. subdelicatus* (Wang & Qi, 2003) and *Sw. concinna* (Kossenko, 1975) are also assigned to the genus *Swadelina* in the same manner. All of these species together with *Sw. einori* are regarded herein as one group.

The main features of *Sw. einori* are: 1) presence of a long groove along the platform axis, 2) a relatively short carina (up to one third of the platform length, 3) very short rostral ridges, and 4) two simple and not well developed lobes located on the ventral part of the platform. *Sw. einori* from the Luokun section is almost identical to *Str. einori* from the Askyn section, but the range of this species differs in the two sections.

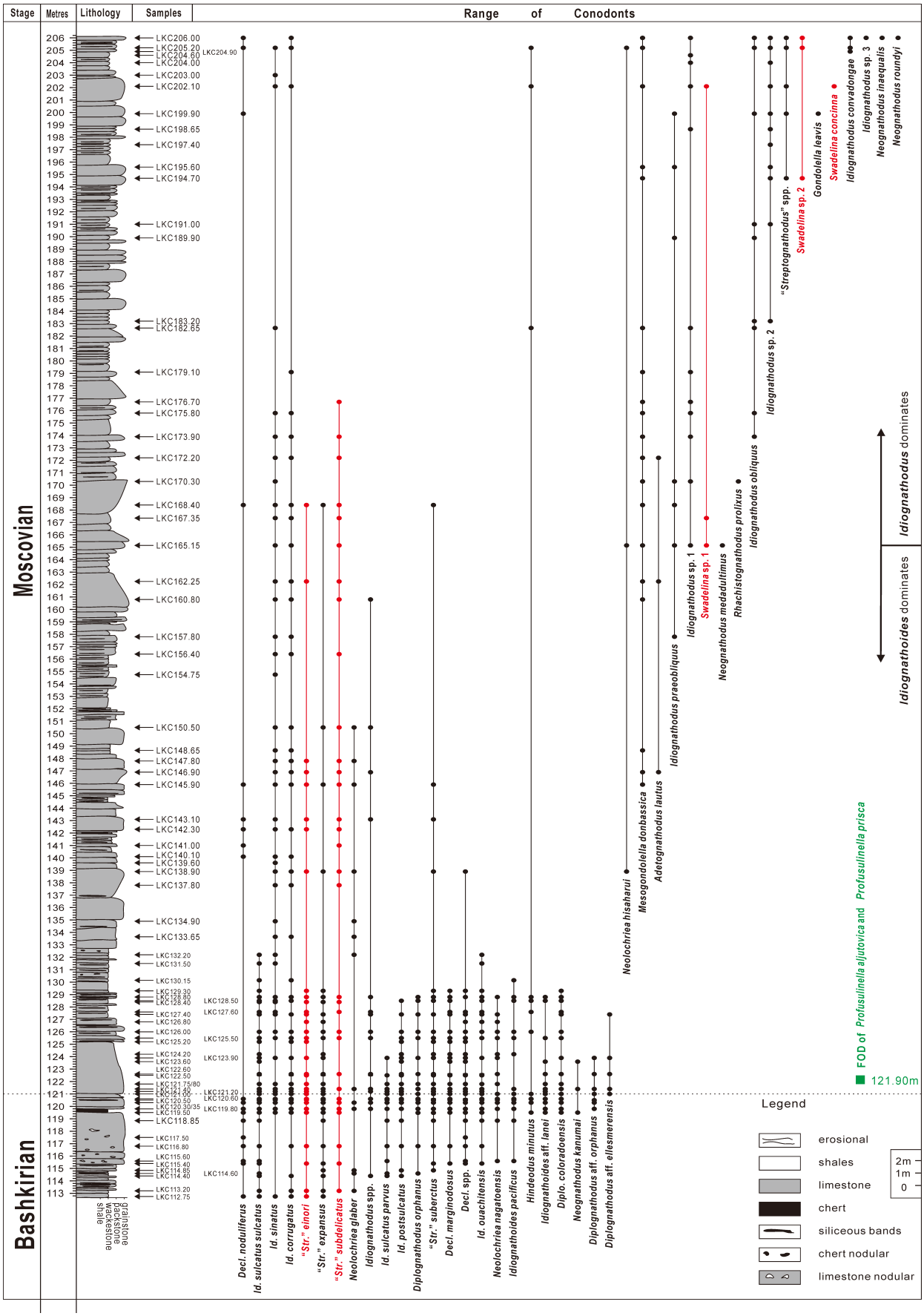

Fig 2. Range chart of conodonts from the studied interval (Middle Bashkirian-lower part of Upper Moscovian) at the Luokun section.

In the Askyn section, four specimens were found in unit 33 of the lower Moscovian Solontsovian Horizon; whereas, in the Luokun section, the entry of *Sw*. *einori* was recorded in middle Bashkirian strata at 112.75 m above the base of the section.

Elements that are very similar to *Sw*. *einori* were found in the upper Atokan and lower Desmoinesian (Klawak Formation and the Ladrones Limestone) of southeastern Alaska (Savage & Barkeley, 1985).

