1. TITLE OF CONSTITUENT BODY and NAME OF REPORTER

SUBCOMMISSION ON CARBONIFEROUS STRATIGRAPHY

ANNUAL REPORT **2011**

SUBMITTED BY
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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; Richards *et al*., 2002), and it subdivides the Carboniferous into two subsystems, the Mississippian Subsystem below and the Pennsylvanian Subsystem above. There are serious problems with the GSSP at the base of the Carboniferous (Kaiser, 2009), such that the boundary needs to be at least placed at lower stratigraphic position, and both a new event marker and stratigraphic section are probably required. 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. The ultimate goal is to calibrate biostratigraphy with other methods of correlation so that the successions dominated by terrestrial and endemic cold-water marine biotas in the Gondwana and Angara regions can be correlated with the biostratigraphic framework of the pan-tropical standard succession.

3. ORGANIZATION

3a. Officers for 2008-2012:
Chair: Barry C. Richards (Canada)
Vice-Chair: Xiangdong Wang (China)
Secretary: Markus Aretz (France)

Website

During the 2008-2009 fiscal year, the SCCS established an official website: www.nigpas.ac.cn/carboniferous. The site has eight main pages containing the following information: 1) Homepage - list of SCCS officers, task groups and leaders, and voting members, 2) GSSPs - shows ratified GSSPs and those in progress, 3) Working Groups - lists task groups and provides latest task-group progress reports and work plans, 4) Annual Reports - includes annual reports submitted to the ICS by the SCCS, 5) News - information about current SCCS activities and progress, 6) Forthcoming Meetings - lists conventions for professional societies and field meetings that are relevant to membership goals and activities, 7) Newsletters - the current (2011 v. 29 issue) back issues of the Newsletter on Carboniferous Stratigraphy are available in pdf format for download, and 8) Links - provides web links to important websites such as those of the ICS and IUGS.

Membership

In addition to the three executive voting members, the SCCS has 18 rank-and-file voting members (list at end of report), and approximately 280 corresponding members (see latest issue of Newsletter on Carboniferous Stratigraphy for contact information). The main business meetings of the SCCS are held every two years, both at the quadrennial meetings of the International Congress on the Carboniferous and Permian (ICCP), and at a field meeting convened by the SCCS midway between the congresses. The last ICCP was the 17th, held in Perth Australia from July 3rd to 8th, 2011. The latest major field meeting was held in southern China from November 22nd to 30th, 2010 (see Newsletter on Carboniferous Stratigraphy, v. 29, p. 26-27, 30) but subordinate meetings and workshops are held every year as the opportunities arise. A SCCS business meeting is also held at the quadrennial International Geological Congress (IGC); the last was at the 33rd IGC in Oslo, Norway in 2008.

The SCCS has six current task groups and one exploratory Project Group:
Task Group to redefine the Devonian-Carboniferous Boundary [which is also the base of the Lower Mississippian Series and Tournaisian Stage] is a task group established in early 2008 that comprises 10 members appointed by Thomas Becker Chairman of the Devonian Subcommission (SDS) and 10 members selected by Philip Heckel former Chairman of the SCCS in 2008, who summarized the reasons for establishing the group in the 2008 issue of Newsletter on Carboniferous Stratigraphy [v. 26, p. 3]. At the International Commission of Stratigraphy workshop about the GSSP concept that was held in Prague from May 31st to June 3rd 2010, the SCCS Chairman Barry Richards appointed Markus Aretz as task-group Chairman, whereas the SDS Chairman Thomas Becker designated Carlo Corradini as Vice-chairman. Aretz has summarized the recent work of the group through October 2011 in this annual report and in volume 29 of the Newsletter on Carboniferous Stratigraphy.
Task Group to establish the Tournaisian-Viséan Boundary [which is also the base of the Middle Mississippian Series] is chaired by George Sevastopulo (Ireland). Using e-mail communications from the chairman, the recent activities of the group are summarized herein through October 31st 2011.
Task Group to establish the Viséan-Serpukhovian Boundary [which is also the base of the Upper Mississippian Series] is chaired by Barry Richards (Canada), who summarized the recent work of the group through October 31st, 2011 in volume 29 of the Newsletter on Carboniferous Stratigraphy and herein.
Task Group to establish the Bashkirian-Moscovian Boundary [which is also the base of the Middle Pennsylvanian Series] is chaired by John Groves (U.S.A.), who summarized the recent work of the group through October 31st, 2011 in volume 29 of the Newsletter on Carboniferous Stratigraphy and herein.
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). Ueno summarized the recent work of the group through October 31st, 2011 in volume 29 of the Newsletter on Carboniferous Stratigraphy and herein.
Project Group on Carboniferous magnetostratigraphy, chaired by Mark Hounslow (United Kingdom), who did not submit a progress report this year for the Newsletter on Carboniferous Stratigraphy but summarized the recent work of the group through June 2009 in volume 27 of the Newsletter on Carboniferous Stratigraphy.

4. INTERFACES WITH OTHER INTERNATIONAL PROJECTS

The SCCS has worked 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 in the Ural Mountains and elsewhere.

5. CHIEF ACCOMPLISHMENTS AND PRODUCTS IN November 1st 2010 - October 31st 2011 fiscal year

The **Newsletter on Carboniferous Stratigraphy, Volume 29**, published in November 2011, includes commentaries by the current SCCS executive on various current issues, summaries about field meetings and workshops, reports of the task groups for November 1st 2010 to October 31st 2011, and articles on various topics of interest. Volume 29 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 have 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 main body of the Annual Report and task-group reports included in Appendix B.

Summary of Task Group Reports

The references and full text of the reports are provided in the references at the end of this report and in Appendix B, respectively.

Task group to redefine the Devonian-Carboniferous Boundary

Members of the task group are conducting research in several parts of the World and their work focuses on several goals, defined in previous years (Richards and task group, 2010; Aretz, 2011a). Following the 2010 IPC3 workshop in London England, the task group has been collecting data for a first synthesis that will be presented at the March, 2013 workshop in Morocco. A few task-group members attended the XVII ICCP in Perth Australia, and three contributions related to the D/C boundary were made: Aretz (2011b), Brice and Mottequin (2011) and a poster about the D/C boundary in Czech Republic.

Boundary criterion

The group is searching for an event for redefining the D/C Boundary, currently defined by what was considered as the first evolutionary occurrence of the conodont *Siphonodella sulcata* (Huddle, 1934) in the lineage *Siphonodella praesulcata* Sandberg 1972 to *S. sulcata* in the GSSP section at La Serre, France (Paproth and Streel, 1984). A new boundary position that does not substantially change the current level of the D/C Boundary is favored and the search for a new marker is focused on both biotic events and depositional to geochemical markers. The multi-phase Hangenberg Event Interval (Kaiser, 2005; Kaiser et al., 2008) is a level of interest but more data on the timing an correlation of phases within the Hangenberg are required before any component of the event can be used for global correlations.

Since the problems with the conodont lineage *S. praesulcata – S. sulcata* and the FAD of *S. sulcata* that are used to define the D/C Boundary at La Serre were recognized (Ji *et al*., 1989; Kaiser 2005, 2009) clarification of the lineage has been a prime task for the conodont workers (Spalletta *et al*. 2010). Results have been published for siphonodellids (Kaiser and Corradini, 2011) and protognathodids (Corradini *et al*. 2011), but the two conodont groups do not appear to contain potential index fossils for the boundary. The currently used lineage presents taxonomic problems and instability resulting from the diverging identification and naming of transitional forms within the lineage. The identification of *S. sulcata* is subjective and, therefore its FAD may not be a suitable boundary marker.

The second conodont group, which is often used as an alternative index to the siphonodellids, is the protognathodids. They have several shortcomings: rarity in many sections, regional variation in the first occurrence data, and restricted stratigraphic and global rages. Thus, none of the *Protognathodus* species [*Protognathodus meischneri* Ziegler 1969, *Protognathodus collinsoni* Ziegler 1969,

Protognathodus kockeli (Bischoff, 1957) and *Protognathodus kuehni* Ziegler & Leuteritze, 1970)] have a high potential as an index for redefinition of the boundary.

Because the conodonts most frequently used to locate the D/C Boundary do not provide a good candidate for defining that boundary, other fossil groups and sedimentary events need to be considered and require comprehensive analysis. Data arising from the current work will be incorporated into correlation charts that will be presented at a March 2013 joint workshop of the SCCS and Subcommission on Devonian Stratigraphy in Morocco.

Progress in Europe

Researchers from the Czech Republic are using a multidisciplinary approach to study the D/C boundary interval. They are working on sections in the southern part of the Moravia – Silesian Basin (Central Europe, Czech Republic) ranging from the late Famennian *expansa* to the early Tournaisian *sandbergi* zones. Protognathodid faunas are rather abundant in the calciturbidite succession in the Lesni lom quarry, where the Hangenberg Event facies are developed. The foraminiferal studies confirm the presence of *Quasiendothyra* up to the *duplicata* Zone. Petrophysical measurements show a relatively good correlation potential within turbiditic facies but the correlation with the nodular facies is limited. First results of carbon-isotopic studies are interesting and show a positive peak of $\delta^{13}C_{carb}$ in the middle to upper *praesulcata* zones in the Lesni lom quarry.

Task-group member Hanna Matyja is working with colleagues from Poland and Germany on D/C boundary projects in the subsurface of northwest Poland and in Tian-Shan Range of central Asia. Their short-term objectives are the establishment of a high-resolution biostratigraphic scheme and stable-oxygen and carbon-isotope profiles but a longer-term goal is to identify the signatures of the Hangenberg Event. Results of the multidisciplinary study of the Pomeranian Basin will be published in a Special Volume of the Geological Society of London. Task-group member D. Brice and B. Mottequin continue to study brachiopods from the boundary interval in Europe and Northern Africa.

North America

Task-group member Barry Richards continues his ongoing studies of the latest Famennian to early Tournaisian Exshaw Formation in the southern Canadian Rocky Mountains and Foothills to see if the main events in the multi-phase Hangenberg Event Interval, can be more precisely located in the formation with a multidisciplinary approach including stable-carbon isotope geochemistry and U-Pb geochronology. Conodont data (Johnston *et al.*, 2010) indicate the contact between Devonian and Carboniferous strata lies in the upper part of the black shale member of the Exshaw at its type section and at several other localities. The position of the D/C boundary has not been precisely located in the Exshaw and it is hoped a multi-discipline approach will more tightly constrain its position.

China

Task-group members E. Poty, M. Aretz and co-workers continue their work on the correlation of latest Devonian to Mississippian shallow-water sequences in Southern China with those in Europe. First results, indicating a high correlation potential of many sequence boundaries, were presented at the XVII International Congress on the Carboniferous and Permian in Perth (Poty *et al*., 2011).

Task Group to establish the Tournaisian-Viséan Boundary

Following approval of the proposed GSSP (see 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 has been preparing the final report about the Tournaisian-Viséan Boundary GSSP. After completion of the report, the task group will be dissolved according to ICS rule (7.5).

Task Group to establish the Viséan-Serpukhovian Boundary

During the fiscal year, the task group made encouraging progress toward the selection of a GSSP for the Viséan/Serpukhovian Stage Boundary; an index for boundary definition has been selected and work is well advanced at two prime candidate sections. The group has concluded that the first evolutionary appearance of the conodont *Lochriea ziegleri* Nemirovskaya, Perret & Meischner 1994 in the lineage *Lochriea nodosa* (Bischoff, 1957) -*Lochriea ziegleri* presents the best potential for

boundary definition. *L. ziegleri* appears in the Brigantian Substage 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). *G*roup members are conducting multidisciplinary research in Europe, Russia, China and North America. Because the FAD of *L. ziegleri* has been quite precisely located in the best GSSP candidate sections, the focus of current biostratigraphic investigations is the ammonoids, foraminifers and corals.

A major accomplishment was completion of the comprehensive study of the foraminifers spanning the Viséan/Serpukhovian boundary in southern Guizhou Province, China by Groves *et al.* (in press).

Meetings

The task group participated in two important meetings during the fiscal year: 1) "The SCCS Workshop on GSSPs of the Carboniferous System: Carboniferous Carbonate Succession from Shallow Marine to Slope in Southern Guizhou Province, China" and 2) the XVII International Congress on the Carboniferous and Permian in Perth, Australia. The SCCS Workshop, held in Nanjing consisted of two days of working sessions (examination of fossils) and a day of oral presentations. The workshop was followed by a six-day field excursion to Carboniferous and latest Devonian exposures in southern Guizhou province. The field excursion guidebook "Carboniferous carbonate succession from shallow marine to slope in southern Guizhou" edited by Wang Xiangdong *et al*. contains ten chapters dealing with conodonts and foraminifers from the Viséan-Serpukhovian, Bashkirian-Moscovian, Moscovian-Kasimovian and Kasimovian-Gzhelian boundaries in southern Guizhou.

Several task-group members attended the XVII International Congress on the Carboniferous and Permian in Perth presented at Symposium 2 - "SCS: Carboniferous stage boundaries" and in several other sessions. The scientists that presented the papers plan to have them published in two special journal issues.

Field activities

Southern Guizhou province, Nashui section

In early December a team visited the Nashui section (by village of Naqing) near the city of Luodian in southern Guizhou province to finish measuring and sampling the boundary interval for lithostratigraphic and sedimentologic data. Ten metres of strata on either side of the Viséan/Serpukhovian boundary as defined by the first evolutionary appearance of the conodont *Lochriea ziegleri* were measured at a bed-by-bed level for lithological and geochemical studies. The Viséan/Serpukhovian boundary is currently placed at 60.1m above the base of the original section measured by Qi and Wang (2005), which is equivalent to a position 17.94 m above the base of the new section measured and permanently marked by aluminum pins glued into drill holes by the task group in 2008.

In the Nashui section, conodonts within the *L. nodosa - L. ziegleri* lineage are well preserved and abundant (Qi, 2008). Elements transitional between *L. nodosa* and *L. ziegleri* are plentiful, occurring in several samples, and the oldest representatives of *L. ziegleri* could be readily distinguished from the associated transitional forms of *L. nodosa*. Unfortunately, the conodonts do not allow direct correlation from the Nashui section to the nearby shallow-water Yashui section because of their paucity in the neritic to restricted-shelf facies at the latter locality. Groves *et al*. (in press) completed their study of the foraminifers across the boundary interval in the section. The association of foraminifers from a 20 meter-thick interval centered about the boundary at Nashui lack species diagnostic of the boundary but contain ones whose previously established ranges were known to extend from the upper Viséan into the lower Serpukhovian.

Southern Guizhou province, Yashui section

The Yashui section, situated near the city of Huishui in Guizhou province, is important because it contains abundant rugose corals and foraminifers (Wu *et al*., 2009) and is dominated by shallow-marine neritic to supratidal facies. A major reason for studying the section is to determine the relationship of the coral and foraminiferal zones to the *L. nodosa - L. ziegleri* transition in south China.

In February 2010, 101.4 m of the Yashui section were measured and sampled (bed by bed) from the upper Viséan into the upper Serpukhovian. In December of 2010, measurement of the section at a bed-by-bed level was extended into the lower Bashkirian at 121.12 m. Conodont samples collected from the section in 2008-2009 have been processed but yields were poor and the *L. nodosa - L. ziegleri* transition could not be precisely located. The section provides an excellent opportunity to see what the shallow-marine and supratidal platform facies are like in southern Guizhou Province. Groves *et al.,* (in press) completed a comprehensive study of the foraminifers, using samples he collected in May 2008. They found that the base of the Serpukhovian could be approximated using foraminifers but a precise correlation with the first evolutionary occurrence of *L. ziegleri* in the Nashui section could not be established because of the lack of foraminiferal indices for the boundary in the Nashui section and the paucity of conodonts through the boundary level at Yashui.

The foraminiferal successions across the Viséan/Serpukhovian boundary in the type area of the Serpukhovian Stage in the Moscow Basin of Russia (Kabanov *et al*., 2009; Gibshman *et al*., 2009), the Uralian region of Russia (Nikolaeva *et al.,* 2009) and in the central United States suggest that the appearances of *Asteroarchaediscus postrugosus* (Reitlinger, 1949), *Janischewskina delicate* (Malakhova, 1956), "*Millerella*" *tortula* Zeller, 1953 and *Eolasiodiscus donbassicus* Reitlinger, 1956 are useful auxiliary indices to the base of the Serpukhovian. The stage boundary at Yashui is provisionally identified at 41.6 m above the base of the section on the appearance of *Janischewskina delicata*. "*Millerella*" *tortula*, another possible index to the base of the Serpukhovian, appears at 49 m above the base of the section (Groves *et al.,* in press). *Asteroarchaediscus postrugosus* and *Eolasiodiscus donbassicus*, useful markers for the base of the Serpukhovian elsewhere in Eurasia and North America, were observed at Yashui.

