1. TITLE OF CONSTITUENT BODY and NAME OF REPORTER

SUBCOMMISSION ON CARBONIFEROUS STRATIGRAPHY

ICS ANNUAL REPORT **2015,** SUBMITTED BY: Barry C. Richards, Chairman of SCCS; Geological Survey of Canada-Calgary, 3303-33rd St. N.W., Calgary, Alberta, Canada; Office Phone: 1 (403) 292-7153; Cell Phone: 1 (403) 650-3682; Fax: 1 (403) 292-6014; Email: barry.richards@canada.ca

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 on La Serre Hill in southern France (Paproth & Streel, 1984; Paproth *et al*., 1991), and the Carboniferous-Permian boundary GSSP at the top has been selected in northern Kazakhstan (Davydov *et al*., 1998). The mid-Carboniferous boundary GSSP is preserved in Arrow Canyon, Nevada, U.S.A. (Lane *et al.*, 1999), and it subdivides the Carboniferous into two subsystems, the Mississippian Subsystem below and the Pennsylvanian Subsystem above. The immediate SCCS goals are to redefine the Carboniferous-Devonian boundary and select the best stage boundaries within the two Carboniferous subsystems to facilitate global correlation within the system.

3a. CHIEF ACCOMPLISHMENTS AND PRODUCTS IN November 1st 2014 - October 31st 2015 fiscal year

Task Group Progress Reports

The joint Devonian-Carboniferous Boundary GSSP Reappraisal Task Group [base of Carboniferous is also the base of Lower Mississippian Series and Tournaisian Stage] was established in early 2008 and is chaired by Markus Aretz (France; aretz@get.obs-mip.fr).

Introduction and general activities

During the fiscal year, the group made continued progress with it primary tasks – the search for a suitable criterion for redefinition of the D-C boundary and the hunt for a suitable section for the GSSP. Studies by Ji *et al*. (1989) and subsequent analysis (Kaiser, 2009) demonstrated severe problems exist with the D-C boundary GSSP (Paproth *et al*., 1991). The boundary GSSP on La Serre Hill in France is defined by the first occurrence of the conodont *Siphonodella sulcata* (Huddle, 1934) in the lineage *Siphonodella praesulcata* Sandberg, 1972 to *S. sulcata.*

The current work and results of the task group have been presented and discussed in formal and informal discussions with task-group members and interested researchers at three international meetings: STRATI 2015 in Graz, Austria (Aretz & Corradini, 2015), 18th International Congress on Carboniferous and Permian, in Kazan, Russia (Aretz, Corradini & Working Group, 2015), and IGCP 596 – Subcommission on Devonian Stratigraphy (SDS) Symposium in Brussels, Belgium (Corradini, Aretz & Working Group, 2015). Highlights of the research are: the conodont *Protognathodus kockeli* (Bischoff, 1957) has good potential for boundary definition, the geochemical signature of the mulita-phase Hangenberg Event (Kaiser *et al*., 2008) is well known, and the base of the Hangenberg Black Shale has substantial potential for international correlation.

Reports from Task-Group members

Italian Group: Carlo Corradini and Claudia Spalletta

Research of the Italian group focused on the revision of conodonts from the latest Devonian and earliest Mississippian (Corradini *et al*., 2015). All genera occurring in that time frame were evaluated and a new zonation across the boundary proposed. They suggest the FAD of the conodont *Protognathodus kockeli* (Bischoff, 1957) should be considered as a new index for boundary definition. Conodonts from a new section across the D-C boundary in Sardinia were also studied (Mossoni *et al*., 2015).

Czech group

The Czech researchers reported that the research grant of Czech Grant Agency on the high-resolution multiproxy stratigraphic analysis of the D-C boundary in Europe was completed at the end of 2014. Outputs include: Kalvoda *et al*. (2015), Kumpan *et al*. (2014a, 2014b; 2015). In addition, a manuscript by Bábek, O., Kumpan, T., Kalvoda, J., and Matys Grygar, T. titled "Devonian/Carboniferous boundary glacioeustatic fluctuations in a platform-to-basin direction: A geochemical approach of sequence stratigraphy in pelagic settings" is nearing completion.

Thomas Becker and Münster Group

The results of the Münster Group were published in a series of papers and the highlights are presented here. 1) Kaiser *et al*. (2015) concentrated on the extinction, sedimentary and geochemical patterns of the global Hangenberg Crisis, which represent a first-order global ecosystem turnover at the same scale as the "Big Five" mass extinctions. A crisis scenario was developed, with globally recognizable lower, middle, and upper crisis intervals that have significant correlation potential. 2) Becker *et al.* (2015a) summarized the biostratigraphy and lithostratigraphy across the D-C boundary in the Rhenish pelagic and Ardennes neritic successions. They concluded the base of the Hangenberg Black Shale presents the best option for international correlation because it can be recognized by more methods and is more widely recognizable than other levels. 3) Revisions of the main ammonoid group that spans the D-C boundary and Hangenberg Crisis, the Prionoceratidae (Fischer & Becker, 2014), showed a much higher pre-crisis diversity than previously assumed. Two prionoceratid lineages survived and new data Zhong *et al*. (2014) Becker *et al*. (2015a,b) confirmed that the re-radiation, the onset of *Acutimitoceras* (Stockumites), started either immediately after the extinction or immediately after the hypoxic/anoxic interval. Therefore, the black-shale extinction event would make an acceptable marker for the D-C boundary from the perspective of ammonoid experts. 4) Further sampling in several Rhenish D-C sections (Kumpan *et al.*, 2015; Becker *et al.*, 2015a,b) provided more precision concerning the development of hypoxia, extinctions, and re-radiation of ammonoids and conodonts. The marker clymeniid *Postclymenia evoluta* crosses the main ammonoid extinction level and, for the first time, has been found in the Hangenberg Black-Shale at Drewer (where it is much more common in the basal crisis interval Drewer Sandstone) and in the basal Hangenberg Shale at Oberrödinghausen.