In the studied interval, *Idiognathoides sinuatus*, *Id*. *sulcatus sulcatus*, *Id*. *corrugatus* Harris & Hollingsworth, 1933, *Declinognathodus noduliferus*, "*Str.*" *expansus* and others were found together with the FOD (first occurrence datum) of *Sw*. *einori*. The last occurrence datum (LOD) of *Sw. einori* is at 168.4 m above the base of the section. *Sw. einori* was found at this level together with *Idiognathoides sinuatus*, *Id*. *corrugatus*, *Idiognathodus praeobliquus*, *I*. sp. 1, *Mesogondolella donbassica*, and *Sw*. *subdelicatus* and others.

At a level slightly higher, the FOD of *Sw. einori*, another similar species, *Sw*. *subdelicatus* (Plate 1, figs. 1-3) was found. It was found earlier in the upper Bashkirian in the Naqing section (Wang & Qi, 2003). It is very similar to *Sw*. *einori* but differs from the latter by having an elevated rostral half of the platform along the axis. The LOD of *Sw. subdelicatus* in Luokun section occurs in the middle Moscovian at 176.7 m above the base of the section. Both *Sw. einori* and *Sw. subdelicatus* probably had the same ancestor.

At 165.15 m above the base of the section, another species of the *Sw. einori* group, *Sw*. n. sp. 1 was found. It is very similar to *Sw*. *einori* but differs from the latter by having a shorter carina, narrower groove, more developed caudal lobe, and the elevation of the rostral lobe occurs below the margin of the upper surface of the platform. The accompanying species are: *Neognathodus medadultimus*, *Neolochriea hisaharui* Mizuno, 1997, *Idiognathodus praeobliquus*, *Idiognathoides corrugatus*, *Sw*. *subdelicatus*, *Mesogondolella donbassica*, and numerous *Idiognathodus* n. sp. 1. The latter species dominates at this level. The LOD of *Sw*. sp. 1 is at 202.1 m. It occurs together with *Idiognathodus* n. sp. 2, *Idiognathoides corrugatus*, *Id*. *sinuatus*, *Hindeodus minutus* (Ellison, 1941), *Mesogondolella donbassica*, *Swadelina* n. sp. 2, "*Str*." spp., and a specimen of *Sw*. *concinna*. At this level, *Idiognathodus* sp. 2 dominates. We found only three specimens of *Sw*. sp. 1 in the Luokun section. One is a gerontic specimen and the other two are poorly preserved; consequently, we show the picture of an adult specimen from the lower Moscovian beds of the Naqing section (Plate 1, figs. 22).

Swadelina sp. 2 (Plate 1, figs. 14-18) is characterized by a short carina, V-shaped trough, relatively long rostral ridges, wide platform, incompletely dissected transverse ridges, and well-developed lobes located on the ventral part of the platform. *Swadelina* sp. 2 ranges upwards in the section. It was identified in the last sample of the section at 206.0 m together with *Idiognathodus obliquus*, *I*. sp. 1, *I*. sp. 2, *I*. n. sp. 3, *I. convadongae* Méndez, 2006, *Neognathodus roundyi* (Gunnell, 1931), *Neognathodus inaequalis*, *Idiognathoides corrugatus*, *Mesogondolella donbassica*, *Hindeodus minutus*, "*Str*." spp., and one specimen of *Declinognathodus noduliferus*.

The single specimen of *Swadelina concinna* (Plate 1, fig. 13) is very similar to those from the Donets Basin by having a ventral-most position of lobes, U-shaped trough, length of carina, and rostral ridges. It differs from *Sw*. *einori*, *Sw*. *subdelicatus* and *Sw*. sp. 1 by having longer rostral ridges. It differs from *Sw*. sp. 2 by having shorter rostral ridges and narrower platform.

A specimen of *Swadelina* n. sp. 3 (Pl. 1, fig. 12) from the Naqing section is also illustrated here for comparison with *Sw*. *einori* group.

Thus the troughed platform, short carina, and ventrally located two lobes are the main features of *Sw*. *einori*, as well as all the *Swadelina* species including the latest Moscovian *Sw. subexcelsus* (Alekseev & Goreva, 2001) and the earliest Kasimovian *Sw. makhlinae* (Alekseev & Goreva, 2001), which proves that they are closely related. The origination of the genus *Swadelina* is a subject of discussion. Kossenko (1975) pointed out the relationship of *Sw. concinna* to "*Str.*" *suberectus*. It is, therefore, likely that they had a common ancestor.