Southern Urals, Verkhnyaya Kardailovka section

During August 2011, task-group members worked at the condensed, deep-water, carbonate section along the Ural River near the village of Verkhnyaya Kardailovka on the eastern slope of the Ural Mountains in southern Russia. Nikolaeva and her colleagues have worked on the section for several years and published several syntheses including that of Pazukhin *et al*. (2010). Their syntheses demonstrate the first evolutionary appearance of *L. ziegleri* occurs in the lower part of the limestone-dominant component of the section immediately above an interval containing elements transitional between *L. nodosa* and *L. ziegleri.*

In August 2010 and 2011, the lower 22 m of the Verkhnyaya Kardailovka section was excavated with backhoes and front-end loaders. The section was subsequently permanently marked with aluminum pins glued into drill holes at one metre intervals. In August 2011, the limestone-dominant component of the section was measured and sampled bed-by-bed for lithology and geochemical samples from about 12 m to 35 m above the section's base. During August 2011, the section was systematically sampled for conodonts from 12 m to 20 m above its base. Conodont samples had been collected from the section on prior occasions but additional sampling was required to more precisely tie the conodont biostratigraphy into the new measurements and to confirm the FAD of *L. ziegleri*.

Task Group to establish the Bashkirian-Moscovian Boundary

The task group is conducting research at locations in Europe and Asia and their investigations continue to focus on evolutionary transitions in conodont and fusulinid lineages. Members participated in two salient events: 1) SCCS Workshop on GSSPs of the Carboniferous System: "Carboniferous Carbonate Succession from Shallow Marine to Slope in Southern Guizhou", and 2) the preparation of a new proposal for a formal marker event for the lower Moscovian Boundary. In addition, members presented papers at the 2010 XVII International Congress on the Carboniferous and Permian in Perth, Australia.

The SCCS Workshop was held in November, 2010 in southern China and consisted of working sessions and presentations at the Nanjing Institute of Geology and Palaeontology, Chinese Academy of Sciences (NIGPAS) followed by a field excursion to southern Guizhou. The field excursion guidebook

edited by Wang Xiangdong *et al.* contains ten chapters dealing with conodonts and foraminifers from several levels including the Bashkirian-Moscovian Boundary in southern Guizhou.

At the NIGPAS workshop, Qi Yuping and co-authors gave an important paper: "New interpretation of the conodont succession of the Naqing (Nashui) section: Candidate GSSP for the base of the Moscovian Stage, Luosu, Luodian, Guizhou, South China." They advocated placing the base of the Moscovian in the Nashui section at the joint first appearances of advanced morphotypes of *Streptognathodus expansus* and *Streptognathodus suberectus*. The level coincides with the local appearance of *Neognathodus kanumai* and it occurs about 4 m below the local appearance of *Diplognathodus ellesmerensis*, an event previously identified as a potential boundary marker. Qi *et al.* (2010) clarified the taxonomic distinctions between stratigraphically lower morphotypes of *S. expansus* and *S. suberectus* and the higher, advanced morphotypes of the same species. Additional work is necessary: 1) to show that the advanced morphotypes of *S. expansus* and *S. suberectus* occur elsewhere in evolutionary continuity with their respective ancestors; and 2) to test the biostratigraphic fidelity of the advanced morphotypes relative to other, potential lower Moscovian indices.

Members of the B-M task group developed a new proposal to mark the base of the Moscovian with the FAD of the fusulinoidean genus *Eofusulina* Rauser-Chernousova in Rauser-Chernousova *et al.* 1951 *in* evolutionary continuity with its ancestor *Verella* Dalmatskaya 1951. Operationally, the level can be recognized by the lowest stratigraphic occurrence of a fusulinoidean exhibiting septal fluting across the entire length of its shell. The proposal was circulated within the task-group for comments, but a formal vote was not held because a widely held concern was that relatively few sections were known in which the *Verella–Eofusulina* transition could be documented with closely spaced sampling. The search for such localities has become an immediate priority.

Eofusulina triangula (Rauser-Chernousova and Beljaev in Rauser-Chernousova *et al.*, 1936) is among the stratigraphically oldest and most widespread species in the genus. It is distinguished from other early species in the genus by its unusual triangular shell outline. The proposal's authors do not designate this species as the boundary marker, however, because in some areas its FAD is slightly above the FAD of congeneric species that exhibit a more nearly fusiform shape. In other words, the boundary shall be marked by the advent of a genus-rank character (pole-to-pole septal fluting) rather than a species-rank character (shell shape).

Specimens assigned to *Verella spicata* Dalmatskaya, 1951 occur widely in uppermost Bashkirian rocks and specimens assigned to *Eofusulina triangula* occur widely in lower Moscovian rocks. As implied by its name, *Verella transiens* Ginkel and Villa in Ginkel 1987 is intermediate between typical representatives of the two genera. Septal fluting in this species is more intense than in typical *Verella*, but less intense than in typical *Eofusulina*. The type specimens of *V. transiens* are from the lower, but not lowest Vereian of northwestern Spain. Other conspecific specimens are known from Limestone I3 in the Donets Basin of Ukraine, just below the joint appearances of *Eofusulina* sp. and *Declinognathodus donetzianus* in Limestone K1 (Nemyrovska *et al.*, 2010). Thus, the stratigraphic range of *V. transiens* spans the Bashkirian-Moscovian boundary as traditionally recognized. The existence of this morphologically and stratigraphically transitional form further demonstrates the concept of the *Verella–Eofusulina* evolutionary continuum.

FADs of the fusulinoideans *Profusulinella prisca* (Deprat, 1912) and *Aljutovella aljutovica* (Rauser-Chernousova, 1938) are designated as auxiliary events for marking the base of the Moscovian. Both species are widespread throughout the geographic area containing *Eofusulina* spp., and both have been utilized in formal zonal schemes for marking the base of the Moscovian.

Fusulinoideans are rare in many deeper-water deposits. The base of the Moscovian can be approximated in the absence of fusulinoideans by the FADs of the conodonts *Declinoghathodus donetzianus* and *Diplognathodus ellesmerensis* (Nemyrovska, 1999; Qi *et al.*, 2007), and possibly by the FADs of advanced morphotypes of *Streptognathodus expansus* and *S. suberectus* (Qi *et al.*, 2010).

Additional Activities

Katsumi Ueno (Fukuoka University, Japan) and his students in collaboration with Tsutomu Nakazawa (AIST, Japan), Yue Wang, and Xiangdong Wang (NIGPAS) recently studied latest Bashkirian-earliest Moscovian fusulinoidean biostratigraphy of the Zongdi section in southern Guizhou Province, South China. They investigated a 50-m interval, focusing on the *Verella-Eofusulina* lineage. This interval in the Zongdi section consists chiefly of shallow-marine bioclastic limestone with frequent dolomitic levels and several subaerial exposure surfaces with paleosols. At Zongdi the lowest *Verella* occurs at 56 m and specimens continue up to 76 m. The lowest *Eofusulina* occurs at 80.5 m and others are commonly found up to 95 m. It is important to note that the FAD of *Eofusulina* is just below the first subaerial exposure in the studied interval, suggesting that the evolutionary first appearance event of *Eofusulina* from *Verella* might be recorded here. The Zongdi section is one of few sections on the Yangtze Carbonate Platform of South China that yield both *Verella* and *Eofusulina*.

Demir Altiner and colleagues from Ankara studied the sequence stratigraphy and fusulinoidean biostratigraphy of Bashkirian-Moscovian boundary beds in the Tauride Belt in southern Turkey. Three sections spanning the Lower Bashkirian (Askynbashky) to Lower Moscovian (Solontsovsky) beds were measured on a bed-by-bed basis. The Bashkirian-Moscovian boundary is recognized by the first occurrence of *Profusulinella prisca* within the *P. staffellaeformis-P. paratimanica* lineage. This level coincides with the first occurrence of *Aljutovella aljutovica*. The lowest occurrence of the genus *Eofusulina* is slightly higher than that of *P. prisca* and *A. aljutovica*. Upward-shoaling cycles indicate the presence of two third-order sequences dated as Askynbashky to lowermost Asatausky and Asatausky to Solontsovsky. Sandstone intercalated within the Upper Bashkirian carbonate succession represents a falling-stage systems tract deposited during the culmination of the second Carboniferous glacial interval. Following the sea-level fall in the earliest Asatausky, a new carbonate regime was installed in the Asatausky-Solontsovsky interval by a glacio-eustatic sea-level rise. The Bashkirian-Moscovian boundary seems to be located within the transgressive systems tract of the new regime.

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

Task-group members are working in several parts of the world but current activities are focused on the study of fusulines and conodonts from sections in South China and Russia. Substantial progress has been made on locating an event marker for the Moscovian-Kasimovian Boundary and the FAD of a conodont has been selected for definition of the Kasimovian-Gzhelian Boundary

Progress reports from task group members

South China.

Qi Yuping and James Barrick, have been studying conodonts from the uppermost Moscovian to lower Gzhelian slope carbonates in the Naqing (Nashui) section, southern Guizhou, South China. They think the FAD of *Idiognathodus turbatus* Rosscoe and Barrick 2009 is the best potential boundary marker for the base of the Kasimovian Stage. Conodonts are abundant in late Moscovian deposits, but they are strongly dominated by a succession of morphotypes of *Swadelina*. The Naqing *Swadelina* interval can be correlated with the Krevyakian Substage in the Moscow Basin type succession and with the latest Desmoinesian in North American. In the Naqing section, a new association of *Idiognathodus* morphotypes appears at 236.0 m and elements of *Swadelina* disappear by this level. Some new morphotypes resemble the characteristic early Kasimovian species *Idiognathodus turbatus*. In the collection from 235.75 m to 236.60 m, many transitional morphotypes (which are similar to *Idiognathodus sagittalis* Kozitskaya 1978) with rapid morphological transformation from *Idiognathodus swadei* Rosscoe and Barrick 2009 to *I. turbatus* occur. Therefore, the important conodont evolutionary lineage from *I. swadei* to *I. turbatus* is confirmed in the Moscovian-Kasimovian boundary interval in the Naqing section.

The task group to establish the Kasimovian-Gzhelian boundary has selected the conodont *Idiognathodus simulator* (Ellison, 1941) *s.s.* as the event marker for defining the base of the Gzhelian (Heckel *et al*., 2008) and is directing research toward selecting a suitable section for the GSSP. Within the Naqing section, Qi and Barrick have been investigating the conodont faunal change of the

Kasimovian-Gzhelian transitional interval. In the uppermost Kasimovian, the less common *Idiognathodus* species include morphotypes with reduced lobes, and more significantly, forms with a weakly developed eccentric groove that could be the ancestor of *I. simulator*. After a thin (about 1.5 m thick) conodont-poor interval in the uppermost Kasimovian, diverse and abundant conodonts appear at 255.6 m and they include the first *Idiognathodus simulator*, which marks the base of the Gzhelian in the Naqing section. Therefore, the presence of the lineage of *I. simulator* from its potential ancestor has been proven using the new conodont collections from the section. Although they allow recognition of the boundary, existing collections from the Kasimovian-Gzhelian boundary interval at Naqing are not sufficient to make a complete description of the boundary conodont faunas. Qi and Barrick are working on new and larger collections from the critical boundary interval to obtain a more complete understanding of the conodont fauna and to enable a better evaluation of the Naqing section as a stratotype section for the base of the Gzhelian Stage.

In addition to the Naqing section, Qi Yuping recently found several new sections covering the Moscovian-Kasimovian and Kasimovian-Gzhelian boundary intervals in southern Guizhou. Among them the Narao and Fengting sections seem to be promising for further boundary work as many debris flows containing fusulines occur together with fine-grained, potentially conodont-rich limestones in both sections. The new sections probably represent shallower environments than the lithofacies in the Naqing section and present a potential for correlating the chronostratigraphic framework within the Yangtze Carbonate Platform by using conodont and fusuline biostratigraphy.

Russia Valery V. Chernykh recently studied in detail the morphological status of "*Streotognathodus*" *simulator* (*=Idiognathodus simulator* by some authors) from the Urals and compared them with the representatives of this species from the Midcontinent region of North America. Chernykh proposed to change the diagnosis of this conodont species. This taxonomic modification would enlarge the morphological range of the species, making it possible to explain the difference between the American and Eurasian forms as intraspecific variability. Chernykh also examined the stratigraphic value of some associated conodonts from the group *simulator*.

Ukraine Tamara I. Nemyrovska and Katsumi Ueno recently worked in the Lugansk region of the Donets Basin in Ukraine, studying the Annovka section in the Bryanka area. The Annovka section includes the upper part of the C2\7 Suite (Limestone M) and the C3\1 (Limestone N), broadly corresponding to the Moscovian-Kasimovian Boundary interval.

General activities

Task-group members attended several meetings and workshops but the most significant were "The SCCS Workshop on GSSPs of the Carboniferous System: Carboniferous Carbonate Succession from Shallow Marine to Slope in Southern Guizhou" (November, 2010) and the XVII International Congress on the Carboniferous and Permian held in Perth, Australia (July, 2011).

The SCCS November workshop, held in Nanjing China consisted of working sessions (examination of fossils) and a day of oral presentations that included several talks of interest to the task group: 1) Latest Moscovian to earliest Gzhelian (Pennsylvanian) conodont faunas from the Naqing (Nashui) section, south Guizhou - by J. Barrick; and 2) *Carbonoschwagerina*-mimics from the Zhongdi section of southern Guizhou, South China and its relation with the Kasimovian-Gzhelian - by K. Ueno *et al*. The workshop was followed by a field excursion to southern Guizhou province that enabled participants to examine the Moscovian–Kasimovian and Kasimovian–Gzhelian boundaries at the shallow-water Zhongdi section and the deep-water Nashui (Naqing) section. The guidebook "Carboniferous carbonate succession from shallow marine to slope in southern Guizhou" edited by Wang Xiangdong *et al*. contains ten chapters dealing with conodonts and foraminifers from several levels including the Moscovian-Kasimovian and Kasimovian-Gzhelian boundaries in southern Guizhou.

At the XVII International Congress on the Carboniferous and Permian, held in Perth Australia in July 2011, task-group members gave several presentations directly related to the group's activities including those of Ueno & Task Group (2011), Qi *et al.* (2011), and 3) Goreva & Alekseev (2011).

Project Group on Carboniferous Magnetostratigraphy

Progress by the project group has been hampered by a shortage of members, insufficient funding, and a lack of integration with the activities of the other SCCS task groups. The group is particularly interested in collaborating with task groups working on sections and boundaries where magnetostratigraphy could be employed, to facilitate international correlations. Sections that have low thermal maturity and are dominated by siliciclastics are the most suitable for magnetostratigraphic analyses (review in SCCS Newsletter, v. 22: 35-41) but carbonates can be used. Unfortunately, most of the best GSSP candidate sections are carbonate dominant and thermally over mature but some reference sections and stratotypes for stages show potential. The study of Mississippian magnetostratigraphic has languished and much remains to be done before Carboniferous magnetostratigraphy can be widely applied to facilitate global correlations.

During the May 31st to June 3rd 2010 ICS meeting in Prague, the task group leader discussed with Barry Richards and Svetlana Nikolaeva (Russia) the possibility of designing a magnetostratigraphic project that would evaluate Late Mississippian and Pennsylvanian sections in the Moscow Basin, Lard Basin in northwestern Canada and sections in the mid-continent region of the USA. So far, these initial discussions have not developed into tangible outcomes and the main problems stem from a lack of funding and suitable investigators.

John Utting (member Viséan/Serpukhovian boundary task group) and colleagues Peter Giles (Geological Survey of Canada-Atlantic) and Neil Opdyke (University of Florida) have completed a very useful magnetostratigraphic study of the Brigantian, Pendleian and much of the Arnsbergian substages (upper Viséan and Serpukhovian) in the Maritimes Basin of eastern Canada (Giles *et al*., in progress). They have correlated the polarity reversal patterns in the Maritimes Basin with published data from the Brigantian to mid-Arnsbergian interval in the central part of the Appalachian Basin in the eastern United States (Di Venere and Opdyke, 1990, 1991).