Barry Richards (Canada)

Richards and colleagues continued studies of the upper Famennian to lower Tournaisian in the Western Canada Sedimentary Basin (WCSB) and adjacent Montana to see if events in the multi-phase Hangenberg Event interval can be located in the region using a multidisciplinary approach. Sedimentologic evidence for the stages of the Hangenberg event is not clearly expressed and significant ($\delta^{13}C_{org}$) excursions similar to those documented for the phases of the Hangenberg in Western Europe have not been recognized even in sections that must contain the D-C boundary and Hangenberg level.

Task Group to establish the Tournaisian-Viséan Boundary [which is also the base of the Middle Mississippian Series] is chaired by George Sevastopulo (Ireland; gsvstpul@tcd.ie).

Following approval of the proposed GSSP (Devuyst *et al.*, 2003) at Pengchong in southern China, by the SCCS in 2007 and its ratification by the ICS and IUGS, task-group member François-Xavier Devuyst had been preparing the final report about the Tournaisian-Viséan boundary GSSP but the task-group chairman George Sevastopulo has taken over that role. Substantial progress has been made with writing the final report on the base of the Viséan but Sevastopulo was not well during 2015 and was not able to complete the manuscript as planned. Sevastopulo and his task group hope to complete a draft during the 2016 fiscal year. The report provides a brief resume of the GSSP and then lists the successful attempts to identify the boundary in Eurasia by Jiri Kalvoda and others, and discusses the problems of identifying (and best approximation to) the boundary in North America and Gondwana. It also includes contributions by relevant paleontological experts on the up-to-date knowledge of the ranges of different fossil groups over the boundary interval, which is useful because many taxa that

were considered to be of early Viséan age are actually restricted to the latest Tournaisian or first occur there.

Task Group to establish the Viséan-Serpukhovian Boundary [which is also the base of the Upper Mississippian Series] is chaired by Barry Richards (Canada; barry.richards@canada.ca).

Introduction and general activities

An index for boundary definition has been selected, but not voted on by the task group and SCCS for final approval, and work is well advanced at the two prime GSSP candidate sections: the Verkhnyaya Kardailovka in the southern Ural Mountains of Russia and the Naqing (Nashui) section in southern Guizhou Province, China. In the Cantabrian Mountains of northwest Spain, work continued on the Millaró and Vegas de Sotres sections, two other potential candidate sections for the GSSP. For boundary definition, the group is using the first evolutionary occurrence of the conodont *Lochriea ziegleri* Nemirovskaya, Perret & Meischner, 1994 in the lineage *Lochriea nodosa* (Bischoff, 1957) –*Lochriea ziegleri. L. ziegleri* appears in the Brigantian Substage of NW Europe somewhat below the current base of the Serpukhovian as defined by its lectostratotype section in the Zaborie quarry near Serpukhov in the Moscow Basin, Russia (Kabanov *et al*., 2009, 2012, 2014a,b).

Progress in southern Guizhou Province, China

In south China, the boundary index – the FAD of *L. ziegleri* has been precisely located in the Naqing section (Qi *et al*., 2013). In 2015, a major accomplishment in south China was the completion of a sedimentological/geochemical study across the Viséan/Serpukhovian boundary by Jitao Chen and Isabel Montanez (Chen *et al*., in press). The studied sections include the limestone-dominated, shallow-marine Yashui section and deep-water (slope) Naqing, Narao, Luokun, and Dianzishang sections. The new sedimentological and lithostratigraphic work confirms interpretations presented by the task group in previous annual reports and by Groves *et al.* (2012). It also demonstrates the boundary level in the Naqing, Narao, Luokun, and Dianzishang sections is dominated by carbonate-slope lithofacies, whereas the Yashui section comprises restricted-shelf carbonates. The $\delta^{13}C_{carb}$ record in the Naqing section (Buggisch *et al*., 2011, Chen *et al*., in press) and nearby sections shows a prominent negative $\delta^{13}C$ excursion in chert-rich facies slightly above the FAD of *Lochriea ziegleri*.

The manuscript titled "Conodonts of the genus *Lochriea* near the V/S boundary (Mississippian) at the Naqing section, Guizhou Province, South China" by Yuping Qi, Tamara Nemyrovska, Qiulai Wang, and Keyi Hu was completed. Their study enables confirmation and refinement of known lineages within the genus, and two lineages are proposed: 1) noded *Lochriea* species, such as *L. mononodosa–L. nodosa–L. ziegleri, L. senckenbergica* and *L. multinodosa*, and 2) ridged *Lochriea* species such as *L. monocostata–L. costata–L. cruciformis*. The numerous and variable species of *Lochriea* across the V/S boundary in the Naqing section are sorted out and the possibilities for their derivation evaluated.