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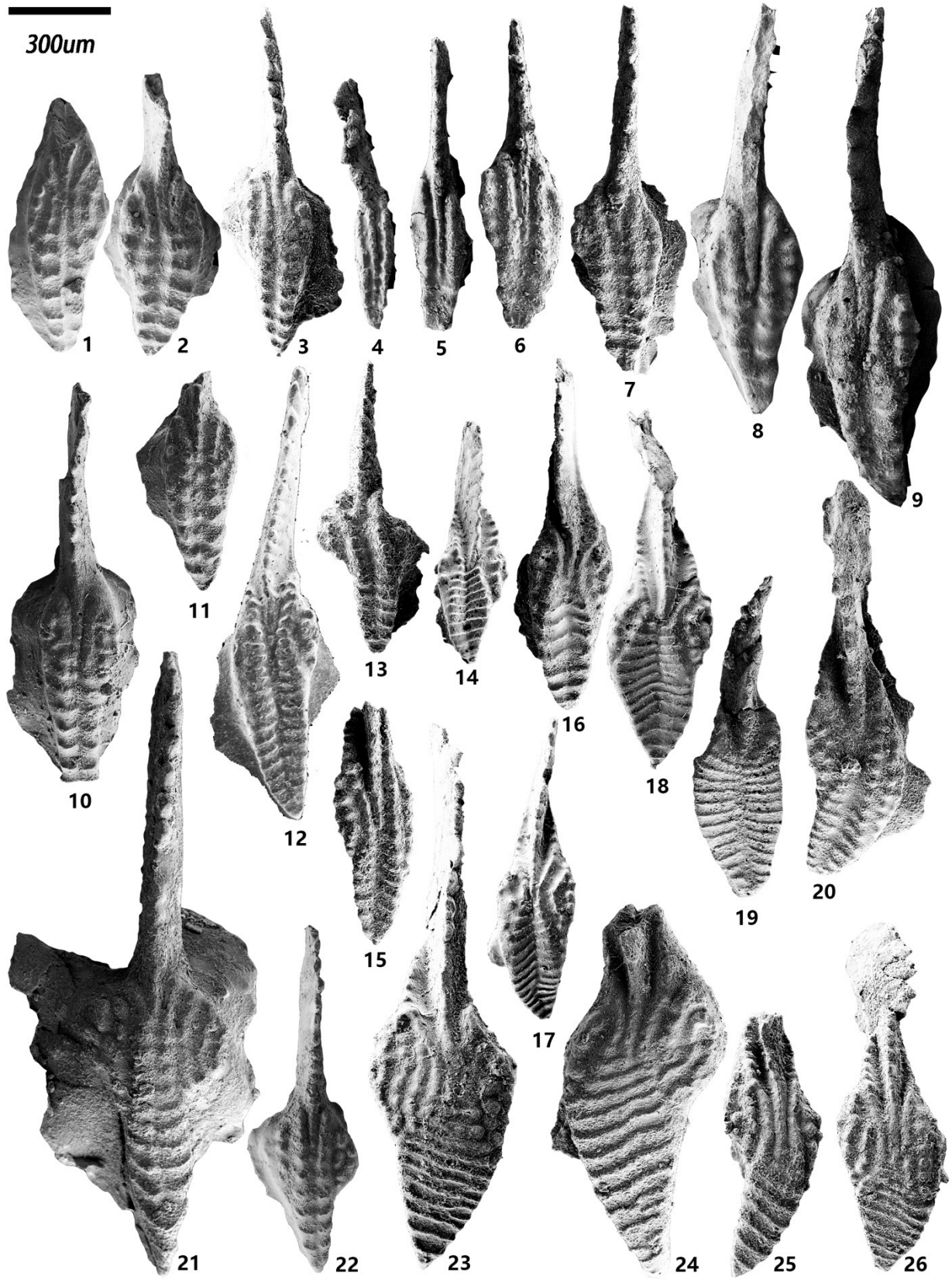
Plate 1. Bashkirian-Moscovian conodonts from the Luokun and Naqing section. All specimens are from the Luokun section except figs. 10 - 12 and 22, which are from the Naqing section. Figs. 1-3. "*Streptognathodus*" *subdelicatus* (Wang & Qi, 2003): 1, 2 – specimens LKC125.5, 3 – specimen LKC176.7. Figs. 4-11. "*Streptognathodus*" *einori* Nemirovskaya & Alekseev, 1994: 4 – specimen LKC120.6, 5, 9 – specimens LKC120.5, 6 – specimen LKC113.2, 7 – specimen LKC142.3, 8 – specimen LKC125.5, 10 – specimen LDC180.5, 11 – specimen LDC179.9. Fig. 12. *Swadelina* n. sp. 3 – specimen LDC231.9. Fig. 13. *Swadelina concinna* (Kossenko 1975) – specimen LKC202.1. Figs. 14-18. *Swadelina* n. sp. 2: 14, 18 – specimens LKC206.0, 15, 16 – specimens LKC194.7,



17 – specimen LKC205.2. Fig. 19. "*Streptognathodus*" *expansus* Igo & Koike, 1964 – specimen LKC168.4. Fig. 20. "*Streptognathodus*" *suberectus* (Dunn, 1966) – specimen LKC168.4. Figs. 21-22. *Swadelina* n. sp. 1: 21 – specimen LKC165.15, 22 – specimen LDC186.1. Figs. 23-24. *Idiognathodus praeobliquus* Nemyrovska, Perret-Mirouse & Alekseev, 1999: 23 – specimen LKC175.8, 24 – specimen LKC168.4. Figs. 25-26. *Idiognathodus obliquus* Kossenko & Kozitskava, 1978: 25 – specimen LKC173.9, 26 – specimen LKC199.9.