CONFERENCES AND FIELD MEETINGS NOVEMBER 1ST, 2010 - OCTOBER 31ST, 2011

During the last fiscal year there were several geological conferences, field meetings and workshops that SCCS members needed to attend. The most significant meetings for the subcommission were "The SCCS Workshop on GSSPs of the Carboniferous System: Carboniferous Carbonate Succession from Shallow Marine to Slope in Southern Guizhou Province, China" (November 22nd - 29th, 2010) and the XVII International Congress on the Carboniferous and Permian in Perth, Australia (July 3rd -8th, 2011). In this Annual Report, we summarize relevant components of the Nanjing/southern Guizhou field meeting and the business meeting associated with the XIVICCP. The full report from the latter business meeting (Aretz *et al*., 2011) is published in volume 29 of the Newsletter on Carboniferous Stratigraphy.

Report on the SCCS Workshop on GSSPs of the Carboniferous System: Carboniferous Carbonate Succession from Shallow Marine to Slope in Southern Guizhou Province, China (November, 2010)

The SCCS Workshop, November 22nd to 24th 2010, was organized by Xiangdong Wang and his colleagues and held at the Nanjing Institute of Geology and Palaeontology, Chinese Academy of Sciences (NIGPAS). It consisted of two days of working sessions (examination of fossils) and a day of oral presentations. Several talks of interest to the task groups were given and are listed under the full task-group reports in Appendix B. The workshop was followed by a six-day field excursion to Carboniferous and latest Devonian exposures in southern Guizhou province. The 2010 field excursion guidebook "Carboniferous carbonate succession from shallow marine to slope in southern Guizhou" edited by Wang Xiangdong *et al*. contains ten chapters dealing with conodonts and foraminifers from the Viséan-Serpukhovian, Bashkirian-Moscovian, Moscovian-Kasimovian and Kasimovian-Gzhelian

boundaries in southern Guizhou. The excursion enabled the participants to examine boundary sections for all of the Carboniferous stage boundaries that the SCCS is currently working on to establish GSSPs.

Report on business meeting at XVII International Congress on the Carboniferous and Permian held in Perth, Australia (July 3rd -8th, 2011)

The business meeting for the subcommission was held on the 4th of July 2011 at Perth, Australia during the 17th ICCP. It was attended by the SCCS executive and several regular voting members. The meeting dealt with several topics, presented here in the order discussed at Perth.

Membership and Composition of Subcommission 2012-2016

The leadership and membership situation within the SCCS was outlined by the Chairman as follows. The current Chairman and Assistant Chairman were voted into office in 2008 and can be re-elected for one additional term. The Secretary/Treasurer was appointed by the subcommission Chairman; an election was not required. Six regular SCCS voting members D. Altiner, D.R. Boardman, L. Hance, T.I. Nemyrovska, B.C. Richards and K. Ueno will complete their third term in 2012 and must step down from that position during the August 2012 IGC.

During the meeting, a lively discussion occurred over the issue of whether or not the work of the SCCS can be carried out satisfactorily if subcommission chairs and task-group leaders are required to retire as regular voting members. Some meeting participants felt that the SCCS should be more flexible and ensure the continuity of work within task groups by not requiring task-group leaders to retire after serving three terms. Scientists supporting this position suggested exceptions should be made because in several other ICS subcommissions some voting members retain their status well over 16 years. Other members expressed that the SCCS has always worked well with the 12 years rule, since it guarantees a high and diverse level of participation by the community of Carboniferous researchers. The Chairman indicated that task-group leaders can function adequately if they are not voting members and that some task groups have been led for years by scientists who were not voting members.

Xiangdong Wang and I (B. Richards) declared our willingness to serve for a second term as Chairman and Assistant Chairman, respectively. Markus Aretz was asked if he would continue as the SCCS Secretary/Treasurer for another term but he replied by stating the Chairman for 2012-2016 must be elected before the secretary position can be filled.

Newsletter

It was announced that the publication date shown on the Newsletter on Carboniferous Stratigraphy has been changed from July to November and that the change will be mentioned in the Annual Report the SCCS submits to the ICS. The question of whether or not we should apply for an ISSN number for the newsletter was discussed briefly.

SCCS Mandate

I (Chairman) indicated that establishing GSSPs for stage and series boundaries is the primary task of the SCCS and that ICS want to see the subcommission make more rapid progress on defining the remaining GSSPs. In this regard, I reminded participants that proposals for boundary definition and the use of specific sections for GSSPs need to be written and put to vote. It was suggested that the task group for the definition of the base of the Serpukhovian should have a formal vote on the boundary criterion.

A lively discussion about holding a vote on a published proposal submitted by Vladimir Davydov and his colleagues to use the Usolka section in the southern Ural Mountains of Russia for the GSSP of the Kasimovian/Gzhelian boundary followed. Katsumi Ueno, Chairman of the Kasimovian/Gzhelian task group along with some other SCCS members, stated that before a decision can be made on the Usolka section, the boundary level must be adequately excavated. Following the discussion about the Usolka section, I (Chairman) recommended the meeting be closed and the motion was seconded by several voting members.

6. CHIEF PROBLEMS ENCOUNTERED IN 2011

Several problems confronted the SCCS task groups during the fiscal year and most are ongoing. Many of the most active specialists are working on two or more task groups and have over extended themselves, making it difficult to make substantial progress during any one fiscal year. 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.

The most significant issue confronting the SCCS is 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. The problem is being overcome somewhat by correlating other fossil groups to bracket the boundary levels in major regions where the boundary-event taxa have not been found.

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. The best of the known deeper water successions in terms of abundance and diversity of conodonts and continuity of outcrop are in southern China and the southern Urals. The direction the current work of the SCCS is advancing indicates all of the remaining GSSPs will be placed in south China and Russia. Additional suitable sections, even if they just become reference sections, should be located and intensively studied in Western Europe, northern Africa/Middle East, and North America.

Some lineages used in the past for boundary definition such as the *Siphonodella praesulcata-Siphonodella sulcata* conodont lineage, used to define the Devonian-Carboniferous boundary, were not sufficiently known prior to being used for GSSP definition. Specialists are finding those lineages are either no longer suitable for defining and correlating boundaries or require intensive re-evaluation.

Bureaucratic regulations have made it exceedingly difficult to export ordinary rock samples from Russia, thereby impeding progress on the study of Russian sections by SCCS members outside of Russia.

7. SUMMARY OF EXPENDITURES IN 2011:

STATEMENT OF OPERATING ACCOUNTS FOR NOVEMBER 1st, 2010 TO OCTOBER 31st, 2011

Prepared by Barry Richards, Chairman SCCS

(Accounts maintained in Canadian currency)

INCOME (November 1, 2010 – October 31, 2011)

IUGS-ICS Grant; July 14, 201 (US $1,800 = $1,679.40 Cdn.)	$1,679.40
Donations from Members; November 1, 2010 - October 31 2011	$100.00
Interest Bank of Montreal; November 1, 2011 - October 31, 2011	0.17
TOTAL INCOME	**$1,779.57**

EXPENDITURES (November 1, 2010 – October 31, 2011)

Bank Charges: Bank of Montreal July 14, 2011	$0.00
Richards travel to Nanjing for SCCS workshop and field meeting; Nov. 23 - Dec. 7, 2010	$500.00
Travel and registration support for SCCS chairman and voting members to XVII International Congress on the Carboniferous and Permian in Perth, Australia; July 2011	$1,000.00
Travel support for SCCS chairman to attend SCCS field meetings in southern Urals, Russia in August 2011	$500.00
TOTAL EXPENDITURE	**$2,000.00**

BALANCE SHEET (2010 – 2011)

Funds carried forward from October 31, 2010	$1,215.00

Plus Income November 1, 2010 – October 31, 2011	$1,779.57
Total assets	**$2,994.57**
Less Expenditures November 1, 2010 – October 31, 2011	$2,000.00
BALANCE CARRIED FORWARD (to 2011 - 2012 fiscal year)	**$994.57**

8. WORK PLANS, CRITICAL MILESTONES, ANTICIPATED RESULTS AND COMMUNICATIONS TO BE ACHIEVED NEXT YEAR (2012):

The following activities are planned for the new fiscal year (Nov. 1, 2011 to Oct 31, 2012) by the task groups, as communicated by task-group chairs and distilled from the reports in # 5 above, for which the full texts including references are in Appendix B.

Devonian-Carboniferous boundary The primary tasks for the D-C boundary task group continues to be the location of a suitable event marker to define the boundary and location of a suitable section for the GSSP. A biostratigraphic analysis by Ji Qiang and his colleagues (Ji *et al*., 1989) and further work (Kaiser, 2009) indicates that there are problems with the D-C boundary GSSP (Paproth *et al*., 1991) at La Serre, France.

At the onset of the reappraisal project in 2008, the SCCS executive hoped the current event marker, the FAD of the conodont *Siphonodella sulcata*, could be used for boundary definition. Preliminary results from the re-evaluation of the lineage containing that index (Kaiser and Corradini, 2011) suggest it is not useable but addition work is required by other specialists to test their findings. Slightly later in the project, it was thought a protognathodid conodont lineage could be used for D-C boundary definition but the assessment of that group has not provided favorable results (Corradini *et al*., 2011).

Considerable progress on re-evaluating the lineage containing the current D-C boundary marker, the FAD of the conodont *S. sulcata*, has been made. Additional study of the lineage is required, however, and the task group plans to complete that work shortly. In the La Serre section, Corradini and Kaiser (2009) identified seven morphotypes in the transition from *S. praesulcata* to *S. sulcata*. Unfortunately, the conodonts within the transition are reworked and no correlation exists between the stratigraphic level and individual morphotypes. The task group plans to determine if any correlation between the morphotypes and stratigraphic level exists in other D-C boundary sections, where reworking is not an issue.

Several task-group members have been studying the taxonomic and phylogenetic problems within the protognathodid conodont lineages (Corradini *et al*., 2011). Four species of *Protognathodus* are known from the relevant time span: *Protognathodus meischneri, P. collinsoni, P. kockeli* and *P. kuehni.* Presently favoured for boundary definition are the first occurrences of *P. kockeli* from *P. collinsoni* and *P. kuehni* from *P. kockeli.* The SCCS executive has asked the conodont specialists to evaluate the utility of using the lineages for boundary definition by studying them in the best of their D-C boundary sections.

If the FAD of *S. sulcata* is retained for boundary definition, a suitable section for the GSSP is required because work at La Serre (Ji *et al*., 1989; Kaiser, 2009; Corradini and Kaiser, 2009) indicates the lack of a phylogenetic transition from *S. praesulcata* to *S. sulcata* in that section. In addition, the section is not suitable because the first occurrence of *S. sulcata* occurs immediately above an abrupt facies change (ooid grainstone on sandy shale) that is probably erosional. Because of the potential break, some task-group members are completing independent sedimentologic assessments of that contact and the entire section.

At the July 2010 ICP3 workshop in London and at other recent meetings, it was proposed that we consider using some component of the multiphase Hangenberg Event Interval (Kaiser *et al*., 2008) for boundary definition. At the end of the meeting, Markus Aretz asked participants to prepare for the D-C boundary workshop in Morocco from (March 25th to April 1st, 2013; see circular in v 29 of Newsletter on Carboniferous Stratigraphy), by developing precise correlation charts for their regions of study showing the biostratigraphic, geochemical and depositional events within the Hangenberg Event.

Four of the D-C boundary projects that are planned for next four to five years are outlined below. 1) Vladimir Pazukhin along with Yuriy Gatovsky and Lyudmila Kononova (Moscow State University) plan to complete a monograph on the conodont biostratigraphy of D-C boundary interval in the Ural Mountains of Russia. The study will consider the interval from the Famennian *marginifera* Zone into the Tournaisian *isosticha* Zone. 2) Chinese colleagues along with the SCCS executive and task-group leaders initiated a re-assessment of the best D-C boundary sections in China by visiting the Dapoushang section (Ji *et al*., 1989) in southern Guizhou Province during the November 22nd - 29th 2010 SCCS workshop and field meeting. 3) Task-group member Jiri Kalvoda and colleagues from the Czech Republic are conducting a multidiscipline project to study the D-C Boundary interval in Western Europe including the La Serre section. The project's principal goal is the correlation of evolutionary changes in foraminifer and conodont faunas in the D-C Boundary interval with a high-resolution stratigraphic framework arising from multidiscipline stratigraphic-paleoenvironmental analysis. Anticipated benefits of the project for the ICS and SCCS are a better understanding of the *S. praesulcata - S. sulcata* lineage and whether or not it is suitable for definition of the D-C Boundary GSSP. Other conodont lineages relevant to the boundary (protognathodids lineages) will also be evaluated. The resulting high-resolution stratigraphy will be used to test the isochroneity of the events within the Hangenberg Event Interval and contribute to a better correlation between basinal and shallow-water successions. 4) In western Canada, Barry Richards intends to continue ongoing studies of the latest Famennian to early Tournaisian Exshaw Formation (see Richards *et al*., 2002) and its correlatives to see if the main events in the multi-phase Hangenberg Event Interval can be more precisely located in the formation by using a multidisciplinary approach. The work is part of a broader investigation intended to access the hydrocarbon resources of the interval and will include examination of coeval correlatives (including Bakken Formation) in adjacent areas.

Tournaisian-Viséan boundary The task group plans to continue with its preparation of the final manuscript for the project.

Viséan-Serpukhovian boundary Since determining that the FAD of the conodont *Lochriea ziegleri* in the lineage *Lochriea nodosa -Lochriea ziegleri* is the best index for boundary definition, the task group will draft a proposal advocating the use of that index and direct its attention toward selecting the best candidate section for the GSSP. The best two candidate sections are the Nashui section by the village of Naqing in southern Guizhou Province, China and the Verkhnyaya Kardailovka section on the Ural River in southern Russia. A third section by the village of Millaró in the Cantabrian Mountains of northern Spain may have potential rivaling that of the others.

Activities in South China

The deep-water (slope), carbonate-dominant Nashui section in southern Guizhou Province, 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* precisely located. The conodont studies for the locality are essentially complete and the FAD of *L.* ziegleri is located at 60.10m (Qi *et al*., 2010) above the base of the section. Some additional work is required including the slicing the bed (parallel to bedding) containing the FO and the immediately underlying bed to see if boundary can be more precisely located. John Groves plans to complete his study of the foraminifers in the section, thereby finishing most of the work needed for this important fossil group. Work on the sedimentology, stable-isotope geochemistry, 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 Nashui 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 three reference sections - the Yashui, Dianzishang, and the Luokun sections - will continue.

The most important reference section for Nashui is the Yashui section, near the city of Huishui in Guizhou province. It is an important section because it contains abundant well-preserved rugose corals

and foraminifers (Wu *et al*., 2009) and is dominated by shallow-marine, neritic- to peritidal-ramp facies. In 2010 the Yashui section was measured and described by at a bed-by-bed level of detail and sampled by team members for lithology, conodonts, foraminifers, and rugose corals. John Groves plans to complete his study of the foraminifers in the lower part of the section prior to the end of the fiscal year. Investigations on the sedimentology, stable-isotope geochemistry and geophysical characteristics of the section are less advanced than the paleontological work and will be the focus of the team's work in 2012.

Strata in the Dianzishang section, situated by Dianzishang village along the Zin Zai River 1 km upstream from the Red Flag Bridge, are intermediate between the lower-slope to basin deposits at Nashui and the shallow-marine ramp deposits at Yashui. The Dianzishang section includes spectacular syndepositional slump deposits formed in slope settings and provides another opportunity to see conodonts and foraminifers spanning the *L. nodosa- L. ziegleri* transition in the region. In February 2010, task-group members measured 72.7 m of strata extending from the uppermost Viséan into lowermost Bashkirian. Conodont work at the locality has been completed to the extent that the Viséan-Serpukhovian boundary has been located using the *L. nodosa - L. ziegleri* transition. John Groves plans to complete his study of the foraminifers in the section by the end of the fiscal year. Work on the sedimentology, stable-isotope geochemistry and geophysical characteristics of the boundary interval and section are not as advanced as the paleontological studies and will be an important aspect of the work at the locality in the next two fiscal years.

During 2010, the task group commenced measuring and sampling of the Luokun section, situated by the village of Luokun several kilometres from Naqing and the Nashui section. Like the Nashui section, the exposure at Luokun is essentially 100% complete but dominated by slope carbonates of that are more proximal aspect than those at Nashui. Study of the section will provide another opportunity to see conodonts and foraminifers spanning the *L. nodosa- L. ziegleri* transition in the region. Foraminifers are more abundant and better preserved than at Nashui, and it is anticipated that a better correlation between conodonts and foraminifers can be achieved by the study of the Luokun section. Study of all aspects of the section is at a preliminary level but sufficient biostratigraphic work has been completed to locate the approximate positions of the Viséan-Serpukhovian and Serpukhovian-Bashkirian stage boundaries. During 2012 - 2013, the task group plans to complete the measurement and sampling of the section at a bed-by-bed level.