After the foraminiferal study of Groves *et al*. (2012), foraminifers across the V/S boundary in south China have been intensely studied by Paul Brenckle and Qingyi Sheng, who found age-diagnostic Serpukhovian foraminiferal species including *Janishewskina delicata* (Malakhova, 1956), an auxiliary index to the base of the Serpukhovian. They were collected about two meters above the V/S boundary (at 60.1m) as defined by the FAD of *L. ziegleri* in the Naqing section.

Progress in South Ural Mountains, Russia

The task group completed sedimentologic and stable-carbon isotope studies across the boundary level in the Verkhnyaya Kardailovka section and presented a summary of their work in the field guide for the XVIII International Congress on the Carboniferous and Permian (ICCP) in Kazan, Russia (Kulagina *et al*., 2015) and in talks at the ICCP (Nikolaeva *et al*., 2015; Richards *et al*., 2015). The studies confirmed results presented by the task-group members in previous reports Nikolaeva *et al.* (2014, 2009) and demonstrated the boundary level lies in stylonodular, deep-water, pelagic carbonate lithofacies. A preliminary $\delta^{13}C_{carb}$ study across the boundary within the Kardailovka section was also completed (Nikolaeva *et al*., 2015; Richards *et al*., 2015). In contrast to $\delta^{13}C$ trends observed in south

China (Buggisch *et al*., 2011; Chen *et al*., in press), the pattern in the Kardailovka section lacks significant excursions near the boundary. Instead, the Kardailovka section shows a substantial positive shift of about 1‰ (from +2 to +3‰) between 3.05 and 1.97 m below the boundary and very stable $\delta^{13}C_{carb}$ values from 1.97 m below the boundary to the top (at 21.75 m) of the lower segment of the section at 2.05 m above the boundary. The presence of a negative excursion in the Naqing section and not at Kardailovka suggests $\delta^{13}C_{carb}$ excursions are of little use for global correlations at the boundary. At Verkhnyaya Kardailovka, the Viséan-Serpukhovian boundary recognized by the FAD of the conodont *L. ziegleri* lies within the *Hypergoniatites-Ferganoceras* Genozone. Three foraminiferal zones in the Serpukhovian and the beds with *Endostaffella asymmetrica* in the Upper Viséan are recognized.

Progress Moscow Basin

Gibshman continued to study the foraminifers in upper Viséan and lower Serpukhovian using new specimens from the Polotnyany Zavod section (Kaluga Region). The distribution of *Janischewskina* species indicates a succession from *J. minuscularia* (Ganelina) (Aleksinian substage) to *J. typica* Mikhailov (Venevian substage) and *J. delicata* (Malakhova, 1956) (basal Serpukhovian Tarusian substage) (Gibshman, 2015a,b).

Progress Cantabrian Mountains Spain

Work continued on the Millaró and Vegas de Sotres sections in the Cantabrian Mountains to precisely locate the FAD of the conodont *Lochriea ziegleri*. The Vegas de Sotres section yielded an important record of foraminifers (Cózar *et al*., 2015). The sedimentology and stable-isotope geochemistry of the deep-water, limestone-dominated Vegas de Sotres and Millaró sections is progressing.

Task Group to establish the Bashkirian-Moscovian Boundary [which is also the base of the Middle Pennsylvanian Series] is chaired by Alexander Alekseev (Moscow State University, Russia; aaleks@geol.msu.ru).

Introduction

In 2015, continued progress was made toward the selection of a marker species and a section for the GSSP at the base of the Moscovian Stage. The conodont *Diplognathodus ellesmerensis* Bender, 1980 is the best candidate for boundary definition and the Naqing section in south China shows great potential for the GSSP (Qi *et al*., 2010, 2013). *D. ellesmerensis*, derived from *Diplognathodus* aff. *orphanus* (Merrill, 1972), is easily recognized by conodont workers and has been recovered from China, Western and Eastern Europe (Moscow Basin and South Urals), boreal Canada, and South America making it one of the most widely recovered conodonts in the Pennsylvanian. The conodont *Declinognathodus donetzianus* Nemyrovska, 1990 shows potential as an auxiliary index. The fusulinid *Verella* is a useful indicator for the uppermost Bashkirian and *Depratina prisca* (Deprat) and *Aljutovella aljutovica* (Rauser) lowermost Moscovian markers. A disadvantage of *D. ellesmerensis* is its long stratigraphic range (to upper Moscovian).

Progress in Middle Urals, Russia; Alexander S. Alekseev

In the Mariinsky Log section (western slope Middle Urals, Perm region) uppermost Bashkirian (Asatauian) foraminiferal and conodont assemblages were found in the topmost beds of the Mariinsky Formation. The assemblages contains conodonts *Idiognathoides ouachitensis* (Harlton), *I. sinuatus* Harris and Hollingsworth, *Idiognathodus aljutovensis* Alekseev *et al*., *Neognathodus* cf. *atokaensis* Grayson (Ponomareva *et al*., 2015). In the nearby Kremennoy section, conodont data indicate a gap and probable absence of Vereian Substage at the B-M boundary, thereby reducing the GSSP potential of both sections.