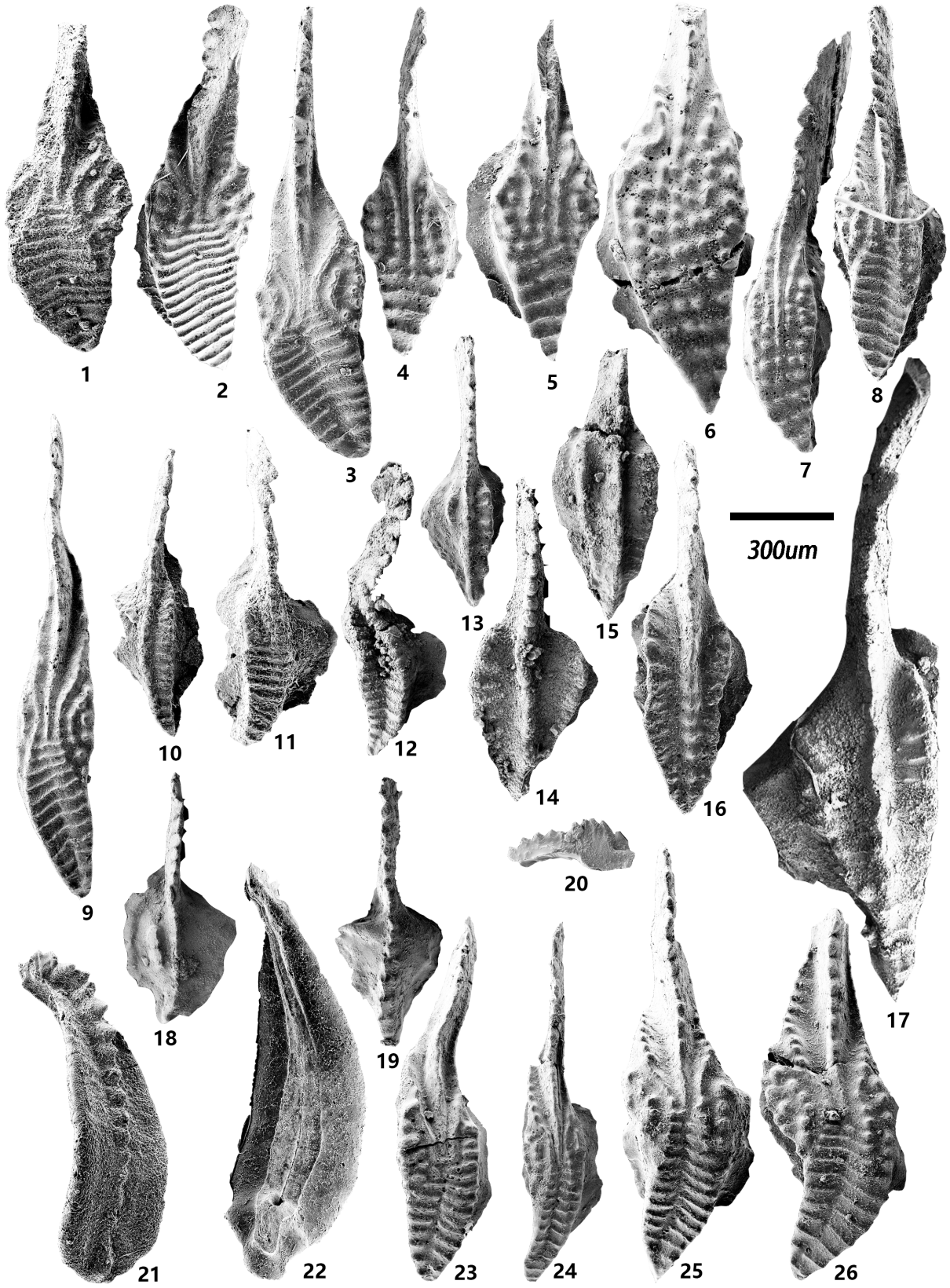


Plate 2. Bashkirian-Moscovian conodonts from the Luokun section. Figs. 1-3. *Idiognathodus* n. sp. 1: 1 – specimen LKC199.9, 2, 3 – specimen LKC206.0. Figs. 4, 5, 7. *Idiognathodus* n. sp. 2 – specimens LKC206.0. Fig. 6. *Idiognathodus* n. sp. 3 – specimen LKC206.0. Figs. 8, 9. *Idiognathodus convadongae* Méndez, 2006: 8 – specimen LKC206.0, 9 – specimen LKC205.2. Fig. 10. *Idiognathoides sinuatus* Harris & Hollingsworth, 1933 – specimen LKC172.2. Fig. 11. *Idiognathoides corrugatus* Gunnell, 1933 – specimen LKC173.9. Fig. 12. *Idiognathoides*

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***ouachitensis* (Harlton,1933) – specimen LKC120.6. Fig. 13. *Neognathodus roundyi* (Gunnell, 1931) – specimen LKC206.0. Fig. 14. *Neognathodus kanumai* Igo, 1974 – specimen LKC123.6. Fig. 15, 17. *Neognathodus* sp. 1: 15 – specimen, LKC120.6, 17 – specimen LKC119.8. Fig. 16. *Neognathodus inaequalis* Kozitskaya et Kossenko, 1978 – specimen LKC206.0. Fig. 18. *Neolochriea nagatoensis* Mizuno, 1997 – specimen LKC125.5. Fig. 19. *Neolochriea hisaharui* Mizuno, 1997 – specimen LKC205.2. Fig. 20. *Diplognathodus* aff. *ellesmerensis* Bender, 1980 – specimen LKC121.0. Figs. 21, 22. *Mesogondolella donbassica* Kossenko, 1975: 21 – specimen LKC194.7, 22 – specimen – LKC206.0. Figs. 23-26. "*Streptognathodus*" spp.: 23, 24, 26 – specimens LKC206.0, 25 – specimen LKC205.2.**

CONODONTS OF KASIMOVIAN-GZHELIAN TRANSITION, USOLKA SECTION, SOUTHERN URALS, RUSSIA: NEW DATA

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Abstract

The Usolka section is proposed as the Global Stratotype Section and Point (GSSP) for the lower boundary of the Gzhelian Stage. In the note summarizes the results of research Kasimovian-Gzhelian boundary interval of the Usolka section.