Activities in Southern Urals, Russia

With its conodonts characteristic of the *L. nodosa-L. ziegleri* transition, abundant ammonoids, and moderately common foraminifers, the Kardailovka section, a deep-water basinal 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. During the summers of 2010 and 2011, the lower part of section was completely exposed using a backhoe and aluminum marker pins were placed at one-metre intervals. Conodonts, foraminifers and ammonoids in section have been studied in detail (Nikolaeva *et al*., 2009; Pazukhin *et al*., 2010) but additional collections will be required when the section is measured and sampled at a bed-by-bed level in August 2012. Sufficient conodont work been done to locate the approximate position of the FAD of the conodont *L. ziegleri* in the lineage *L. nodosa-L. ziegleri* but additional collecting of closely-spaced samples is required to more completely document the transition and precisely locate the FAD of *L. ziegleri*. Work on the sedimentology, stable-isotope geochemistry and geophysical characteristics of the section is less advanced than the paleontological work and will be a focus of the team's investigations in 2012 and 2013. The sections contains numerous volcanic ash layers near the boundary level and the task group will have the most important ashes dated using the U-Pb isotope dilution thermal ionization mass spectrometry (ID-TIMS) methodology. A couple of relatively shallow-water but poorly-exposed sections such as the Bolshoi Kizil River section (Kulagina *et al*., 2009) occur in the region. The task group plans to start measuring the best of them in 2012 to place the important Kardailovka section into its sedimentological and

paleoenvironmental context and to determine the relationship of shallow-water coral and foraminiferal zones to the deeper-water *L. nodosa - L. ziegleri* transition at Kardailovka.

Activities in Cantabrian Mountains, northern Spain

In June 2010, Javier Sanz-López and Silvia Blanco-Ferrera introduced task-group members to several sections spanning the Viséan-Serpukhovian boundary in the Cantabrian Mountains of northwestern Spain. One of the sections, the Millaró section by the village of Millaró in the fold and Nappe province of the Cantabrian zone, is excellent rivaling the better known Kardailovka and Nashui exposures. 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 section is the common occurrence of abundant, well-preserved ammonoids being studied by team-member Svetlana Nikolaeva. Deposits within the *L. nodosa - L. ziegleri* transition are dominated by nodular, deep-water, basin carbonates of the Alba Formation. The conodont biostratigraphy has been moderately well established (Sanz-López *et al*., 2007) but the FAD of *L. ziegleri* may need to be more precisely located and sedimentological, geophysical and geochemical analyses are required. During 2012 to 2013, the team plans to systematically sample the section for ammonoids and commence sedimentological, geophysical and geochemical analyses.

Activities in Rocky Mountains, Canada

The task-group chairman along with corresponding members Sergio Rodriguez and Wayne Bamber will continue to study carbonate-dominant sections across the Viséan-Serpukhovian boundary interval in the upper Viséan to Serpukhovian Etherington Formation in the southern Canadian Rocky Mountains. They are preparing a monograph on the taxonomically diverse rugose coral faunas that span the boundary within the Etherington. Although none of the Etherington sections are likely to be candidates for the GSSP, the investigation will provide valuable biostratigraphic and sedimentologic data that will assist correlations between Western North America and the low-latitude tropical-marine successions of Europe and Asia.

Bashkirian-Moscovian boundary The task group is conducting research in Eurasia to continue its evaluation of lineages suitable for boundary definition. Investigations focus on evolutionary transitions in conodont and fusulinid lineages and it is anticipated that during the new fiscal year a lineage and taxon suitable for boundary definition will be selected.

During the coming fiscal year, most work will be directed on localities in Guizhou Province, South China. The well-known Naqing (= Nashui) section contains exceptionally abundant and diverse conodonts in a relatively deep-water, slope setting (Qi *et al*., 2007; 2010). Fusulinids are present at Naqing, but they are less abundant and not as well preserved the conodonts. Qi Yuping is leading a group of conodont specialists who have identified three levels at which a lower Moscovian boundary might be placed. The lowest potential marker is the appearance of *Streptognathodus expansus* Igo & Koike, 1964 at 169.05 m above the base of the section. This species appears in evolutionary continuity with a yet-to-be-named ancestor. The next higher potential marker is the appearance of *Diplognathodus ellesmerensis* Bender, 1980 at 174.3 m. Whereas the evolutionary origin of *D. ellesmerensis* was once unclear, Qi and his colleagues now report the discovery of a transitional form linking *D. orphanus* with *D. ellesmerensis*. The highest potential boundary level is the appearance of *Mesogondolella* spp. (e.g., *M. donbassica*) at 179.9 m. *Mesogondolella* is an attractive marker because it is easily identified and widespread geographically, but its appearance is consistently above those of *Declinognathodus donetzianus*, *Neognathodus kanumai* and *N. atokaensis*, which are conventionally regarded as Moscovian indices. Work for the coming year will involve formally describing the ancestor to *S. expansus*, fleshing out evolutionary relationships between *D. orphanus* and *D. ellesmerensis* and testing the intercontinental biostratigraphic fidelity of the potential marker events.

Work on the sedimentology, stable-isotope geochemistry, and geophysical characteristics of the boundary interval in the Nashui section are not as advanced as the paleontological investigations and need to be a focus of the team's work in 2012. During 2012, the task group plans to complete

measuring the Moscovian component of the section into the lower Kasimovian and finish a bed-by-bed analysis of the strata over a 10 to 20 metre-thick interval on either side of the probable boundary level.

Fusulinid specialists in the task group recently proposed the FAD of *Eofusulina* as a potential marker for the base of the Moscovian Stage. This prompted Katsumi Ueno along with Japanese and Chinese colleagues to re-sample platform carbonates at the Zongdi section (Ueno *et al*., 2007) in an attempt to demonstrate a continuous *Verella–Eofusulina* lineage. At Zongdi the lowest *Verella* was found at 56 m and specimens continue up to 76 m. The lowest *Eofusulina* occurs at 80.5 m and others are commonly found up to 95 m. Ueno *et al*. noted that the FAD of *Eofusulina* is just below a subaerial exposure surface at 83.0 m, suggesting that at this locality the derivation of *Eofusulina* from *Verella* might be a true evolutionary first appearance event. Ueno and colleagues will continue their investigation of the *Verella–Eofusulina* lineage at Zongdi and also at the recently discovered Luokun and Dianzishang sections, which are known to contain good conodont and fusulinid faunas.

Demir Altiner and colleagues conducted an analysis of the sequence stratigraphy and fusulinid biostratigraphy of Bashkirian-Moscovian boundary beds in the Tauride Belt, southern Turkey. Three overlapping sections spanning the Lower Bashkirian (Askynbashky) to Lower Moscovian (Solontsovsky) beds were measured and sampled on a bed-by-bed basis. The Bashkirian-Moscovian boundary is recognized locally by the first occurrence of *Profusulinella prisca* within the *P. staffellaeformis-P. paratimanica* lineage. Turkish sections might rival those in South China as candidates for the basal Moscovian GSSP but it is necessary to undertake detailed analyses of the conodonts in order to integrate sequence stratigraphy with a combined conodont-fusulinid biostratigraphy.

Moscovian- Kasimovian boundary During the 2012 fiscal year, the ongoing biostratigraphic analyses reported on in section #5 above will continue particularly in southern China. Qi Yuping and James Barrick have been studying conodonts from the uppermost Moscovian to lower Gzhelian slope carbonates in the Naqing (Nashui) section, southern Guizhou, South China. They consider that the FAD of *Idiognathodus turbatus* Rosscoe and Barrick 2009 is the best potential boundary marker for the base of the global Kasimovian Stage. The task-group leader hopes a proposal to use *I. turbatus* for boundary definition can be developed in the new fiscal year. After such a proposal is made and voted on, additional taxonomic work and comparison of morphotypes from different regions can be continued. The proposal would be based on specimens from south China and also recognized in the Midcontinent region of the U.S.A., the Moscow Basin, the southern Urals of Russia, and Donets Basin of Ukraine. The use of *I. turbatus* would raise the base of the Kasimovian up one substage from the traditional position at the base of the Krevyakinian Substage, to approximately the base of the Khamovnikian Substage but will facilitate global correlation.

Activities in southern China

During the last several years, Qi Yuping and James Barrick have been studying conodonts from the uppermost Moscovian to lower Gzhelian slope carbonates in the Naqing (Nashui) section, southern Guizhou Province. As a consequence of that work, they consider that the FAD of *Idiognathodus turbatus* is the best potential boundary marker for the base of the Kasimovian. They will continue with intensive studies to provide more detailed information on the conodont succession across the Moscovian-Kasimovian boundary in the Nashui section (Qi *et al*., 2007, 2009; Barrick *et al*., 2010) as a potential GSSP locality.

Work on the sedimentology, stable-isotope geochemistry, and geophysical characteristics of the Moscovian-Kasimovian boundary interval at Nashui is less advanced than the paleontological investigations and need to be a focus of the team's field work in 2012-2013. The task group needs to complete a bed-by-bed study through about 10 metres of strata on either side of the proposed Moscovian-Kasimovian boundary level. That work will include taking a continuous sample through about one metre of strata on each side of boundary to determine the location of all principal sedimentary events and the characteristics and origins of the beds.

To place the Nashui 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) and the Luokun sections will continue. Like the Nashui section, the exposure at Luokun is essentially 100% complete and dominated by slope carbonates of turbiditic and hemipelagic aspect but the lithofacies are of more proximal aspect. Study of the section will provide another opportunity to see conodonts and foraminifers spanning the Moscovian-Kasimovian transition in the region. Foraminifers are more abundant and better preserved than at Nashui and it is anticipated that a better correlation between conodonts and foraminifers can be achieved by the study of the Luokun section.

Activities in Moscow Basin, Russia

The task group will continue to study specimens from the Stsherbatovka quarry section on the Oka-Tsna Swell of the Ryazan Region, east of the town of Kasimov in the Moscow Basin. In the section, the middle part of the Neverovo Formation (Khamovnikian Substage) contains abundant macrofauna. Conodonts occur as well but are not common and most elements are juveniles of the *Idiognathodus sagittalis-I. turbatus* group. *Idiognathodus sulciferus* was also identified. Earlier, fusulines were used to correlate this interval with the Krevyakinian *Obsoletes obsoletus* Zone, but the conodonts suggest a younger age. The Stsherbatovka section, situated about 250 km southeast of the better-known Afanasievo section (Goreva et al., 2009) in the Moscow Basin, demonstrates a wider distribution of the marker conodont species for identifying the base of the Kasimovian. The section is better than the Afanasievo section (neostratotype of Kasimovian and potential candidate for GSSP at its base), because it was deposited in somewhat deeper water and elements of the *I. sagittalis-I. turbatus* group are more abundant.

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. The event level is consistent with both the working ammonoid definition of the boundary and with the first appearance of a cotype of the fusulinid *Rauserites rossicus* in the Moscow region. The recent selection of the lectotype of the fusulinid *R. rossicus* at the first appearance of *I. simulator* in Russia will expedite the recognition of this boundary in Eurasia. So far, only the Usolka section in the southern Ural Mountains of Russia has been proposed as a candidate section for the GSSP (Chernykh *et al.*, 2006; Davydov *et al*., 2008); other proposals are being developed.

Activities in Russia

The Usolka section requires substantial new stratigraphic work and re-assessment. On August 14 2009, task-group members and other SCCS representatives visited the Usolka section during a Field Meeting. The fieldtrip participants observed that only fragments of the section were exposed and they were in small, partly filled to overgrown trenches. In response to that observation, the task group needs to extensively excavate the site during its re-assessment.

In the summer of 2010, Russian colleagues briefly visited the Kholodny Log section on the western slope of the Middle Urals. The upper part of the section is a famous shallow-water Asselian (Lower Permian) succession containing abundant fusulinids but the lower part of the section spans the Kasimovian/Gzhelian boundary interval, which contains abundant fusulinids and the conodont *Streptognathodus pawhuskaensis*. The task group plans to visit the locality to collect more samples for conodonts.

Task-group member Alexander Alekseev and colleagues are working in the Yablonevy Ovrag Quarry, Zhiguli Mountains, by Samarskaya Luka National Park in the Volga River region, Russia. The section contains abundant *Idiognathodus simulator*, the index conodont for the boundary and it is anticipated the group will develop a GSSP proposal based on studies at the locality.

Activities in China

Yuping Qi and colleagues plan to continue with detailed sampling and analysis across the proposed Kasimovian-Gzhelian boundary level in the Nashui section (Wang and Qi, 2003) in Guizhou Province, south China for conodonts and fusulinids. Conodont recovery across the boundary level has not been as good as expected and large samples are required to obtain an adequate understanding of evolutionary trends. A sedimentologic, geophysical and geochemical analysis of that section at the appropriate level is required. During 2012 to 2013, the task group plans to complete the measurement and sampling of the upper Kasimovian to Lower Permian component of the Nashui section (for lithology, stable-isotope geochemistry, and geophysics) In conjunction with the latter work, the task group plans to complete a bed-by-bed study through 10 metres of strata on either side of the proposed Kasimovian-Gzhelian boundary level. That work will include taking a continuous sample through about 1.5 m of strata on each side of boundary to determine the location of all principal sedimentary events and the characteristics and origins of the beds.

9. BUDGET AND ICS COMPONENT FOR Nov. 1, 2011 - Oct. 31, 2012 fiscal year

PROJECTED EXPENSES

Mailing and sample shipping	$500
Bank charges at Bank of Montreal	$25
Travel support for SCCS Chairman to attend 34th IGC in Brisbane (August 2 to 10, 2012) to participate in ICS meetings on August 6th and 9th, attend joint SCCS and SPS business meeting on August 7th and give presentation about Carboniferous stage boundaries in symposium 35.1	$1000
Travel support for other SCCS voting members to attend 34th IGC	$2000
Travel support for SCCS Chairman and voting members to southern Urals in August for field meeting and work on the Kardailovka GSSP candidate for Viséan/Serpukhovian boundary	$500
Travel support for SCCS Chairman and voting members to attend meeting for IUGS 575 in Ukraine during late September 2012	$500
TOTAL PROJECTED EXPENSES	$4,525.00
INCOME	
Carryover (from CREDIT balance at end Nov. 1, 2010 - Oct. 31 2011 fiscal year)	$994.57
Estimated donations	$200.00
TOTAL PROJECTED INCOME	$1,194.57
BALANCE	
Estimated (deficit) / credit from above	-$3,339.43
BUDGET REQUEST FROM ICS for 2012	$3,330.00

10. SUMMARY OF CHIEF ACCOMPLISHMENTS OVER PAST FIVE YEARS (2007-2011)

This summary is updated from last year's annual report by incorporating information from the task-group reports published in the November 2011 issue of the Newsletter on Carboniferous Stratigraphy. For the full reports including references see Appendix B.

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 and Clayton, 2006a, 2006b), and all effort is now focused on selecting events and GSSPs for stage boundaries.

Task Group to redefine the Devonian-Carboniferous Boundary

Studies by Ji *et al*. (1989) and subsequent analysis (Kaiser, 2009) demonstrated severe problems exist with the Devonian-Carboniferous Boundary GSSP (Paproth *et al*., 1991) at La Serre Hill in France. Because of the serious problems with the integrity of the GSSP, Thomas Becker (Chairman of Subcommission on Devonian Stratigraphy) and Philip Heckel (former Chairman of SCCS) established the joint Devonian-Carboniferous Boundary GSSP reappraisal task group in 2008, appointing 10 members from each subcommission. In June 2010, the SCCS Chairman Barry Richards appointed Markus Aretz to chair the task group.

Following a 2008 SCCS workshop at the 33rd International Geological Congress (IGC) in Oslo, Richards included plans for future work by the task group in the 2008 SCCS Annual Report submitted 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 from the base of bed 89 or a more suitable section must be located, and 3) because the first appearance of *S. sulcata* may not be the best marker, other conodont lineages require evaluation.

Progress

Since Richards submitted the work plan in 2008, 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). 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.

During the 2010 IPC3 workshop in London, the multi-phase Hangenberg Event (Kaiser, 2005; Kaiser *et al*., 2008) was identified as a level of interest for boundary definition. However, more data 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 and plan to present results at the joint SDS/SCCS meeting planned for 2013 in Morocco.

From the work completed from 2009 through 2011, 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*. Although an event for boundary definition boundary has not been chosen, the search for better GSSP sections is progressing. New D-C boundary sections are being evaluated and previously studied sections such as the Hasselbachtal and those in southern China (Ji *et al*., 1989) are being re-evaluated.