Ivanova (2015) studied the fusulinid subfamily Eofusulininae including *Verella* from the B-M interval in the Middle and South Urals. *Verella* is a latest Bashkirian genus but its species are commonly absent in B-M boundary sections because of unconformities. Ivanova found that the Sokol section (Chusovaya River, Middle Urals) contains abundant *Verella*; however, the associated

conodonts have not been studied. Studies in this region and elsewhere indicate *Verella* is useful for latest Bashkirian correlations, because it is widely distributed.

South Urals, Russia

The Basu River section, which contains in the B-M boundary interval, contains the fusulinids *Depratina prisca* (Deprat) and *Aljutovella aljutovica* (Rauser) as well the conodont *Declinognathodus donetzianus* Nemyrovska but *Verella, Eofusuilina* and *D. ellesmerensis* have not been found (Kulagina *et al*., 2009).

Cantabrian Mountains, Spain; Elisa Villa

The Carboniferous of Central Asturias (Cantabrian Mountains) includes a thick stratigraphic package comprising siliciclastics with abundant limestone intercalations in which the B-M transition is well-represented. The B-M transition was studied in three sections but the Los Tornos and La Camocha are most relevant because they include strata containing abundant archaediscids and fusulinids showing mixed Bashkirian and Moscovian features. This B-M transition appears to fill a gap at the base of the Moscovian stratotype in the Moscow Basin. The third section, at Santo Firme, contains a volcanic ash that provided a radiometric age within the transition.

Because of marked povincialism, the fusulines have little potential as markers for the B-M boundary but some are useful auxiliary indices. The Cantabrian assemblages show close affinities to Central Asian fusulines, indicating that they belong to the Paleo-Tethys province. In spite of difficulties introduced by the gap at the Moscovian stratotype and provincialism, approximate correlations using fusulinids can be established with the Moscow Basin, South Urals, and Donets Basin. The transition interval in the Cantabrians is partially equivalent to the *Depratina prisca* Zone (Kulagina, 2009) of the South Urals, where the fusuline record could be somewhat more complete than in the Moscow Basin.

Elements in the assemblages from the Cantabrians are representatives of the lineage leading from *Eowedekindellina* to *Verella* and then to *Eofusulina.* The first appearance of one advanced *Verella* species (*Verella transiens* van Ginkel and Villa, *in* van Ginkel, 1987), is used in the Cantabrians as a marker for a level slightly older than the base of the *Aljutovella aljutovica* Zone at the base of the Moscovian stratotype in the Moscow Basin (Makhlina *et al*., 2001), whereas the first appearance of *Eofusulina* emerges as a local marker for a younger level within the Vereian.

South China; Yuping Qi

Yuping Qi, Tamara Nemyrovska, and Lance Lambert continued working on the abundant and diverse conodonts from the B-M boundary interval in the Naqing section. Many important chronomorphoclines, especially "*Streptognathodus*" *expansus* Igo & Koike,1994 "*Streptognathodus*" *suberectus* Dunn, 1966 and *Diplognathodus* aff. *orphanus* (Merrill) to *D. ellesmerensis* Bender 1980, were recognized.

Yuping Qi and his students collected more conodonts across the B-M boundary at the Naqing, Narao, and Luokun sections. Because of the new conodonts, the FAD of *D. ellesmerensis* was lowered from 176.9 m to 175.9 m in the Naqing section. In the Luokun section, *D. ellesmerensis* was found at 121.0 m, 0.9 m below the appearances of *Profusulinella aljutovica* Rauser and *P. prisca* (Deprat), which are traditional biomarkers for the basal Moscovian in the Moscow Basin. Many specimens of *Neolochriea* and ridged *Declinognathodus* across the B-M boundary were observed in the Naqing and Luokun sections.

Task group to establish the Moscovian–Kasimovian [which is also the base of the Upper Pennsylvanian Series], and the **Kasimovian –Gzhelian boundaries** is chaired by Katsumi Ueno (Japan; katsumi@fukuoka-u.ac.jp).

Introduction

In the past fiscal year, task-group members continued to study the Moscovian-Kasimovian and Kasimovian-Gzhelian stage boundaries in their respective areas. The search continued for an index within an evolutionary lineage for definition of the base of the Kasimovian. Two conodont species,

Idiognathodus turbatus Rosscoe & Barrick, 2009 and *I. sagittalis* Kozitskaya, 1978, were proposed as potential markers by Villa and Task Group (2008). Rosscoe and Barrick (2013) suggested that using *Idiognathodus heckeli* Rosscoe & Barrick 2013, the precursor species to *I. turbatus*, might be more appropriate. The first appearance datum (FAD) of the conodont *Idiognathodus simulator* (Ellison, 1941) *s.s.* in its potential lineage *Idiognathodus eudoraensis - I. simulator* (Heckel *et al*., 2008; Villa *et al*., 2009) has been formally selected for defining the base of the Gzhelian Stage but the ancestry of *I. simulator* (=*Streptognathodus simulator*) is now uncertain (Qi *et al*., 2015). The search for a suitable section for the GSSP at the base of the Gzhelian has been narrowed down to three sections. Carlos A. Méndez (University of Oviedo, Spain) stepped down from task-group membership, and Guzel Sungatullina (Kazan Federal University, Russia) joined the group.