Introduction

The Usolka section is located on the right bank of the Usolka River (near the northeastern margin of the city of Krasnousolsk) in the Bashkortostan Republic of Russia (Fig. 1). The section occurs in the axial part of the Belsk Depression in the relatively deeper-water portion of the Pre-Uralian Foredeep (Chernykh *et al*., 2006). The Kasimovian-Gzhelian boundary beds in the Usolka section are predominantly a mixed carbonate-siliciclastic succession with numerous volcanic ash beds (Fig. 1, 2). Chernykh et al. (2006) proposed the Usolka section as a potential candidate for establishing a GSSP for the base of the Gzhelian Stage (Chernykh *et al*., 2006; Davydov *et al*., 2008). There have been some concerns about the precise position of the boundary in the section and the first appearance datum (FAD) of the index species of the conodont *Streptognathodus simulator* Ellison, 1941 within the proposed GSSP (Villa *et al*., 2008; 2009; Ueno, 2013).

To confirm the precise position of the FAD of *S. simulator* in the Usolka section we collected additional conodont samples, and re-measured and described the section during field seasons in 2012-2014. Stratigraphic ranges of some important taxa are shown in Figure 1. The succession of the Kasimovian-Gzhelian transition in the section is as follows:

Kasimovian Stage. *Streptognathodus firmus* Zone

41. Grey and massive micritic dolomitized limestone. Conodonts: *Streptognathodus crassus* Chernykh, 2012, *S. praenuntius* Chernykh, 2005, *S. zethus* Chernykh and Reshetkova, 1987 – 0.51 m

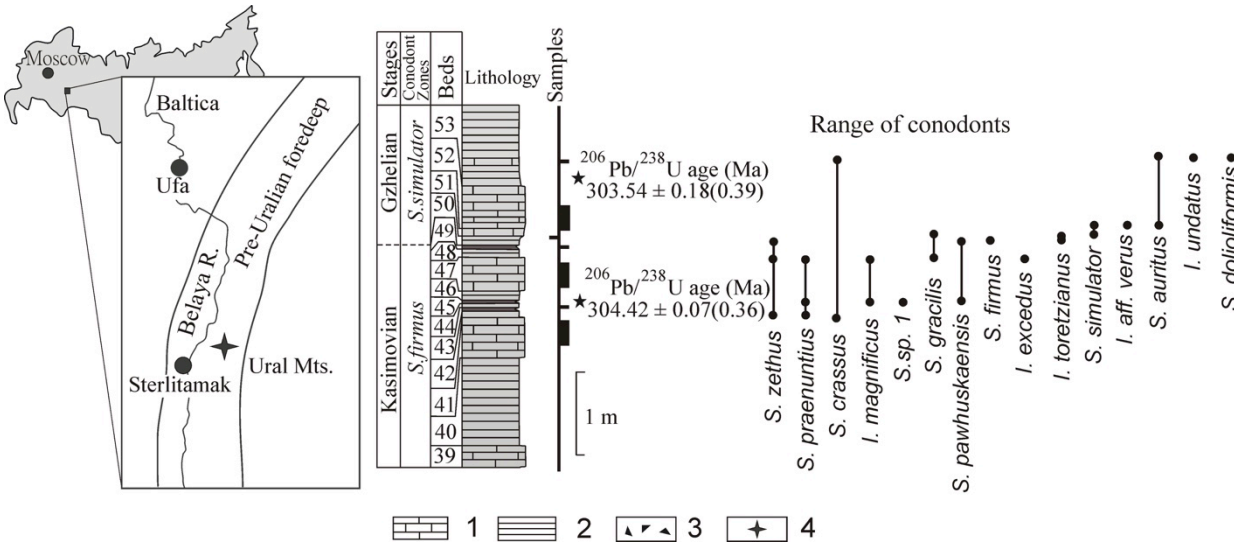

Fig. 1. Location of the Usolka section, distribution of most important conodont taxa across Kasimovian-Gzhelian boundary interval. 1 – limestone, 2 – mudstone, 3 - volcanic ash, 4 - location of Usolka section