Tournaisian-Viséan Boundary By 2003 work by the Tournaisian-Viséan Boundary task group 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. The Secretary's report for 2008 (Newsletter on Carboniferous Stratigraphy, v. 26 p. 4) provides the details about the proposal and SCCS ballot. The principal work of the task group has come to completion and task-group members are preparing the final report.

Viséan-Serpukhovian Boundary The Viséan-Serpukhovian Boundary task group plans to use the FAD of *Lochriea ziegleri* Nemirovskaya, Perret & Meischner 1994 in the conodont lineage, *Lochriea nodosa* (Bischoff, 1957) -*Lochriea ziegleri,* for boundary definition. By 2010 the *L. nodosa-L. ziegleri*

lineage had become widely recognized in Western Europe, Russia and Asia (Skompski *et al*., 1995; Nikolaeva *et al*., 2009; Qi and Wang, 2005) and although the lineage is not yet known from North America, specimens of *L. ziegleri* and other species in the genus have been discovered. By late 2010, the task group decided the FAD of *L. ziegleri was* suitable for boundary definition and a proposal is being written in preparation for a vote by the task group and SCCS.

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 (Nikolaeva *et al*., 2005). Since 2005 the section has been thoroughly examined and a synthesis published about the ammonoids, conodonts, and ostracodes (Nikolaeva *et al*., 2009). The synthesis indicates conodonts that are transitional between *L. nodosa* and *L. ziegleri* occur in the section immediately below the FAD of *L. ziegleri.* Prior to 2010, extensive parts of the section were poorly exposed but during August 2010 and 2011 the covered components of the section were excavated and permanent aluminum marker pins placed at one metre intervals in preparation for a bed-by-bed sedimentological analysis and systematic sampling for conodonts, stable-isotope geochemistry and magnetic susceptibility studies in 2011 and subsequent years.

In 2005 the *Lochriea* lineage was reported from carbonate-slope facies in the Nashui section in southern Guizhou Province, China (Qi and Wang, 2005). Since 2007, the conodonts spanning the Viséan-Serpukhovian boundary in the Nashui section have undergone intensive study by Chinese colleagues and the section has become a strong potential candidate for a GSSP at the base of the Serpukhovian. Qi Yuping has finished his analysis of the conodonts across the Viséan-Serpukhovian boundary at Nashui and incorporated the results in his doctoral thesis and subsequent papers (Qi, 2008). In the Nashui section, 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, and the oldest representatives of *L. ziegleri* can be distinguished from the associated transitional forms of *L. nodosa*. A detailed stratigraphic section extending from the upper Viséan into the Bashkirian has been measured at Nashui 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. John Groves completed his study of the foraminifers in time for the November 2010 SCCS workshop and field meeting in Nanjing. His work indicates foraminifers 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 and Dianzishang sections) in the region from 2009 through 2011 is enabling the task group to place the Nashui section into its paleogeographic, stratigraphic, and lithofacies contexts.

In June 2010, Spanish colleagues introduced task-group members to several sections spanning the Viséan-Serpukhovian boundary in the Cantabrian Mountains of Spain. Two of the sections, the Vegas de Sotres and Millaró (Sanz-López *et al*., 2004; 2007) in the Alba Formation, are excellent deep-water carbonate sections rivaling the better known Kardailovka and Nashui 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 (Sanz-López *et al*., 2007; Blanco-Ferrera *et al*., 2009) but the biostratigraphic and sedimentologic work at the two localities is less advanced than at the Nashui and Verkhnyaya Kardailovka sections.

Work has been initiated on ammonoid-rich successions in the western U.S.A. (Korn and Titus, 2011), southern Urals of Kazakhstan, and on foraminifer- and coral-rich successions in Western

Europe and western Canada in order to bracket the level of the first appearance of *L. ziegleri* in North America. By the end of the 2011 fiscal year, the lineage has 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 (Brenckle *et al*., 2005; Qi Yuping, pers. com., 2010).

Although the *Lochriea* lineage along with associated faunas and strata are being studied in several areas, the task group has concluded the Nashui section in China and the Verkhnyaya Kardailovka section in Russia have the best potential as GSSP candidates.

Bashkirian-Moscovian Boundary Several conodont and foraminiferal lineages have been appraised and potential candidate sections located but a suitable marker for the Bashkirian-Moscovian Boundary has not been selected. Substantial attention has turned to evaluating the *Declinognathodus marginonodosus—D. donetzianus* lineage for boundary definition but the lineage does not have a sufficiently wide geographic distribution. Other conodont taxa and fusulinids are being used for correlations into successions where the latter lineage was not developed. 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. Most recently (2010-2011), the group developed a proposal to use the (FAD) of the fusulinoidean genus *Eofusulina* Rauser-Chernousova in Rauser-Chernousova *et al.* 1951in evolutionary continuity with its ancestor for boundary definition (Groves *et al*., 2011). They also started to develop a proposal using a new conodont level (Qi *et al*., 2010).

Russian colleagues discovered an evolutionary lineage of *Declinognathodus marginonodosus—D. donetzianus* 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 (Kulagina *et al*., 2009).

In northwest Spain, Javier Sanz-López, Silvia Blanco-Ferrera and Elisa Villa are conducting integrated foraminifera and conodont biostratigraphic analyses at the San Antolin-La Huelga section along the Bay of Biscay in the Cuera area (Bahamonde *et al*., 2008; Villa *et al*. 1997). The Bashkirian-Moscovian boundary is provisionally placed about 180 m above the base of the section. The boundary is marked by the lowest occurrence of *Idiognathoides postsulcatus*, and this level is slightly higher than the lowest occurrences of *Declinognathodus marginodosus* and *Profusulinella* ex gr. *prisca*. The San Antolin-La Huelga section contains four conodont taxa identified as potential Bashkirian-Moscovian Boundary markers: *Id. postsulcatus*, *Diplognathodus ellesmerensis*, *Neognathodus nataliae* and *Declinognathodus donetzianus*.

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. At the Nashui section in Guizhou Province, *D. ellesmerensis* appears in evolutionary continuity from *D. coloradoensis* at the base of the Moscovian. 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.*

The Bashkirian-Moscovian Boundary interval at Nashui has been selected for intensive biostratigraphic and sedimentologic study as a potential candidate for a GSSP. In 2008 John Groves and colleagues visited the carbonate-dominant section and initiated a detailed biostratigraphic and sedimentologic analysis across the boundary. Since that trip, Qi Yuping finished his analysis of the conodonts across the Bashkirian-Moscovian Boundary and incorporated the results in his doctoral thesis (Qi, 2008). A detailed stratigraphic section extending from the upper Serpukhovian into the Moscovian was measured at Nashui and aluminum marker pins placed at one-metre intervals. Groves (2010) completed his study of the foraminifers in the Nashui 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.

During 2010, Qi Yuping and Lance Lambert were examining conodonts from the Nashui section that span the Bashkirian-Moscovian Boundary interval and discovered that rapid morphologic evolution in P_1 elements of *Streptognathodus expansus* and *S. suberectus* permit the identification of a new and possibly better biostratigraphic level at which the base of the Moscovian might be placed and presented initial findings (Qi *et al*., 2010) at a November 2010 SCCS workshop and field meeting in Nanjing, China. They advocated placement of the base of the Moscovian at the joint first appearances of advanced morphotypes of *Streptognathodus expansus* and *Streptognathodus suberectus* in the Nashui section. That level coincides with the local appearance of *Neognathodus kanumai* and it occurs approximately 4 m below the local appearance of *Diplognathodus ellesmerensis*, an event previously identified as a potential boundary marker. Qi *et al.* (2010) clarify the taxonomic distinctions between stratigraphically lower morphotypes of *S. expansus* and *S. suberectus* and the higher, advanced morphotypes of the same species. Additional work is necessary: 1) to show that the advanced morphotypes of *S. expansus* and *S. suberectus* occur elsewhere in evolutionary continuity with their respective ancestors; and 2) to test the biostratigraphic fidelity of the advanced morphotypes relative to other, potential lower Moscovian indices.

In 2010, the task group developed a new proposal (Groves *et al*., 2011) to mark the base of the Moscovian using the (FAD) of the fusulinoidean genus *Eofusulina* Rauser-Chernousova in Rauser-Chernousova *et al.* 1951 in evolutionary continuity with its ancestor *Verella* Dalmatskaya 1951. The level is recognized by the lowest stratigraphic occurrence of a fusulinoidean exhibiting septal fluting across the entire length of its shell. The proposal was circulated within the task-group for comments but not voted on. A widely held concern was that relatively few sections were known in which the *Verella–Eofusulina* transition could be documented with closely spaced sampling.

Moscovian-Kasimovian Boundary The Moscovian-Kasimovian task group has extensively evaluated conodonts and fusulinoideans as indices for definition of the base of the Kasimovian and have concluded that the 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. Nevertheless, two fusulinoidean events appear to coincide with events in conodont appearances near the M-K Boundary. The higher one, involving *Montiparus*, is readily identified, but the lower one, among protriticitids, is more dependent on preservation.

Despite major provincialism between Eurasian and North American conodont lineages during the late Moscovian and Kasimovian, widely distributed conodont appearances have been recognized. Taxonomic and zonational updating of the conodont faunas in Eastern Europe (Goreva and Alekseev, 2006; Goreva *et al*., 2007), and in the Midcontinent of the U.S.A. (Rosscoe and Barrick, 2009) formed the basis for welcome progress at the June 2008 workshop and meeting at the University of Oviedo, Spain. Members attending the Oviedo meeting unanimously agreed (Villa and task group, 2008) to focus future work on two conodont species as the potential biostratigraphic marker for the base of the Kasimovian: 1) *Idiognathodus sagittalis* Kozitskaya 1978, 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), and 2) *Idiognathodus turbatus* Rosscoe and Barrick 2008 based on material from the Midcontinent U.S.A., and recognized also in the Moscow Basin, southern Urals, and Donets Basin. A potential ancestor-descendent lineage from *I.* aff. *sagittalis* n. sp. to *I. sagittalis* may be present in the Moscow Basin and a lineage from *Idiognathodus swadei* Rosscoe and Barrick 2008 to *I. turbatus* has been described from the Midcontinent of the U.S.A. The use of either conodont would raise the boundary one substage from the traditional position at the base of the Krevyakinian Substage,

to approximately the base of the Khamovnikian but will facilitate global correlation. Using the new research direction, the group has made substantial progress in selecting GSSP candidate sections.

Kasimovian-Gzhelian boundary Members of the Kasimovian-Gzhelian Boundary task group plan to use the FAD of the conodont *Idiognathodus simulator s.s.* (Ellison, 1941) in the lineage *Idiognathodus* aff. *simulator-I. simulator s.s.* to define the boundary (Heckel *et al.*, 2008). *I.* aff. *simulator* is now named *I. eudoraensis* by Barrick *et al*. (2008).

The search for a suitable candidate section for the GSSP has started with the investigation of two sections; additional candidates are required. A preliminary description of the potential GSSP at Usolka in the southern Urals was published by Chernykh *et al.* (2006) and in more detail by Davydov *et al.* (2008). In 2009 SCCS geologists examined the section and discovered it required substantial excavation work and additional study before a proposal could be put to ballot. The other potential candidate section lies within the Nashui section in south China and is undergoing a thorough biostratigraphic, sedimentologic and geochemical investigation. Within the section, the presence of the lineage containing *I. simulator* has been proven. Existing conodont collections from the Kasimovian-Gzhelian Boundary interval at Naqing permit recognition of the boundary but are insufficient to make a complete description of the boundary conodont faunas. Qi and 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.

Project Group on Carboniferous Magnetostratigraphy 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 Carboniferous Newsletter. 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.

During the November 1st 2008 to October 31st 2009 fiscal year, the search for Mississippian sedimentary rocks that are likely to carry a primary magnetisation, to construct a magneto-stratigraphic timescale, focused on two sections in southern Scotland but no analytical results are available yet. Both sections have good potential for recovery of primary magnetisation because they are dominated by siliciclastics and their thermal maturity is low (Hounslow, 2009).

During the May 31st to June 3rd 2010 ICS meeting in Prague, the project-group leader discussed with Barry Richards and Svetlana Nikolaeva (Russia) the possibility of designing a magnetostratigraphic project that would evaluate Late Mississippian and Pennsylvanian sections in the Moscow Basin, Liard Basin in northwestern Canada and sections in the mid-continent region of the USA. So far, these initial discussions have not developed into tangible outcomes and the main problems stem from a lack of funding and suitable investigators.

Peter Giles (Geological Survey of Canada-Atlantic) and colleagues have largely completed a useful magnetostratigraphic study of the Brigantian, Pendleian and much of the Arnsbergian substages (upper Viséan and Serpukhovian) in the Maritimes Basin of eastern Canada (Giles *et al*., in progress). They have correlated the polarity reversal patterns in the Maritimes Basin with published data from the Brigantian to mid-Arnsbergian interval in the central part of the Appalachian Basin in the eastern United States (Di Venere and Opdyke, 1990, 1991).

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 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 (Menning *et al*., 2006; Davydov *et al*., 2010). The Pennsylvanian-Permian succession in the south Urals has provided new dates on the Carboniferous-Permian Boundary and the late Moscovian with error bars of $\pm$ 0.2 Ma, which Heckel used to more accurately calibrate the late Pennsylvanian time scale by means of cyclothems (Strasser *et al*., 2007). 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.

11. OBJECTIVES AND WORK PLAN FOR NEXT 4 YEARS (2012-2015)

The SCCS executive is encouraging its task groups to maintain progress on researching and selecting defining events for as many stage boundaries as possible in the next four years. 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 exceptions of the bases of the Tournaisian and Moscovian 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, Bashkirian-Moscovian and Moscovian-Kasimovian task groups).

We will encourage some task groups to consider division of their respective time slices (all are stages). Some stages such as the Viséan are inordinately long and require division to facilitate more precise Global correlation. Should a stage such as the Viséan be divided, the name of that stage would be applied to the corresponding series such as the Middle Mississippian in the case of the Viséan, thereby retaining the classic names in current use. A strong possibility exists that the ICS will call for the formal recognition of substages and should this occur, major tasks for the SCCS subsequent to establishment of GSSPs for all of our current stage boundaries will be the selection of substages for inclusion in the ICS chronostratigraphic chart, establishment of task groups for the substages, and initiation of the search for events and GSSPs for boundary definition.

Devonian-Carboniferous Boundary

The main goal of the Devonian-Carboniferous Boundary task group over the next four years 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. The SDS and SCCS will hold an important joint meeting - *The Devonian and Lower Carboniferous of northern Gondwana* - in Morocco in March, 2013 (Webpage: http://www.israbat.ac.ma/seminaires.htm) that should lead to substantial progress on selecting the boundary event and provide direction for future research. Following selection of the event, suitable candidate sections for the GSSP must be located.

Since I (SCCS Chairman) submitted the D-C work plan for the next four years in the 2008 Annual Report for the ICS, 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) 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 and other appropriate taxa are unknown. 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 before the FAD of *S. sulcata* is abandoned.

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). 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.

Even if the FAD of *S. sulcata* is retained for boundary definition, 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* and the base of bed 84b, which contains the FAD of *S. sulcata,* immediately overlies a probable 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. Intensive biostratigraphic, geochronologic, sedimentologic and geochemical studies will be initiated at all potential GGSP sections.

The siphonodellids and protognathodids may not be as useful for boundary definition as previously thought, but other significant latest Famennian to earliest Tournaisian biostratigraphic events may have potential for boundary definition and an intensive search will be undertaken to locate them. The task group plans to explore the possibility of using either a sedimentological or geochemical event such as some 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. The latter question is being investigated and results will be presented at the joint SDS/SCCS workshop in Morocco in March, 2013. At the International Commission of Stratigraphy meeting held in Prague from May 31st to June 3rd, 2010 to discuss the GSSP concept, Vladimir Davydov (Boise State University, Idaho USA) proposed that volcanic-ash layers could be used to define boundaries such as the D-C boundary. Ash layers represent instants in deep time and can be precisely dated using U-Pb isotope dilution thermal ionization mass spectrometry (ID-TIMS) methodology.

Tournaisian-Viséan Boundary By 2003 work by the Tournaisian-Viséan Boundary task group 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 members are preparing the final report.

Viséan-Serpukhovian Boundary Task Group The Viséan-Serpukhovian task group plans to use the FAD of *Lochriea ziegleri* in the conodont lineage *Lochriea nodosa* - *Lochriea ziegleri* for boundary definition. 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 requires completion. Two well-known sections, Verkhnyaya Kardailovka and Nashui 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 (Nikolaeva *et al*., 2009; Pazukhin *et al*., 2010). The other main candidate is the Nashui section near Naqing in southern Guizhou Province, China (Qi and Wang, 2005). In the Nashui section, the *Lochriea* lineage has been intensively studied and the FAD of *L. ziegleri* precisely located. Field work is essentially complete and the remaining objective is to complete the analytical work and prepare the final synthesis for publication.