MOSCOVIAN-KASIMOVIAN BOUNDARY

Southern Urals, report of Guzel Sungatullina and Valery Chernykh

Guzel Sungatullina studied the conodonts from the Moscovian–Kasimovian boundary interval of the Usolka section in the Southern Urals of Russia. The Moscovian in this section yielded a conodont assemblage characteristic of the *Neognathodus roundyi* Zone, which includes the following taxa: *Gondolella laevis*, *G. magna*, *Idiognathodus delicatus*, *I. obliquus*, *I. podolskensis*, *I. trigonolobatus*, *Neognathodus dilatus*, *N. inaequalis*, *N. roundyi*, and *Swadelina* sp. 1 (Chernykh *et al*., 2015). The lower part of the Kasimovian Stage contained conodonts typical for the *Streptognathodus subexcelsus* Zone, such as *Idiognathodus delicatus*, *I. trigonolobatus*, *Gondolella magna*, *S. subexcelsus*, and *Swadelina* sp. 1. The Usolka section holds a continuous conodont succession across the Moscovian–Kasimovian boundary.

South China, report of Yuping Qi

The complete evolutionary lineage of *Idiognathodus swadei–I. heckeli–I. turbatus* has been documented in the Moscovian–Kasimovian (M-K) boundary interval in the Naqing (Nashui) section, southern Guizhou province, South China. The Naqing section has been well sampled for conodonts, and either *I. turbatus* or *I. heckeli* can serve as an acceptable bio-marker for the base of the Kasimovian. Yuping Qi and Jim Barrick are preparing a paper dealing with the conodont succession across the Moscovian-Kasimovian boundary in the Naqing section.

The detailed conodont and fusulinid biostratigraphy of the M-K boundary interval in the Narao section of southern Guizhou province are also being studied, which should provide additional information for correlation of the M-K boundary. Jitao Chen carried out bed-by-bed sedimentologic logging and description for the M-K boundary interval, and collected rock samples for further petrographic and isotope geochemical analysis in Naqing and Narao sections in June and July, 2015. The isotope geochemistry analyses for the M-K boundary interval in both sections are in progress.

KASIMOVIAN–GZHELIAN BOUNDARY

Southern Urals, report of Guzel Sungatullina and Valery Chernykh

From 2012 to 2014 Guzel Sungatullina and Valery Chernykh reinvestigated the Usolka section, which had been previously proposed as a candidate for the GSSP by Davydov *et al*. (2008), to confirm the precise position of the FAD of *Streptognathodus simulator* (=*Idiognathodus simulator*), and collected additional conodonts from the section (Sungatullina *et al*., 2015). Conodonts from the Kasimovian–Gzhelian boundary intervals are diverse and have the potential to permit the Usolka section to be considered again as a GSSP candidate for the base of the Gzhelian.

In the Usolka section, the upper Kasimovian yielded a conodont assemblage characteristic of the *Streptognathodus firmus* Zone, which includes: *Idiognathodus excedus*, *I. magnificus*, *Idiognathodus toretzianus*, *Streptognathodus crassus*, *S. firmus*, *S. gracilis*, *S. pawhuskaensis*, *S. praenuntius*, and *S. zethus*. In the lower part of the Gzhelian at Usolka, conodonts are typical for the *Streptognathodus simulator* Zone: *Idiognathodus toretzianus*, *I. undatus*, *I.* aff. *verus*, *Streptognathodus* aff. *auritus*, *S. crassus*, *S. dolioliformis*, *S. gracilis*, and *S. simulator* (Chernykh *et al*., 2015). The lower boundary of the Gzhelian in the Usolka section is fixed by the appearance of *S. simulator* in the evolutionary

lineage *S. praenuntius–S. simulator–S. postsimulator*, a different lineage than that proposed by Heckel *et al*., (2008) and Villa *et al*., (2009).

South China, report of Qui Yuping

Although *Idiognathodus simulator* (= *Streptognathodus simulator*) has been selected as the index for the base Gzhelian (Heckel *et al*., 2008), the lineage leading to this species is no longer clear (Qi *et al.*, 2015). The conodont successions across the Kasimovian–Gzhelian (K-G) boundary have been investigated in detail in the Naqing and Narao sections in southern Guizhou, south China. Abundant conodonts were obtained from new collections from both sections. The conodont faunas are large and highly diverse in the K-G boundary interval in the Naqing section. *I. simulator* and its variations appear in sample LDC 255.55~255.75 m and range three meters upward. The interval between 254 and 255.55 m that was originally regarded as barren is now known to contain small elements, which could be transitional from an ancestral species to *I. simulator*. The Narao section also contains abundant and diverse conodonts around the K-G boundary interval. In that section, *I. simulator* appears at 229.61 m and ranges about four meters upward, and many ancestral and some transitional elements to *I. simulator* occur below 229.61 m.

According to Jim Barrick, the *I. simulator* group in North America contains a series of "morphospecies" that can be separated using simple characters based on biometric work. These conodonts from the K-G boundary interval in the Naqing and Narao sections can also be separated into morphospecies by the same methodology. The manuscript on conodonts from the K-G boundary intervals in both the Naqing and Narao sections is being prepared by Yuping Qi and Jim Barrick. The sedimentology, stable-isotope geochemistry, and fusulinid faunas through the K-G boundary interval in southern Guizhou, south China are being studied by Jitao Chen, Yue Wang and Katsumi Ueno.