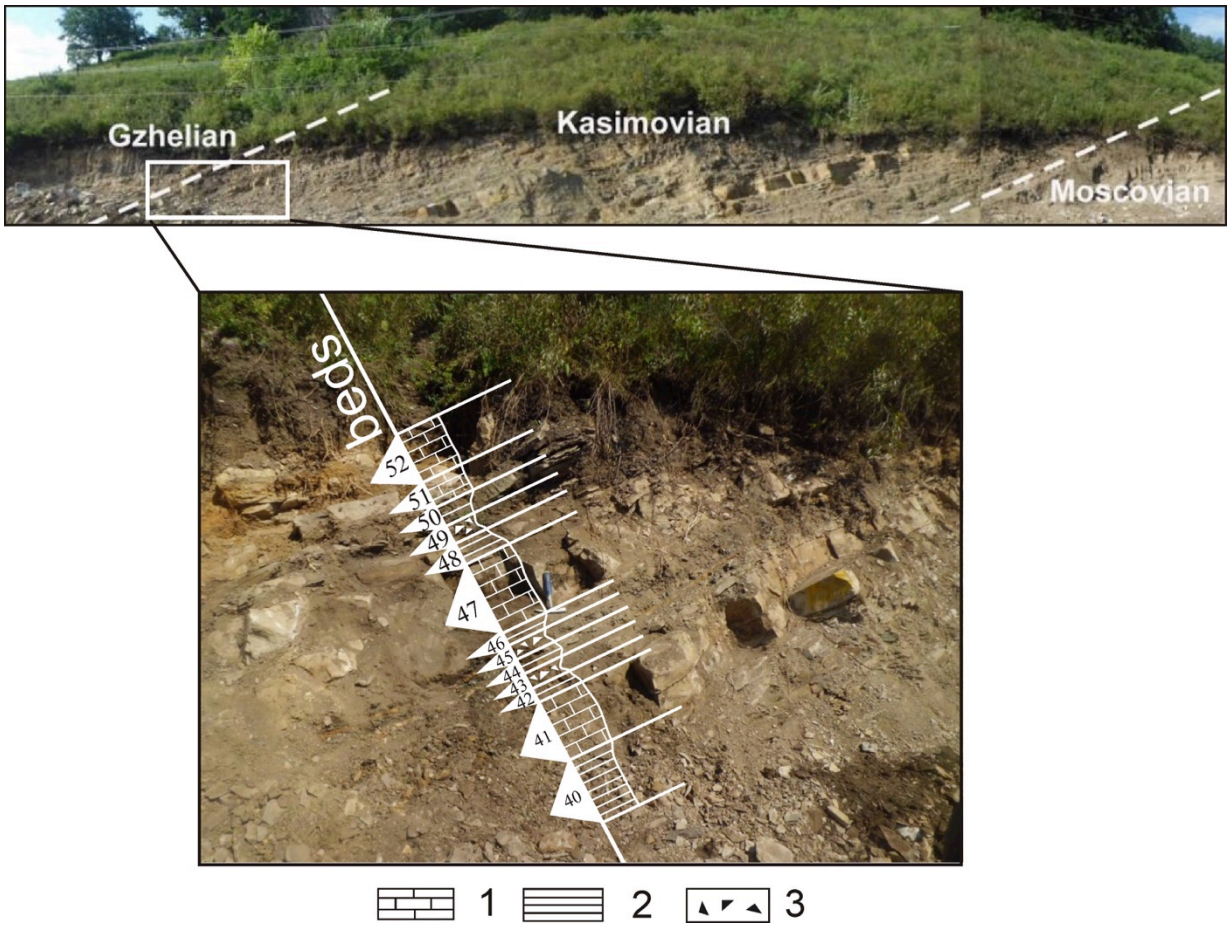

Fig. 2. Photograph of the Usolka Outcrop (location shown in Fig. 1). 1 – limestone, 2 – mudstone, 3 - volcanic ash

thick.

42. Grey mudstone with small phosphatic concretions (2-3 cm in diameter). Conodonts: *Idiognathodus magnificus* Stauffer and Plummer, 1932, *Streptognathodus sp. 1*, *S. pawhuskaensis* Harris and Hollingsworth, 1933, *S. praenuntius* Chernykh, 2005 – 0.06 m thick.

43. Orange-yellow volcanic ash – 0.02 m thick.

44. Grey mudstone with numerous small phosphatic concretions (2-3 cm) – 0.04 m thick.

45. Orange-yellow volcanic ash – 0.01 m thick.

46. Grey mudstone with small phosphatic concretions (3-5 cm) – 0.16 m thick.

47. Grey silicified, dolomitized limestone. Conodonts: *Idiognathodus excedus* Chernykh, 2012, *I. magnificus* Stauffer and Plummer, 1932, *Streptognathodus gracilis* Stauffer and Plummer, 1932, *S. praenuntius* Chernykh, 2005, *S. zethus* Chernykh and Reshetkova, 1987 – 0.42 m thick.

48. Brownish-grey mudstone with small phosphatic concretions (2-3 cm) – 0.19 m thick.

49. Dark-grey volcanic ash. Conodonts: *Idiognathodus toretzianus* Kozitskaya, 1978, *Streptognathodus firmus* Kozitskaya, 1978, *S. pawhuskaensis* Harris and Hollingsworth, 1933, *S. zethus* Chernykh and Reshetkova, 1987 – 0.05 m thick.

50. Brownish-grey mudstone with small phosphatic concretions (2-3 cm) – 0.16 m thick.

Gzhelian Stage. Streptognathodus simulator Zone

51. Grey dolomitized limestone. Conodonts: *Idiognathodus toretzianus* Kozitskaya, 1978, *Streptognathodus gracilis* Stauffer and Plummer, 1932, *S. simulator* Ellison, 1941 – 0.16 m thick.

52. Grey slightly silty micritic limestone with bioclastic debris. Conodonts: *Idiognathodus aff. verus* Chernykh, 2012, *Streptognathodus aff. auritus* Chernykh, 2005 and *S. simulator* Ellison, 1941 – 0.47 m thick.