The *Lochriea* lineage has not yet 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 in Europe and Asia will continue. All this suggests selection of the GSSP is possible in the next four years.

Bashkirian-Moscovian Boundary Task Group The high-priority plans for the Bashkirian-Moscovian Boundary task group during the next four years are to select an event marker for the Bashkirian-Moscovian boundary and then to look for GSSP candidate sections. Several lineages and two main proposals for event markers require immediate evaluation. Until the fall 2010, much of the task group's time was directed toward the evaluation of two conodont lineages that had moderate potential for boundary definition: 1) derivation of *Idiognathoides postsulcatus* from *Id. Sulcatus*, and 2) derivation of *Declinognathodus donetzianus* from *D. marginodosus*. Both lineages have short comings and if either *D. donetzianus* or *I. postsulcatus* are chosen, the group's challenge will be to

demonstrate how the base of the Moscovian can be identified in areas where these taxa do not occur. Nevertheless, the *D. marginonodosus-D. donetzianus* lineage remains a candidate for the event level.

A third potential marker the task group has been evaluating is the appearance of the conodont *Diplognathodus ellesmerensis*, which appears in evolutionary continuity from *D. coloradoensis* at the base of the Moscovian in the Nashui section by Naqing in Guizhou Province, China (Qi *et al*., 2007, 2009) and has been widely recognized globally. The interval spanning the Bashkirian-Moscovian boundary at Nashui is undergoing intensive biostratigraphic and sedimentologic study as a potential GSSP for the base of the Moscovia.

During the fall of 2010, Qi Yuping and Lance Lambert revealed there could be better alternatives for boundary definition than the conodont lineages discussed above (Qi *et al.*, 2010). Rapid morphologic evolution in P_1 elements of *Streptognathodus expansus* and *Streptognathodus suberectus* permit the identification of a new biostratigraphic level that is slightly below the traditional base of the Moscovian. A proposal is being developed by Qi and Lambert in which they will propose to use the appearances of advanced morphotypes of *Streptognathodus expansus* and *S. suberectus* to mark the Bashkirian-Moscovian Boundary. Qi and Lambert must finalize some basic taxonomic work on these two species before they can distribute a formal proposal.

Task-group members collaborated on a new proposal to mark the base of the Moscovian using the (FAD) of the fusulinoidean genus *Eofusulina* Rauser-Chernousova in Rauser-Chernousova *et al.* 1951 in evolutionary continuity with its ancestor *Verella* Dalmatskaya 1951. Operationally, the level can be recognized by the lowest stratigraphic occurrence of a fusulinoidean exhibiting septal fluting across the entire length of its shell. The proposal requires evaluation and was presented at the November SCCS 2011 workshop in Nanjing, China and circulated among task-group members. A widely held concern about the proposal is there are relatively few sections in which the *Verella–Eofusulina* transition can be documented with closely spaced sampling. The search for such localities has become a priority.

The carbonate-dominant Nashui 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 quite 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 les advanced than the paleontological investigations and will be the focus of the team's work in 2011 and 2012.

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. If the fusulinid proposal gains widespread support, it will trigger more work in both sections, because they are known for their fusulinid successions and both would be logical sections in which to search for an eventual GSSP. In late February 2011, Katsumi Ueno and Wang Yue will re-visit the well-known Zhongdi section in southern Guizhou (Ueno *et al*., 2007) for additional sampling of a critical biostratigraphic interval.

If the fusulinid proposal gains widespread support that will also stimulate additional work on sections the task group has been working on in the Cantabrian Mountains of northwestern Spain. The region is known for its fusulinid successions and is a logical region in which to search for an eventual GSSP.

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** are moving ahead as the previously muddled conodont taxonomic problems have been largely resolved. Publication of the cyclothem correlation chart (Heckel *et al*., 2007) across both boundaries in the Midcontinent of the U.S.A. and Eastern Europe where the disconformity-bounded cyclothems are

identified [Moscow Basin, Russia, and Donets Basin in Ukraine], has increased the potential for recognizing the conodont events that can be identified in the essentially complete lower-slope to basin successions in the southern Urals and south China.

Moscovian-Kasimovian Stage Boundary The high-priority plans for the Moscovian-Kasimovian task group during the next four years are to select an event marker for the Bashkirian-Moscovian 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 Midcontinent 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. While the event marker for the Moscovian-Kasimovian boundary still needs to achieve consensus, continued assessment of the two lineages and clarification of the taxonomy of species involved will hasten the process.

The task group will continue to evaluate the utility of the two lineages in the slope-deposits of the Nashui section, a good potential candidate section for the GSSP. Other candidate sections need to be located and intensively studied.

Kasimovian-Gzhelian Boundary Members of the Kasimovian-Gzhelian task group plan to use the conodont lineage *Idiognathodus* aff. *simulator-I. simulator s.s.* to define the boundary at the first appearance of *I. simulator s.s.* (Heckel *et al.*, 2008. *I.* aff. *simulator* is now named *I. eudoraensis* by Barrick *et al*. (2008). Now that an event maker has been selected, task-group members will proceed on the selection of a suitable section for the GSSP. 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); other proposals need to be developed.

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. The Usolka section requires substantial excavation, new stratigraphic work, and re-assessment. On August 14, 2009 representatives of the SCCS visited the Usolka section during a SCCS field meeting. The fieldtrip participants observed that only fragments of the section were exposed and they were in small, partly filled to overgrown trenches. In response to that observation, the task group needs to extensively excavate the site during its re-assessment.

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

Chemostratigraphy, magnetostratigraphy 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 eventually will 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, more coordinated 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, and from the Mississippian of Belgium by the Tournaisian-Viséan task 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.

Meeting-field workshop schedule with themes and anticipated results.

During the November 1, 2011 - October 31, 2012 fiscal year, the 34th International Geological Congress (IGC) in Brisbane, Australia will be the most important meeting in terms of the goals of the subcommission and is discussed below.

From the 5th - 10th of August 2012, the IGC will be held in Brisbane, Australia (website at www.34igc.org). The SCCS will not hold a symposium and workshop at the meeting because we held the XVII International Congress on the Carboniferous and Permian in Perth, Australia last July and do not anticipate many of our members will take the expensive trip to Australia two years in a row. We encourage you, however, to try and attend the meeting and submit abstracts to symposia that are relevant to your task-groups activities. Within congress theme 35 (Geostandards), Marco Balini, Jim Ogg and Stan Finney are chairing Symposium 35.1 GSSPs (Global Boundary-Stratotype Section and Point) as global standards. For symposium 35.1, contributions on all aspects of GSSPs as global standards are encouraged. Several members of the SCCS plan to give oral presentations at Symposium 35.7 "The Devonian-Carboniferous-Permian Correlation Chart" chaired by Manfred Menning. Goals of the presentations are to give progress reports on the activities of the SCCS.

We will hold a joint business meeting for the Subcommission on Carboniferous Stratigraphy (SCCS) and Subcommission on Permian Stratigraphy (SPS) on Tuesday August 7th, 2012 during the 34th IGC. The meeting will be held in room P9 at the Brisbane Convention and Exhibition Centre. At the meting we plan to discuss the membership and outline work plans for the next four years.

Members will also attend the ICS meetings. Two meetings are planed: a public meeting on August 6th and a second on August 9th for subcommission chairs and the ICS executive. Expectations are to receive direction for activities over the next four years.

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APPENDIX B. ***[Full text of Task Group Reports]***

Report of task group to redefine the Devonian-Carboniferous Boundary, Chairman Markus Aretz

Members of the task group are currently conducting research at several locations in Europe, North Africa, Russia, Asia and North America. The current work is directed on several principal aims, which have been defined in previous years (Richards and task group, 2010) and at the task-group workshop

held during the 2010 Third International Palaeontological Congress (IPC3) in London, United Kingdom (Aretz and task group, 2011).

General activities

Following the IPC3 workshop in London, the task-group members have been actively collecting data and a first synthesis of these data should be presented at a workshop in Morocco (March 25th to April 1st, 2013). Until this date no formal meeting is planned, and news and progress are presented in the usual forums.

Several members of the task group attended "The SCCS Workshop on GSSPs of the Carboniferous System: Carboniferous Carbonate Succession from Shallow Marine to Slope in Southern Guizhou Province, China" from November 22nd - 29th, 2010. The SCCS Workshop was organized by Xiangdong, Wang, Yuping, Qi, Yue, Wang and their colleagues and held at the Nanjing Institute of Geology and Palaeontology, Chinese Academy of Sciences (NIGPAS), China. Of particular interest to the task-group members was a talk by Y. Gatovsky and L. Kononova: "Devonian-Carboniferous boundary in the FSU (former Soviet Union)" and a field trip led by Ji Qiang to examine a well-studied Devonian/Carboniferous Boundary section (Ji *et al*., 1989) situated by the town of Dapoushang in Guizhou province.

Not many task-group members attended the ICCP in Perth Australia, but three contributions related to the D/C boundary were made (keynote by the task-group leader (Aretz, 2011a), poster on brachiopods by (Brice and Mottequin, 2011) and a poster on the D/C boundary in Czech Republic.

Boundary criterion

The group is searching for a suitable criterion for the redefinition of the D/C Boundary, currently defined (Paproth and Streel, 1984) by the first evolutionary occurrence of the conodont *Siphonodella sulcata* (Huddle, 1934) in the lineage *Siphonodella praesulcata* Sandberg 1972 to *S. sulcata.* The task group favors a level that will not substantially shift the base of the Carboniferous from its current position, because stratigraphic stability is required. However, the search for a criterion is not focused on a specific fossil group or technique. During the 2010 IPC3 workshop in London, the multi-phase Hangenberg Event (Kaiser, 2005; Kaiser et al., 2008) was identified as a potential level of interest. However, more data 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 potential of the event for boundary definition on a global scale. In order to properly understand the Hangenberg Event, the interval to be studied should include strata below and above the event level, which can be associated with black shales in specific facies realms.

Since the problems with the conodont lineage *S. praesulcata – S. sulcata* and the FAD of *S. sulcata* that are used to define the D/C Boundary GSSP at La Serre were recognized (Ji *et al*., 1989; Kaiser 2005, 2009) clarification of the lineage has been a prime task for the conodont workers (e.g. Spalletta *et al*. 2010). Results have been published for siphonodellids (Kaiser and Corradini, 2011) and protognathodids (Corradini *et al*. 2011). Their papers show that the two conodont groups do not contain potential index fossils for the D/C boundary. The currently used lineage represents a series of taxonomic problems and instability, which result from the diverging identification and naming of transitional forms between *S. praesulcata* and *S. sulcata*. Thus the identification of *S. sulcata* is subjective and the species is not a suitable marker for the base of the Carboniferous.

The second conodont group, which is often used as an alternative index to the siphonodellids, is the protognathodids and they show a variety of problems. They suffer from: a general rarity in many sections, regional variation in the first occurrence datum, and restricted stratigraphic ranges and global distribution; in addition, their relationship to lithofacies is poorly understood. Thus, none of the four species of *Protognathodus* [*Protognathodus meischneri* Zieghler 1969, *Protognathodus collinsoni* Ziegler 1969, *Protognathodus kockeli* (Bischoff, 1957) and *Protognathodus kuehni* Ziegler & Leuteritze 1970] within the boundary interval have a high potential as an index for redefinition of the boundary.

Because the conodonts most frequently used to locate the D/C Boundary do not provide a good candidate for defining that boundary, other fossil groups need to be considered and require comprehensive analysis. Additionally, new results from the restudy of the conodonts in the La Serre section (Kaiser, 2009) show that current global correlations at the D/C Boundary level may be wrong because they rely on conodont datums, which have been identified as being problematic. Thus, the task group has to establish new tools for correlation and revise the global correlations.

The conodont workers of the task group continue their studies on various late Famennian-early Tournaisian sections. Data arising from their work will be incorporated into correlation charts planned at the IPC3 workshop in London.

Progress reports from members

Europe. A team of Czech researchers is currently using a multidisciplinary approach to study the D-C boundary interval (Babek- geophysical methods, sedimentology, and sequence stratigraphy; Fryda- C isotopes; Grygar- element geochemistry; Kalvoda- foraminifers, and conodonts; and Kumpan- conodonts, geophysical logging, and C isotopes). This team is working intensively on Devonian – Carboniferous sections in the southern part of the Moravia – Silesian Basin (Central Europe, Czech Republic) ranging from the late Famennian *expansa* to the early Tournaisian *sandbergi* zones. Protognathodid faunas are rather abundant in the calciturbidite succession in the Lesni lom quarry, where the Hangenberg Event facies are developed. The specimen of *Siphonodella* found in 1986 below the Hangenberg event facies can be assigned to the *sulcata* morphotype, which underlines the problems of the biostratigraphic definition of the D/C boundary. The foraminiferal studies confirm the presence of the genus *Quasiendothyra* up to the *duplicata* Zone. Petrophysical measurements (gamma-ray spectrometry, bulk magnetic susceptibility and colour parameters /spectral reflectance in visible light) show a relatively good correlation potential within the carbonate turbiditic facies but the correlation with the nodular facies is limited. First results of carbon isotopic studies show a positive peak of $\delta^{13}C_{carb}$ in the middle to upper? *praesulcata* zones in the Lesni lom quarry. Preliminary results were presented in a poster at the International Congress on the Carboniferous and Permian in Perth. The Czech workers have extended their work to sections in Austria (Carnic Alps and Graz Palaeozoic).

Task-group member Hanna Matyja continues to work with colleagues from Poland and Germany (T. Becker, S. Kaiser) on two projects related to the D/C boundary in the subsurface of northwest Poland and the Tian-Shan Range of central Asia. Short-term objectives of their work are the establishment of a high-resolution biostratigraphic scheme and geochemical profiles using stable-carbon and oxygen isotopes. A longer-term goal is to identify the signatures of the Hangenberg Event. Results of a multidisciplinary study of the Pomeranian Basin will be published in a Special Volume of the Geological Society of London. Task-group member D. Brice and B. Mottequin continue to study brachiopods from the boundary interval in Europe and Northern Africa.

Morocco. The working group of Thomas Becker continues their research in central and southern Morocco. Their new results and sections will be presented at a 2013 task-group workshop in Morocco.

Pre-Caspian region. Task-group member P. Brenckle continues his investigations of foraminifera in shallow-water facies of the North Caspian Basin.

North America. Member Barry Richards continues his ongoing studies of the latest Famennian to early Tournaisian Exshaw Formation in the southern Canadian Rocky Mountains and Foothills to see if the main events in the multi-phase Hangenberg Event Interval (Kaiser, 2005), can be more precisely located in the formation with a multidisciplinary approach using stable-carbon isotope geochemistry combined with U-Pb geochronology, biostratigraphy and sedimentology. Conodont data indicate the contact between Devonian and Carboniferous strata lies in the upper part of the black shale member of the Exshaw Formation at its type section and at several other localities. The position of the D/C boundary has not been precisely located in the Exshaw Formation and it is hoped evidence from stable-isotope geochemistry will more tightly constrain the position of the boundary.

China. Task-group members E. Poty and M. Aretz and co-workers continue their work on the correlation of latest Devonian to Mississippian third-order sequences in Southern China with those in Europe. The studied sections are all in shallow-water facies. First results, indicating a high correlation potential of many sequence boundaries, were presented at the International Congress on the Carboniferous and Permian in Perth (Poty *et al*., 2011). Work on the correlations will facilitate correlations to other regions in shallow water facies.

Outlook

The work of the task group starts to become more organized. The lack of data on many fossils groups and especially the correlation of the "old" data with the new conodonts results are a constant problem and will strongly influence the future work of the task group. First of all, the task group has to continue gathering biostratigraphic, sedimentologic, geochemical and petrophysical data in the next years. These data have to come from different facies and different fossil groups to insure good correlations in various facies realms and regions.

As decided at the IPC3 workshop in London, one focus should be the compilation of correlation charts for the different phases of the Hangenberg Event. However, that must not exclude or slow the work on stratigraphic ranges of latest Famennian and earliest Carboniferous taxa, because the level of the Hangenberg Event is only one possibility.

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Task Group to establish the Tournaisian-Viséan boundary, Chairman George Sevastopulo

Following approval of the proposed GSSP (see 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 and his colleagues have been preparing the final report about the Tournaisian-Viséan boundary GSSP. After completion of the report, the task group will be dissolved according to ICS rule (7.5).