The Project Group on Carboniferous Magnetostratigraphy, chaired by Mark Hounslow (United Kingdom) m.hounslow@lancaster.ac.uk.

A preliminary set of samples from the Scottish sections at Cove Harbour (covering the Famennian into the middle Viséan) and the Fife coast (covering the middle to late Viséan) were collected by Mark Hounslow, Andy Biggin and Louise Hawkins. The samples showed that the palaeomagnetic behaviours of the samples showed isolation of a primary palaeomagnetic signal, and so should prove suitable for a more extensive study, when funding becomes available. The palaeomagnetic behaviours of the Cove Harbour section samples appeared the most promising. The low maximum burial depth of this section is also likely to be advantages to further study. There are no new published works on Carboniferous magnetostratigraphy related to the project.

The Project Group on Carboniferous and Permian Nonmarine and Marine Correlations, chaired by Jörg W. Schneider (Germany) Joerg.Schneider@geo.tu-freiberg.de

The Project Group continued to be active during the year, holding organizational meetings and talks at conventions. They held a session “Marine-Non-marine Carboniferous and Permian Correlation” at the XVIII International Congress on the Carboniferous and Permian in Kazan, Russia on August 14 2015 in which several papers were presented. In their session, organizational plans were presented in a multi-author presentation (Schneider *et al*., 2015). Schneider *et al*. called for contributors willing to join the project and to contribute to a Pennsylvanian-Permian-Early Triassic nonmarine-marine correlation chart. In volume 61 of Permophiles, Schneider and Lucas (2015) provide detailed instructions on how participants should construct their correlation charts and provide supporting stratigraphic information.

RESULTS FROM CONFERENCES AND FIELD MEETINGS NOVEMBER 1ST, 2014 - OCTOBER 31ST, 2015

During the November 1, 2014 - October 31, 2015 fiscal year, there were several conferences and field meetings in which the SCCS membership participated but the most important two were the 2nd International Congress on Stratigraphy (STRATI 2015) in Graz, Austria during July, and the August

11-15, 2015 XVIII International Congress on the Carboniferous and Permian (XVIII ICCP) in Kazan, Russia.

STRATI 2015

At the July STRATI meeting in Graz, Markus Aretz, the chairman of Task Group to redefine the **Devonian**-Carboniferous (D-C) boundary, had the group evaluate the results of multi-discipline compilations made by most of the task-group members over the last two years. Results of that workshop will provide future direction for the task group. Two important talks about the D-C boundary were given: Aretz & Corradini (2015) and Corradini *et al*. (2015).

XVIII ICCP in Kazan, Russia

The XVIII ICCP was attended by 165 scientists representing some 33 countries. Russia and China had the most delegates. Because of the political tensions, few came from Canada and the U.S.A. None of the SCCS task groups held workshops and business meetings at the XVIII ICCP; however, the SCCS held a general business meeting at the conference and the minutes prepared by Markus Aretz and Svetlana Nikolaeva are provided in volume 32 of the Newsletter on Carboniferous Stratigraphy. Many of our members were deeply involved with the congress organization, leading field trips and giving presentations. The first circular was published in volume 31 of the Newsletter on Carboniferous Stratigraphy and the second and third circulars were available on the conference website: http://www.iccp2015.ksu.ru.

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

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

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

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

CARBONIFEROUS STRATOTYPE SECTIONS NORTH ENGLAND

In October 2015, the subcommission held a field meeting with members of the Yorkshire Geological Society (YGS) and visited several stratotype sections for Carboniferous substages in northern England (see http://www.yorksgeolsoc.org.uk for itinerary and guide books). Purpose of the field trip was to see the condition of the sections and criteria used for defining their boundaries. Prior to the revision of the Carboniferous time scale by Heckel and Clayton (2006a, b) the substages were widely considered as Western European stages.

3b. Output

The **Newsletter on Carboniferous Stratigraphy, Volume 32**, which will be published in early 2016 and be available for download from our website www.stratigraphy.org/carboniferous/index.asp, includes commentaries by the SCCS executive on various current issues, summaries about field meetings and workshops, and articles on various topics of interest. Volume 32 will also contain a revised directory for the corresponding membership. During the last fiscal year, task-group and corresponding members published a number of papers in refereed journals and in abstract volumes associated with conventions. Many of the most important of these publications are cited in the progress reports included in this Annual Report. Some of the most important outputs during the year are:

BECKER, R. T., KAISER, S. I. & M. ARETZ (2015a in press): Review of chrono-, litho- and biostratigraphy around the global Hangenberg Crisis and Devonian-Carboniferous boundary. *In:* BECKER, R. T., KÖNIGSHOF, P. & C.E. BRETT (eds.), Devonian Climate, Sea Level and Evolutionary Events, ─ *Geological Society of London,* Special Publications, **423**: 38 p.

CHEN, J., MONTAÑEZ, I.P., QI, YU., WANG, X., WANG, Q. & W. LIN, W. (in press): Coupled sedimentary and δ 13C records of late Mississippian platform-to-slope successions from South China: Insight into δ 13C chemostratigraphy. Palaeogeography, Palaeoclimatology, Palaeoecology. 2015. doi: 10.1016/j.palaeo.2015.10.051

KUMPAN, T., BÁBEK, O., KALVODA, J., MATYS GRYGAR, T., FRÝDA, J., BECKER, T.R. & S. HARTENFELS (2015): Petrophysical and geochemical signature of the Hangenberg Events: an integrated stratigraphy of the Devonian-Carboniferous boundary interval in the Northern Rhenish Massif (Avalonia, Germany). ─ *Bulletin of Geosciences* 90(3): 667-694. doi:10.3140/bull.geosci.1547.