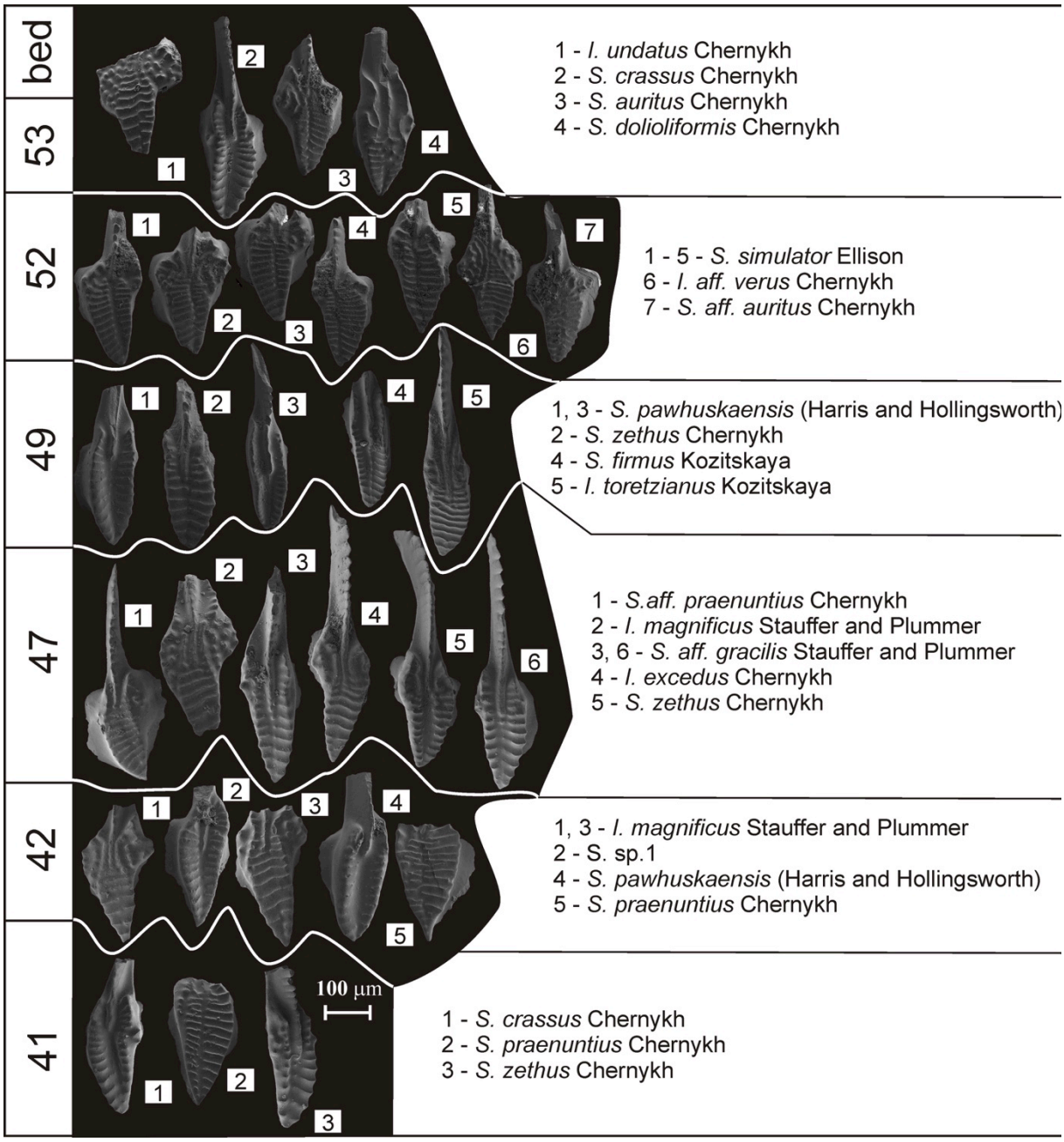

Fig. 3. Distribution of significant conodont species in the described succession S. – Streptognathodus, I. – Idiognathodus

53. Grey mudstone with layers of micritic limestone. Conodonts: *Idiognathodus undatus* Chernykh, 2005, *Streptognathodus aff. auritus* Chernykh, 2005, *S. crassus* Chernykh, 2012, *S. dolioliformis* Chernykh, 2005.

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MEETINGS

SCCS Activities in 2015

18th International Congress on the Carboniferous and Permian

website: http://www.iccp2015.ksu.ru

Carboniferous stratotype sections N. England

see http://www.yorksgeolsoc.org.uk for itinerary and guide books

Planned SCCS Activities

2016

35th International Geological Congress (IGC)

27 August – 4 September 2016 in Cape Town South Africa

Website: http://www.35igc.org/

DCB Workshop in Montpellier, France

Date: 20-22 September 2016

Contact: Markus Aretz (markus.aretz[at]get.omp.eu)

2017

Paleontologic workshop in St. Pertersburg

Date : before or after the August 2017 Bolshoi Karatau trip in Kazakhstan

Contact: Olga Kossovaya (Olga_Kossovaya[at]vsegei.ru) & Alexander Alekseev (aaleks[at]geol.msu).