Task-group member Hongfe Hou is trying to organize an official ceremony for the placement of the "golden spike" in the GSSP section at Pengchong. Several task-group members and SCCS officials plan to attend the historic ceremony.

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Report of task group to establish the Viséan-Serpukhovian Boundary, Chairman Barry C. Richards

Introduction

During the past fiscal year, the task group made substantial progress toward the selection of a GSSP for the Viséan/Serpukhovian stage boundary; an event for boundary definition has been chosen and work is well advanced on two prime candidate sections. For boundary definition, the group plans to use the first evolutionary appearance 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, which is 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, 2003, 2004; Kabanov *et al*., 2009). Members of the task group are conducting research on biostratigraphy, sedimentology and lithostratigraphy, stable-isotope geochemistry and magnetic susceptibility at a variety of locations in Europe, Russia, China and North America. Because the first evolutionary appearance of the conodont *L. ziegleri* in the lineage *L. nodosa-L. ziegleri* has unofficially been selected by the task group as the best potential for boundary definition, biostratigraphic investigations continue to focus on refining the biostratigraphic work done on the conodonts, ammonoids, foraminifers corals and other fossil groups.

Members of the group participated in two important meetings during the fiscal year - 1) the SCCS Workshop on GSSPs of the Carboniferous System: Carboniferous Carbonate Succession from Shallow Marine to Slope in Southern Guizhou Province, China [November 22 - 29, 2010] and 2) the XVII International Congress on the Carboniferous and Permian in Perth, Australia [July 3-8, 2011]. During the fiscal year, the most important accomplishment was the completion of a comprehensive study of the foraminifers spanning the Viséan/Serpukhovian boundary in southern Guizhou Province, China by John Groves and his co-authors. The biostratigraphic studies are much further advanced than the other aspects of the work and the focus in the 1st November 2011- 31st October 2012 fiscal year needs to be on the stratigraphy, sedimentology and geochemistry.

Meetings

The SCCS Workshop on GSSPs of the Carboniferous System: Carboniferous Carbonate Succession from Shallow Marine to Slope in Southern Guizhou Province, China

The SCCS Workshop, held in Nanjing China from November 22nd to 24th 2010 was organized by Xiangdong, Wang, Yuping, Qi, Yue, Wang and their colleagues and held at the Nanjing Institute of Geology and Palaeontology, Chinese Academy of Sciences (NIGPAS) in Nanjing. It consisted of two days of working sessions (examination of fossils) and a day of oral presentations (November 24th). Talks of principal interest to the task group were: 1) Foraminiferal basis for recognizing the Viséan-Serpukhovian boundary at Yashui - by Groves, J., Wang, Y. and Wang W.; 2) Research progress on both conodonts and foraminifers from the candidate GSSP of the Carboniferous Viséan-Serpukhovian boundary in the Naqing (Nashui) section of South China - by Qi, Y. *et al*.; 3) New results from the Verkhnyaya Kardailovka section (south Urals) - a candidate for the Viséan-Serpukhovian boundary GSSP - by Nikolaeva, S.V., Richards, B.C., Kulagina, E.I., Alekseev. A.S., Pazukhin, V.N. and Konovalova, V.A.; 4) Global ammonoid biostratigraphy of the Viséan/Serpukhovian boundary - by Nikolaeva, S.V.; and 5) The Viséan/Serpukhovian boundary - an overview and progress report - by Richards, B.C. The workshop was followed by a six-day field excursion (November 25th to 30th) to Carboniferous and latest Devonian exposures in southern Guizhou province. The 2010 field excursion guidebook "Carboniferous carbonate succession from shallow marine to slope in southern Guizhou" edited by Wang Xiangdong *et al*. contains ten chapters dealing with conodonts and foraminifers from the Viséan-Serpukhovian, Bashkirian-Moscovian, Moscovian-Kasimovian and Kasimovian-Gzhelian boundaries in southern Guizhou. The excursion enabled the field-meeting participants to examine the Viséan/Serpukhovian boundary at the shallow-water (peritidal to non marine) Yashui section, the deep-water (lower to middle slope and basin) Nashui (Naqing) and Luokun sections, and the

intermediate section at Dianzishang (slope turbidites disrupted by impressive submarine slump to landslide deposits).

XVII International Congress on the Carboniferous and Permian in Perth, Australia (July 3rd - 8th, 2011)

Several task-group members attended the congress in Perth, organized by the convener Zhong Qiang Chen and his colleagues at the University in Western Australia, and gave presentations at Symposium 2 - "SCS: Carboniferous stage boundaries" convened by B. Richards, X. Wang and K. Ueno. Of special relevance to the project were the papers: 1) Correlation of the base of the Serpukhovian Stage in northwest Europe and North America - by Sevastopulo and Barham (2011); 2) Summary of research at the Verkhnyaya Kardailovka section (south Urals) - a candidate for the Viséan-Serpukhovian boundary GSSP - by Nikolaeva *et al.* (2011); 3) Global correlations and the Viséan -Serpukhovian stage boundary - by Richards and task group (2011); and 4) Progress on the study of conodonts from candidate GSSPs for the bases of Carboniferous stages in South China - by Qi *et al.* (2011). Task-group members also presented papers in other sessions. The scientists that presented papers plan to have them published in two special journal issues organized by Zhong Chen and his colleagues. The first special issue, provisionally titled-"Multidisciplinary studies of global Carboniferous stage boundaries: toward a better definition and global correlations", will be published in the Geological Magazine in 2012 and the second special issue in the Geological Journal in 2014.

Field activities

Task-group field activities were conducted in several North America, Western Europe and Asia. During late November and early December of 2010, their field work was concentrated in southern Guizhou province, People's Republic of China. In August 2011, field activities were concentrated in the southern Ural Mountains of Russia. Work is well advanced on ammonoid-rich successions in the western U.S.A. (Korn and Titus, 2011) and southern Urals of Kazakhstan. Ongoing studies of upper Viséan to Serpukhovian foraminifer- and coral-rich successions in Western Europe and western North America continued.

Southern Guizhou province, Nashui section

From December 1st to 3rd, 2010 a team including task-group members Qi Yuping and Barry Richards along with two students Wang Wei-jie and Hu Keyi visited the Nashui section (by village of Naqing) near the city of Luodian in southern Guizhou province to finish measuring and sampling the boundary interval for lithostratigraphic and sedimentologic data. Ten metres of strata on either side of the Viséan/Serpukhovian boundary as defined by the first evolutionary appearance of the conodont *Lochriea ziegleri* in the lineage *Lochriea nodosa-Lochriea ziegleri* were measured at a bed-by-bed level for lithological and geochemical studies. In addition, about one metre of strata on either side of the boundary was sampled continuously by extracting large blocks from each bed in that interval. The beds will be sliced into slabs to reveal sedimentary structures and the nature of depositional events within the beds. The Viséan/Serpukhovian boundary is currently placed at 60.1m above the base of the original section measured by Qi and Wang (2005), which is equivalent to a position 17.94 m above the base of the new section measured and permanently marked by aluminum pins glued into drill holes by the task group in 2008. The base of the 2008 section was placed substantially higher in the succession because a thrust fault and associated tectonic deformation was recognized in the underlying Viséan component of the section.

In the Nashui section, conodonts within the *L. nodosa - L. ziegleri* lineage are well preserved and abundant (Qi, 2008). Elements transitional between *L. nodosa* and *L. ziegleri* are plentiful, occurring in several samples, and the oldest representatives of *L. ziegleri* could be readily distinguished from the associated transitional forms of *L. nodosa*. Unfortunately, the conodonts do not allow direct correlation from the Nashui section to the nearby shallow-water Yashui section because of their paucity in the neritic to restricted-shelf facies at the latter locality. During the fiscal year, John Groves and colleagues completed their study of the foraminifers across the boundary interval in the section (Groves *et al.*, in

press). The association of foraminifers from a 20 meter-thick interval centered about the boundary at Nashui lack species diagnostic of the boundary but contain ones whose previously established ranges were known to extend from the upper Viséan into the lower Serpukhovian.

Southern Guizhou province, Yashui section

The Yashui section, situated near the city of Huishui in Guizhou province, is important because it contains abundant rugose corals and foraminifers (Wu *et al*., 2009) and is dominated by shallow-marine neritic to supratidal facies. A major reason for studying the section is to determine the relationship of the coral and foraminiferal zones to the *L. nodosa - L. ziegleri* transition in south China. In February 2010, 101.4 m of the Yashui section were measured and sampled (bed by bed) from the upper Viséan into the upper Serpukhovian. From the 4th to the 6th of December of 2010, the measurement of the section at a bed-by-bed level was extended into the lower Bashkirian at 121.12 m. Conodont samples collected from the section in 2008-2009 have been processed but yields were poor and the *L. nodosa - L. ziegleri* transition could not be precisely located. Additional samples were collected in 2010. Although conodonts have not been recovered, valuable sedimentologic and paleogeographic data were obtained from the section and the diverse coral and foraminifer faunas have proven worthy of study. The section provides an excellent opportunity to see what the shallow-marine and supratidal platform facies are like in southern Guizhou Province. John Groves and his colleagues (Groves *et al.,* in press) completed a comprehensive study of the foraminifers, using samples he collected in May 2008 while Richards measured the lower part of the section, gluing aluminum marker pins in holes drilled at 1 metre intervals and started a sedimentological analysis. Groves *et al.* found that the base of the Serpukhovian could be approximated using foraminifers but a precise correlation with the first evolutionary occurrence of *L. ziegleri* in the Nashui section could not be established because of the lack of foraminiferal indices for the boundary in the Nashui section and the paucity of conodonts through the boundary level at Yashui.

The foraminiferal successions across this boundary in the type area of the Serpukhovian Stage in the Moscow Basin of Russia (Kabanov *et al*., 2009; Gibshman *et al*., 2009), the Uralian region of Russia (Nikolaeva *et al.,* 2005; 2009a,b) and in the central United States suggest that the appearances of *Asteroarchaediscus postrugosus* (Reitlinger, 1949), *Janischewskina delicate* (Malakhova, 1956), "*Millerella*" *tortula* Zeller, 1953 and *Eolasiodiscus donbassicus* Reitlinger, 1956 are useful auxiliary indices to the base of the Serpukhovian. The stage boundary at Yashui is provisionally identified at 41.6 m above the base of the section on the appearance of *Janischewskina delicata*. "*Millerella*" *tortula*, another possible index to the base of the Serpukhovian, appears at 49 m above the base of the section (Groves *et al.,* in press). *Asteroarchaediscus postrugosus* and *Eolasiodiscus donbassicus*, useful markers for the base of the Serpukhovian elsewhere in Eurasia and North America, have not been observed at Yashui.

Southern Urals, Verkhnyaya Kardailovka section

During August 2010, task-group members Svetlana Nikolaeva, Vera Konovalova, Elena Kulagina, and Barry Richards along with students and several other SCCS members including Alexander Alekseev and Uriy Gatovsky worked at the condensed, deep-water, carbonate section along the Ural River opposite the village of Verkhnyaya Kardailovka on the eastern slope of the southern Ural Mountains in southern Russia. Nikolaeva and her colleagues have worked on the Kardailovka section for several years and published syntheses about the ammonoids, conodonts, foraminifers and ostracodes (Nikolaeva *et al.,* 2005, Nikolaeva *et al*., 2009b; Pazukhin *et al*., 2010). Their syntheses demonstrate the first evolutionary appearance of *L. ziegleri* occurs in the lower part of the limestone-dominant component of the section (basal part bed 22a in Pazukhin *et al*., 2010) immediately above an interval containing elements transitional between *L. nodosa* and *L. ziegleri.*

In August 2010 and 2011, the lower 22 m of the Verkhnyaya Kardailovka section was extensively excavated with backhoes and front-end loaders. Following the excavations, the section was permanently marked with aluminum pins glued into drill holes at one metre intervals commencing in

the upper part of a Viséan crinoid-lime grainstone to packstone unit and ending in lower Bashkirian limestone. In August 2011, the limestone-dominant component of the section was also measured and sampled bed-by-bed for lithology and geochemical samples from about 12 m to 35 m above the section's base. The underlying deposits are dominated by thin-bedded to laminated shale, siltstone and volcanic ash that are not measurable at a bed-by-bed level of detail. During August 2011, the section was systematically sampled for conodonts from 12 m to 20 m above its base. Conodont samples had been collected from the section on several prior occasions but additional sampling was required to more precisely tie the conodont biostratigraphy into the new measurements and to confirm the FAD of *L. ziegleri*.

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Report of task group to establish a GSSP close to the existing Bashkirian–Moscovian Boundary

Chairman John Groves

Members of the Bashkirian-Moscovian Boundary Task Group are conducting research in Europe and Asia. Investigations continue to focus mainly on evolutionary transitions in conodont and fusulinid

lineages. Members of the group participated in two salient events during the past year: 1) SCCS Workshop on GSSPs of the Carboniferous System: "Carboniferous Carbonate Succession from Shallow Marine to Slope in Southern Guizhou", and 2) the preparation of a new proposal for a formal marker event for the lower Moscovian Boundary. In addition, several task-group members presented papers at the XVII International Congress on the Carboniferous and Permian in Perth, Australia.

The SCCS Workshop was convened in November, 2010 by Wang Xiangdong, Qi Yuping, Wang Yue and their colleagues with the Nanjing Institute of Geology and Palaeontology, Chinese Academy of Sciences (NIGPAS). It consisted of three days of working sessions and formal presentations in Nanjing followed by a six-day field excursion to southern Guizhou. Of special relevance to this task group, the excursion allowed participants to examine the Bashkirian-Moscovian boundary at the shallow-water Zongdi and Luokun sections and the deeper-water Nashui section. The field excursion guidebook edited by Wang Xiangdong *et al.* contains ten chapters dealing with conodonts and foraminifers from the Viséan-Serpukhovian, Bashkirian-Moscovian, Moscovian-Kasimovian and Kasimovian-Gzhelian boundaries in southern Guizhou.

During the Workshop at NIGPAS, Qi Yuping and co-authors presented an important paper titled: “New interpretation of the conodont succession of the Naqing (Nashui) section: Candidate GSSP for the base of the Moscovian Stage, Luosu, Luodian, Guizhou, South China.” In the paper they advocated placing the base of the Moscovian Stage in the Nashui section at the joint first appearances of advanced morphotypes of *Streptognathodus expansus* Igo & Koike, 1964 and *Streptognathodus suberectus* Dunn, 1966. This level coincides with the local appearance of *Neognathodus kanumai* and it occurs approximately 4 m below the local appearance of *Diplognathodus ellesmerensis* Bender, 1980, an event previously identified as a potential boundary marker. An article in the field excursion guidebook (Qi *et al.*, 2010) clarifies the taxonomic distinctions between stratigraphically lower morphotypes of *S. expansus* and *S. suberectus* and the higher, advanced morphotypes of the same species. This article was accompanied by a detailed range chart and seven plates in which representative specimens were illustrated. Additional work is necessary: 1) to show that the advanced morphotypes of *S. expansus* and *S. suberectus* occur elsewhere in evolutionary continuity with their respective ancestors; and 2) to test the biostratigraphic fidelity of the advanced morphotypes relative to other, potential lower Moscovian indices.

New proposal for a formal marker event for the lower Moscovian boundary

Eight members of the Bashkirian-Moscovian Boundary task group collaborated on a new proposal to mark the base of the Moscovian Stage by the first appearance datum (FAD) of the fusulinoidean genus *Eofusulina* Rauser-Chernousova in Rauser-Chernousova *et al.* 1951 *in* evolutionary continuity with its ancestor *Verella* Dalmatskaya 1951. Operationally, this level can be recognized by the lowest stratigraphic occurrence of a fusulinoidean exhibiting septal fluting across the entire length of its shell. The proposal was circulated among all task-group members for their comments, but a formal vote was not held. A widely held concern is the relatively few sections in which the *Verella–Eofusulina* transition might be documented with closely spaced sampling. The search for such localities will become a priority during the next fiscal year and in the future.

Eofusulina triangula (Rauser-Chernousova and Beljaev in Rauser-Chernousova *et al.*, 1936) is among the stratigraphically oldest and most widespread species in the genus. It is distinguished from other early species in the genus by its unusual triangular shell outline. The proposal’s authors do not designate this species as the boundary marker, however, because in some areas its FAD is slightly above the FAD of congeneric species that exhibit a more nearly fusiform shape. In other words, the boundary shall be marked by the advent of a genus-rank character (pole-to-pole septal fluting) rather than a species-rank character (shell shape).