3c. CHIEF PROBLEMS ENCOUNTERED IN 2015

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

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

4a. WORK PLANS, CRITICAL MILESTONES, ANTICIPATED RESULTS AND COMMUNICATIONS TO BE ACHIEVED NEXT YEAR (2016):

The following activities are planned for the Nov. 1, 2015 to Oct 31, 2016 fiscal year by the task groups, as communicated by task-group chairs.

Our principal mandate

The establishment of GSSPs for the Carboniferous and its main subdivisions is our principle mandate from the ICS. During the current four-year term, the ICS executive wants to have the SCCS establish GSSPs for as many of the Carboniferous Stage boundaries as possible. At present, GSSPs need to be established for the Viséan-Serpukhovian, Bashkirian-Moscovian, Moscovian-Kasimovian and Kasimovian-Gzhelian boundaries. In addition, the GSSP at the base of the Tournaisian has been reassessed and both a new marker event and a new section will probably be required for that boundary. Based on the information our task-group leaders have provided us in the last two issues of the SCCS annual report to the International Commission of Stratigraphy and volume 32 of the Newsletter on Carboniferous Stratigraphy, we are confident that during the next two to four years GSSPs can be established for most of the boundaries with the possible exception of the base of the Tournaisian.

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

Task-group and project-group work plans

The joint Devonian-Carboniferous Boundary GSSP Reappraisal Task Group A biostratigraphic analysis by Ji *et al*. (1989) and further work (Kaiser, 2009) indicates there are problems with the D-C Boundary GSSP (Paproth *et al*., 1991) at La Serre Hill, France and the conodont lineage used for boundary definition. Therefore, the primary tasks for the D-C boundary task group are to locate a suitable event marker to define the boundary and then find a suitable section for the GSSP.

To help achieve these goals, the task group plans to hold a workshop in the summer of 2016 in either France or Italy to discuss the data gathered to date during the reappraisal of the Devonian-Carboniferous boundary and propose and eventually decide on a new criterion for defining the boundary. Once the new boundary index has been decided upon the task group will search for a suitable section for the GSSP.

In addition to holding the summer 2016 workshop, ongoing work by members of the task group will continue in several regions. 1) 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. 2) Chinese colleagues plan to continue their re-assessment of the best D-C boundary sections in China. 3) In western Canada, Barry Richards and several colleagues intend 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 Hangenberg Event Interval can be more precisely located in the formation by using an approach that includes radiometric dating and stable carbon isotope ($\delta^{13}C$) stratigraphy. 4). Carlo Corradini has several ongoing projects related to the D-C boundary study in various part of northern Gondwana. 5) Thomas Becker (Münster) and his research group plan to continue their investigation of the D-C boundary transition in Morocco, in the Rhenish Massif, Belgium, and China.

Task Group to establish the Tournaisian-Viséan Boundary The task group plans to continue with preparation of the final manuscript for the project. George Sevastopulo, the task group chairman, is leading that work but may require some additional help.

Task Group to establish the Viséan-Serpukhovian Boundary The task group has determined that the FAD of the conodont *Lochriea ziegleri* in the lineage *Lochriea nodosa–Lochriea ziegleri* is the best index for boundary definition. The best two candidate sections are the Naqing (Nashui) section by the village of Naqing in southern Guizhou Province, China and the Verkhnyaya Kardailovka section on the Ural River in southern Russia. The FAD of *L. ziegleri* has been precisely located in these sections and the preliminary sedimentologic and geochemical studies completed. During the 2015 fiscal year, Qi Yuping and Tamara Nemyrovska completed their manuscript on the systematics and phylogeny of

conodonts within the genus *Lochriea* from the Naqing section. Consequently, the phylogeny of *L. ziegleri* is now well established. The principal task for the group in the 2016 fiscal year will be to complete a proposal advocating the use of the FAD of *L. ziegleri* for boundary definition. During the year, the team will also continue to direct its attention toward selecting the best candidate section for the GSSP.

Activities in South China

Paul Brenckle is continuing with the study of foraminifers in the Naqing section and several other sections in southern Guizhou Province including the important Yashui and Dianzishang sections (see Groves *et al*. 2012). To place the Naqing section into its sedimentologic and paleoenvironmental context and to determine the relationship of shallow-water foraminiferal zones to the deeper-water (carbonate slope) *L. nodosa - L. ziegleri* transition in south China, the investigation of four reference sections - the Yashui, Dianzishang, Luokun, and Narao sections - will continue.

Activities in Southern Urals, Russia

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

Preliminary work on the sedimentology, stable-isotope geochemistry and geophysical characteristics of the section have been completed but additional work is required and will be a focus of the team's investigations in 2016. The Kardailovka section contains numerous volcanic ash layers near the boundary level and the task group is having the most important ashes dated using the U-Pb isotope dilution thermal ionization mass spectrometry (ID-TIMS) methodology.