A Field trip to thee Upper Devonian-Carboniferous reef buildups of the Bolshoi Karatau Mountains (South Karatau)

Date: 15-21 August 2017

Contact: Elmira Slyamkhanovna MUSINA. E-mail: musina.63[at]mail.ru

A FIELD TRIP TO THE UPPER DEVONIAN-CARBONIFEROUS REEF BUILDUPS OF THE BOLSHOI KARATAU MOUNTAINS (SOUTH KARATAU)
August 15-21 2017

Institutional organizers: K.I. Satpaev, Institute of Geological Sciences
Organizers: Erbolat Malikovich FAZYLOV, Valentina Yakovlevna ZHAIMINA, Vyacheslav Georgievich ZHEMCHUZHNIKOV, Andrei Evgenievich ZORIN, Sezim MUSTAPAEVA
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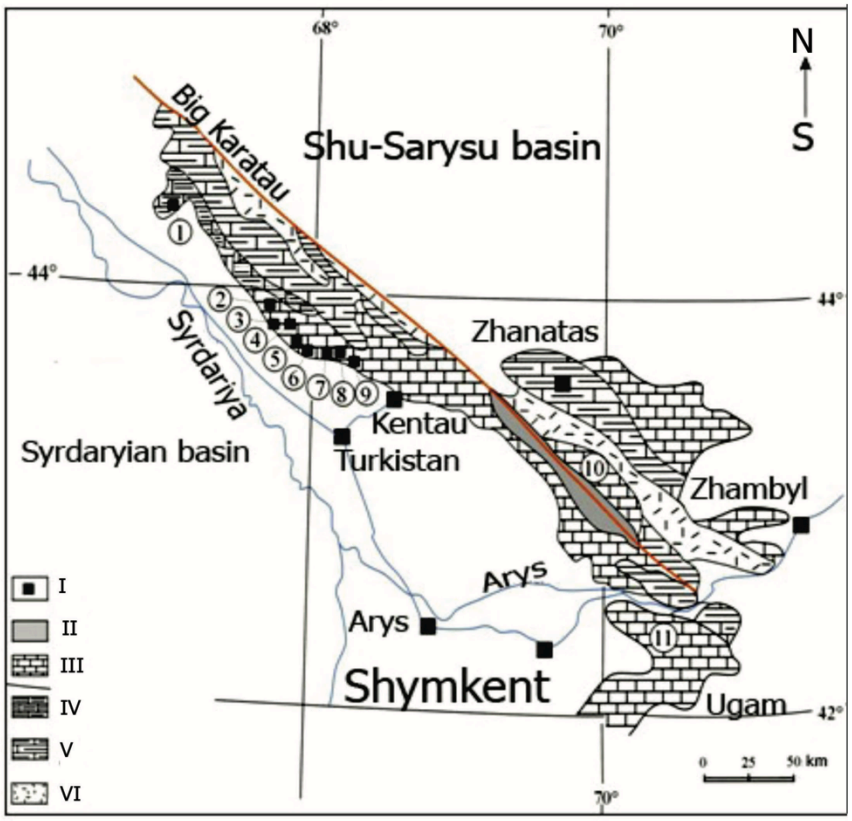
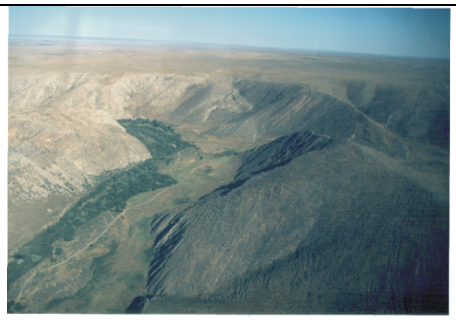
Tel.-Fax : +7(727) 291-7379 (Almaty), mob.: +777325 3928, +701485 4464
Fees: to be confirmed (land transportation from Turkestan to the sections, field lunch, water, guidebook)



Day 1 August 15 (Monday)	Arrival at Almaty https://en.wikipedia.org/wiki/Almaty Meet at the airport. Hotel: approximately USD $50	 Almaty Airport
Day 2 August 16 (Tuesday)	Departure to Turkestan by train at 18.53	 Railway Station “Almaty 2”
Day 3 August 17 (Wednesday)	Arrival at Turkestan 06.53 https://en.wikipedia.org/wiki/Turkistan_(city) Hotel (approximately USD$ 25; breakfast included)	 Railway Station in Turkestan
	Visit to the Aktobe Section (Viséan-Serpukhovian). Deposits of the Akuyuk Reef Complex. Reefs on the slope of a carbonate platform. Field lunch. Dinner at a restaurant	 Aktobe Section – Fore-reef Viséan-Serpukhovian bioherms
Day 4 August 18 (Thursday)	Visit of the Karamurun Section (Famennian-Tournaisian). Reef deposits of the edge of the carbonate platform. Field lunch	

		Karamurun Section
Day 5 August 19 (Friday)	<u>Morning</u> Zhanakorgan Section **Waulsortian** mounds C_1V_1 Viséan-Serpukhovian beds	 Zhanakorgan Section
	<u>Afternoon</u> Field lunch Zhanakorgan Yuzhnyi (Shert) Section. Serpukhovian-Bashkirian reef deposits of the Bashkirian Akuyuk Reef Complex	 Shert Section
Day 6 August 20 (Saturday)	<u>Morning</u> Akuyuk Section, Viséan back-reef deposits <u>Afternoon</u> Field lunch Viséan-Serpukhovian deposits of the Akuyuk Reef Complex	 Akuyuk Section
	Departure to Almaty by train at 22.36	 Mausoleum of Khoja Ahmed Yasawi in Turkestan
Day 7 August 21 (Sunday)	Departure from Almaty	

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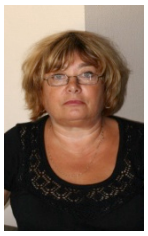

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