The genus *Eofusulina* and its ancestor *Verella* are distinctive among early fusulinoideans in that they possess highly elongate tests with primitive, three-layered wall structure consisting of two prothecal layers and an epitheca. The two genera differ mainly in the degree of septal fluting. Septal

fluting in *Verella* usually is restricted to the poles and lateral slopes, whereas in *Eofusulina* it extends across the entire length of the test. Thus, the proposed event employs the concept of morphologic grade: the boundary shall coincide with a specified point in an evolutionary morphologic continuum. Of secondary importance, the proloculus in *Eofusulina* is much larger relative to overall test size than in *Verella*. Evolutionary relationships between *Verella* and *Eofusulina* have been addressed by Leven (1979) and Ivanova (2008).

Specimens assigned to *Verella spicata* Dalmatskaya, 1951 occur widely in uppermost Bashkirian rocks and specimens assigned to *Eofusulina triangula* occur widely in lower Moscovian rocks. As implied by its name, *Verella transiens* Ginkel and Villa *in* Ginkel 1987 is intermediate between typical representatives of the two genera. Septal fluting in this species is more intense than in typical *Verella*, but less intense than in typical *Eofusulina*. The type specimens of *V. transiens* are from the lower, but not lowest Vereian of northwestern Spain. Other conspecific specimens are known from Limestone I3 in the Donets Basin of Ukraine, just below the joint appearances of *Eofusulina* sp. and *Declinognathodus donetzianus* in Limestone K1 (Nemyrovska *et al.,* 2010). Thus, the stratigraphic range of *V. transiens* spans the Bashkirian-Moscovian boundary as traditionally recognized. The existence of this morphologically and stratigraphically transitional form further demonstrates the concept of the *Verella–Eofusulina* evolutionary continuum.

The proposed marker event is attractive in that specimens of *Eofusulina* are very easy to identify. Juvenile specimens can be identified by their large prolocuIi and elongate shape, even in the first volution. Tangential and/or oblique sections through larger specimens can be identified by their elongate shape and intense septal fluting. The proposed marker is further attractive because of its widespread distribution in North Africa, the Arctic, Eurasia, and accreted Panthalassan oceanic carbonates in circum-Pacific areas. It is known from no fewer than 17 distinct geologic basins.
The authors noted that although *Eofusulina triangula* and other early species in the genus are widespread geographically, *Eofusulina* spp. typically do not occur as abundantly as certain other fusulinoideans. Where they are rare, potential sampling bias means that the lowest observed occurrence might be in rocks slightly younger than basal Moscovian as determined on independent criteria. Similarly, where they were temporarily excluded by inhospitable environments, their local appearance clearly will post-date earliest Moscovian. For these reasons it is desirable to designate auxiliary markers for the base of the Moscovian Stage.

FADs of the fusulinoideans *Profusulinella prisca* (Deprat, 1912) and *Aljutovella aljutovica* (Rauser-Chernousova, 1938) are designated as auxiliary events for marking the base of the Moscovian Stage. Both species are widespread throughout the geographic area containing *Eofusulina* spp., and both have been utilized in formal zonal schemes for marking the base of the Moscovian.
Eofusulina and the auxiliary markers are not known to occur in Australia, Antarctica or sub-Saharan Africa. In the Western Hemisphere, *Eofusulina* is known only from an accreted terrane of Panthalassan origin. Of the areas where the various markers do not occur indigenously, only North and South America contain significant marine deposits of Bashkirian and Moscovian age. The base of the Moscovian Stage can be approximated in the Western Hemisphere by the FAD of *Profusulinella fittsi* (Thompson, 1935), which is known to coincide with *Eofusulina* in Eurasia (Solov'eva, 1963), and other early species in *Profusulinella*. Species in *Profusulinella* are thought to have arrived in the Western Hemisphere in early Moscovian time as immigrants via the Franklinian Shelf. Many North American species strongly resemble and might be conspecific with early Moscovian Eurasian counterparts (Groves *et al.,* 2007).

Fusulinoideans are rare in many deeper-water deposits. The base of the Moscovian can be approximated in the absence of fusulinoideans by the FADs of the conodonts *Declinoghathodus donetzianus* and *Diplognathodus ellesmerensis* (Nemyrovska, 1999; Qi *et al.,* 2007), and possibly by the FADs of advanced morphotypes of *Streptognathodus expansus* and *S. suberectus* (Qi *et al.,* 2010).

Additional Activities

Katsumi Ueno (Fukuoka University, Japan) and his students Mikio Shinohara, Keishi Hamachi, Naoki Hayakawa and Yusaku Hoshiki, in collaboration with Tsutomu Nakazawa (AIST, Japan), Yue Wang and Xiangdong Wang (NIGPAS) recently studied latest Bashkirian-earliest Moscovian fusulinoidean biostratigraphy of the Zongdi section in southern Guizhou Province, South China. They investigated a 50-m interval (50-100 m above the base) of the section, focusing particularly on the *Verella-Eofusulina* lineage. This interval of the Zongdi section consists chiefly of shallow-marine bioclastic limestone with frequent dolomitic levels. The interval includes four subaerial exposure surfaces (probably minor unconformities) at 83.0 m, 92.3 m, 93.0 m and 96.0 m. The exposure surfaces are underlain immediately by very thin paleosols and organically pigmented limestones with pendant cements. At Zongdi the lowest *Verella* is found at 56 m and specimens continue up to 76 m. The lowest (but poorly preserved) *Eofusulina* occurs at 80.5 m and others are commonly found up to 95 m. It is important to note that the FAD of *Eofusulina* is just below the first subaerial exposure in the studied interval, suggesting that the evolutionary first appearance event of *Eofusulina* from *Verella* might be recorded here. The Zongdi section is further important because it is one of few sections on the Yangtze Carbonate Platform of South China that yield both *Verella* and *Eofusulina*.

Demir Altiner and colleagues at Middle East Technical University (Ankara) conducted an analysis of the sequence stratigraphy and fusulinoidean biostratigraphy of Bashkirian-Moscovian boundary beds in the Tauride Belt in southern Turkey. Three overlapping sections spanning the Lower Bashkirian (Askynbashky) to Lower Moscovian (Solontsovsky) beds were measured and collected on a bed-by-bed basis. The Bashkirian-Moscovian boundary is recognized locally by the first occurrence of *Profusulinella prisca* within the *P. staffellaeformis-P. paratimanica* lineage. This level also coincides with the first occurrence of *Aljutovella aljutovica*. The lowest occurrence of the genus *Eofusulina* is slightly higher than that of *P. prisca* and *A. aljutovica*. Stacking patterns of upward-shoaling meter-scale cycles indicate the presence of two third-order sequences dated as Askynbashky to lowermost Asatausky and Asatausky to Solontsovsky. A prominent quartz arenitic sandstone intercalated within the Upper Bashkirian carbonate succession has been interpreted as a falling stage systems tract corresponding to stratal offlap during the culmination phase of the second glacial interval in the Carboniferous. Following the sea-level fall in the earliest Asatausky, a new carbonate regime was installed in the Asatausky-Solontsovsky interval by a glacio-eustatic sea-level rise. The Bashkirian-Moscovian boundary seems to be located within the transgressive systems tract of this new carbonate regime.

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Report of task group to establish the Moscovian–Kasimovian and Kasimovian–Gzhelian boundaries, Chairman, Katsumi Ueno

General activities

During the last ICS fiscal year there were several geological conferences, field meetings and workshops of interest to task-group members but the most significant meetings were 'The SCCS

Workshop on GSSPs of the Carboniferous System: Carboniferous Carbonate Succession from Shallow Marine to Slope in Southern Guizhou" (November 22 - 29, 2010) and the XVII International Congress on the Carboniferous and Permian held in Perth, Australia (July 3rd -8th, 2011).

The SCCS November workshop, held in Nanjing China consisted of two days of working sessions (examination of fossils) and a day of oral presentations (November 24th). Several talks of interest to the task group were given including: 1) Latest Moscovian to earliest Gzhelian (Pennsylvanian) conodont faunas from the Naqing (Nashui) section, south Guizhou - by J. Barrick; and 2) *Carbonoschwagerina*-mimics from the Zhongdi section of southern Guizhou, South China and its relation with the Kasimovian-Gzhelian - by K. Ueno *et al*. The workshop was followed by a six-day field excursion (November 25th to 30th) to Carboniferous and latest Devonian exposures in southern Guizhou province. The 2010 field excursion guidebook "Carboniferous carbonate succession from shallow marine to slope in southern Guizhou" edited by Wang Xiangdong *et al*. contains ten chapters dealing with conodonts and foraminifers from the Viséan-Serpukhovian, Bashkirian-Moscovian, Moscovian-Kasimovian and Kasimovian-Gzhelian boundaries in southern Guizhou. The excursion enabled the field-meeting participants to examine the Moscovian–Kasimovian and Kasimovian–Gzhelian boundaries at the shallow-water (peritidal to non- marine) Zhongdi section and the deep-water (carbonate slope) Nashui (Naqing) section.

At the XVII International Congress on the Carboniferous and Permian, several members gave presentations with contents directly related to the task group activities: 1) Ueno & Task Group (2011): The Moscovian-Kasimovian and Kasimovian-Gzhelian boundaries – an overview and progress report; 2) Leontiev & Kossovaya (2011): Preliminary data on the pre-*sagittalis* interval from the Kasimovsky quarry section, Ryazan district, Russia; 3) Qi *et al.* (2011): Progress on the study of conodonts from candidate GSSPs for the bases of Carboniferous stages in South China; 4) Ueno *et al*. (2011): *Carbonoschwagerina*-mimics from the Zhongdi section of South China: New relatives or homeomorphic strangers?; 4) Djenchuraeva & Getman (2011): Biostratigraphy of the upper Moscovian-Kasimovian boundary sediments of low foothills of the Turkestan-Alai, South Tien-Shan; and 5) Goreva & Alekseev (2011): New Russian sections as potential GSSP of the global Kasimovian and Gzhelian stages.

Moscovian–Kasimovian Boundary

South China. Qi Yuping, in collaboration with James E. Barrick, have been studying conodont collections from the uppermost Moscovian to lower Gzhelian slope carbonates at Naqing (Nashui), southern Guizhou, South China. They consider that the FAD of *Idiognathodus turbatus* Rosscoe and Barrick, 2009 is the best potential boundary marker for the base of the Kasimovian. Conodonts are abundant in the late Moscovian faunas, but are strongly dominated by a succession of morphotypes of *Swadelina*. The Naqing *Swadelina* interval can be correlated with the Krevyakian Substage in the Moscow Basin type succession and with the latest Desmoinesian in the North American succession. In the Naqing section, a new association of *Idiognathodus* morphotypes appears at 236.0 m and elements of *Swadelina* disappear by this level. Some new morphotypes resemble the characteristic early Kasimovian species *Idiognathodus turbatus*. In the collection from 235.75 m to 236.60 m, many transitional morphotypes (which are similar to *Idiognathodus sagittalis* Kozitskaya 1978) with rapid morphological transformation from *Idiognathodus swadei* Rosscoe and Barrick 2009 to *I. turbatus* are found. Therefore, the important conodont evolutionary lineage from *I. swadei* to *I. turbatus* is confirmed in the Moscovian-Kasimovian boundary interval in the Naqing section, South China.

Kasimovian–Gzhelian Boundary The task group to establish the Kasimovian-Gzhelian boundary has selected the conodont *Idiognathodus simulator* (Ellison, 1941) s.s. as the event marker for defining the base of the Gzhelian Stage (Heckel *et al*., 2008) and is directing research toward locating suitable candidate sections for the GSSP.

Progress in China Within the Naqing section, Qi and Barrick investigated the conodont faunal change of the Kasimovian-Gzhelian transitional interval using additional materials. In the uppermost

Kasimovian interval in the section, the less common *Idiognathodus* species include morphotypes with reduced lobes, and more significantly, forms with a weakly developed eccentric groove that could be the ancestor of *I. simulator.* After a thin (about 1.5 m thick) conodont-poor interval in the uppermost Kasimovian, diverse and abundant conodonts appear at 255.6 m and they include the first *Idiognathodus simulator*, which marks the base of the Gzhelian in the Naqing section. Therefore, the presence of the lineage of *I. simulator* from its potential ancestor has been proven using the new conodont collections from this section. Although they allow recognition of the boundary, existing collections from the Kasimovian-Gzhelian boundary interval at Naqing are not sufficient to make a complete description of the boundary conodont faunas. Qi and Barrick are working on new and larger collections from the critical boundary interval to obtain a more complete understanding of the conodont fauna and to enable a better evaluation of the Naqing section as a stratotype section for the base of the global Gzhelian Stage.

In addition to the Naqing section, Qi Yuping recently found several new sections covering the Moscovian-Kasimovian and Kasimovian-Gzhelian boundary intervals in southern Guizhou. Among them the Narao and Fengting sections seem to be promising for further boundary work as many debris flows containing fusulines occur together with fine-grained, potentially conodont-rich limestones in both sections. The new sections probably represent shallower environments than the lithofacies in the Naqing section and present a potential for correlating the chronostratigraphic framework within the Yangtze Carbonate Platform by using conodont and fusuline biostratigraphy.

Progress in Russia. Valery V. Chernykh recently studied in detail the morphological status of "*Streotognathodus*" *simulator* (*=Idiognathodus simulator* by some authors) from the Urals and compared them with representatives of this species from the Midcontinent region of North America. In the study, Chernykh proposed to change the diagnosis of this conodont species. This taxonomic modification would enlarge the morphological range of the relevant species, which makes it possible to explain the difference between the American and Eurasian forms as intraspecific variability. Chernykh also examined the stratigraphic value of some associated conodonts from the group *simulator*. The paper will be published in Lithosphere, No. 1 in 2012.

Ukraine. Recently, Tamara I. Nemyrovska and Katsumi Ueno carried out fieldwork in the Lugansk region of the Donets Basin in Ukraine and newly studied the Annovka section in the Bryanka area. The Annovka section includes the upper part of the C2\7 Suite (Limestone M) and the C3\1 (Limestone N), broadly corresponding to the Moscovian-Kasimovian Boundary interval. Their work is still in progress.

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Progress by the magnetostratigraphy group has been hampered by a shortage of members, insufficient funding, and a lack of integration with the activities of the other SCCS task groups. The group is particularly interested in collaborating with task groups working on sections and boundaries where magnetostratigraphy could be employed, to facilitate international correlations. Sections that have low thermal maturity and are dominated by siliciclastics are the most suitable for magnetostratigraphic analyses (based on the review in the SCCS Newsletter, v. 22: 35-41) but carbonates can be used. Unfortunately, most of the best GSSP candidate sections are carbonate-dominant and thermally over mature but some reference sections and stratotypes for stages in the Moscow Basin show potential. In general, the study of Mississippian magnetostratigraphic has languished and much remains to be done before Carboniferous magnetostratigraphy can be widely applied to facilitate global correlations.

During the last fiscal year, little progress was made on the initial palaeomagnetic assessment of the two sections in southern Scotland that were discussed in the SCCS annual report for the Nov. 1st 2008 to Oct. 31st 2009 fiscal year. The first section is at Cove in the Cockburnspath outlier on the southern flank of the Midland Valley Basin and includes the Inverclyde and Strathyclyde groups of latest Devonian to (Asbian) late Viséan age (Cossey *et al*., 2004; Hounslow 2009). The second section is at Kirkbean on the northern edge of the Northumberland Basin and is of early to late Viséan age, overlapping in age with the upper part of the Cove section. Some progress may occur on the two Scottish sections in 2011, if grant income from United Kingdom sources is forthcoming.

During the May 31st to June 3rd 2010 ICS meeting in Prague, the task group leader discussed with Barry Richards and Svetlana Nikolaeva (Russia) the possibility of designing a magnetostratigraphic project that would evaluate Late Mississippian and Pennsylvanian sections in the Moscow Basin, Lard Basin in northwestern Canada and sections in the mid-continent region of the USA. So far, these initial discussions have not developed into tangible outcomes and the main problems stem from a lack of funding and suitable investigators.

John Utting (member Viséan-Serpukhovian boundary task group) and colleagues Peter Giles (Geological Survey of Canada-Atlantic) and Neil Opdyke (University of Florida) have largely completed a useful magnetostratigraphic study of the Brigantian, Pendleian and much of the Arnsbergian substages (upper Viséan and Serpukhovian) in the Maritimes Basin of eastern Canada (Giles *et al*., in progress). They have correlated the polarity reversal patterns in the Maritimes Basin with published data from the Brigantian to mid-Arnsbergian interval in the central part of the Appalachian Basin in the eastern United States (Di Venere and Opdyke, 1990, 1991).

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