Activities in Cantabrian Mountains, northern Spain

The FAD of *L. ziegleri* has been precisely located in the Millaró and Vegas de Sotres sections and the group plans to publish the details of the conodont sequence in those sections. Little detailed work has been done on the sedimentology and geochemistry of these carbonate-dominated, condensed, basin to lower-slope sections. In the 2016 fiscal year, the group plans to embark on a comprehensive sedimentologic and stable-isotope geochemistry investigation of the Millaró and Vegas de Sotres sections. As part of this work, the group plans to search for shallow-water sections correlative with the sections.

Task Group to establish the Bashkirian-Moscovian Boundary The task group plans to continue evaluating conodont lineages suitable for definition of the Bashkirian-Moscovian boundary and it is anticipated that during the 2016 fiscal year a lineage and taxon suitable for boundary definition will be selected and formally voted upon. The group also plans to continue its search for suitable GSSP candidate sections particularly in south China and the southern Urals. At present, the conodont *Diplognathodus ellesmerensis* Bender, 1980 appears to be the best candidate for boundary definition and the Naqing section in south China shows great potential for the GSSP (Qi *et al*., 2010, 2013). *D. ellesmerensis*, derived from *Diplognathodus* aff. *orphanus* (Merrill, 1972), is easily recognized by conodont workers and is one of the most widely recovered conodonts in the Pennsylvanian.

A major effort will be devoted to study of the conodonts within the Bashkirian-Moscovian transitional interval in the Naqing (Nashui) section and nearby sections in southern Guizhou Province, south China. Special attention will be directed toward the study of the lineage containing *Diplognathodus ellesmerensis* Bender 1980, the taxon considered to have the best potential for boundary definition. Qi Yuping, Tamara Nemyrovska, and Lance Lambert are doing the detailed taxonomy work on the conodonts from the Bashkirian-Moscovian boundary interval in the Naqing section. In former years, it was thought that *Diplognathodus coloradoensis* (Murray & Chronic, 1965)

was the immediate ancestor of *D. ellesmerensis*. Instead, the ancestor is likely to be a new species and its taxonomic status needs to be proven. *D. ellesmerensis* appears a little above the FAD of *Declinognathodus donetzianus* Nemirovskaya, 1990 in the Donets Basin, Ukraine. If the ancestry of *D. ellesmerensis* is established in time, the group will plan to prepare a proposal for using this taxon for boundary definition in 2016.

Work on the sedimentology, stable-isotope geochemistry, and geophysical characteristics of the boundary interval in the Naqing and nearby sections are not as advanced as the paleontological investigations and will be the focus of the work of Jitao Chen and Isabel Montanez in 2016.

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

MOSCOVIAN-KASIMOVIAN BOUNDARY

Until 2013, the task group had concluded the first appearance datum (FAD) of either *Idiognathodus sagittalis* Kozitskaya, 1978 or *Idiognathodus turbatus* Rosscoe & Barrick, 2009 had the best potential as a marker for the base of the Kasimovian (Villa & task group, 2008; Ueno & task group, 2011). Now, a lower level defined by the first occurrence of *Idiognathodus heckeli* Rosscoe & Barrick, 2013, which is considered as the direct ancestor of *I. turbatus*, is newly proposed as a more appropriate position of the base of the Kasimovian. In 2016 the group needs to decide which conodont to use as the index for the M-K boundary and then prepare a proposal and have it voted on by the task group and SCCS. After such a proposal is made and voted on, additional taxonomic work and comparison of morphotypes from different regions can be continued.

Activities in southern China

Qi Yuping & James Barrick will continue with studies to provide more detailed information on the conodont succession across the Moscovian-Kasimovian boundary in the Naqing section and several other limestone-dominated, turbiditic sections in the region as a potential GSSP candidate sections. Work on the sequence stratigraphy, sedimentology, stable-isotope geochemistry, and geophysical characteristics of the Moscovian-Kasimovian boundary interval at Naqing and Narao sections will be largely completed by Jitao Chen and Isabel Montañez in 2016.

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

Activities in Moscow Basin, Russia

The task group will continue to study the conodonts *Idiognathodus turbatus* and *I. sagittalis* as possible markers for the base of the Kasimovian Stage in the Moscow Basin. At this moment, they considered that the mid-Khamonvnikian Substage is the best potential level for the fixation of the base-Kasimovian boundary.

KASIMOVIAN-GZHELIAN BOUNDARY

Since 2007, when the task group voted in favor of using the first appearance of the conodont *Idiognathodus simulator* (Ellison, 1941) in the lineage *Idiognathodus eudoraensis* - *I. simulator* as the boundary-defining event (Heckel *et al*., 2008), the search for a suitable section for the GSSP had been the task-group's main objective. However, the ancestry of *I. simulator* (=*Streptognathodus simulator*) is no longer agreed upon and needs to be investigated more carefully and another index may need to be proposed and voted on. Qi *et al.* (2015) found a new species that they claim is the ancestor for *I. simulator*. In the Moscow Basin *S. simulator* is apparently in the evolutionary lineage *S. praenuntius* Chernykh–*S. simulato*r–*S. postsimulator* (Alekseev and Goreva, 2015). Three sections are currently being considered as potential candidate sections: the type Gzhelian in the Moscow Basin (Alekseev

and Goreva, 2015), the Usolka section in the southern Urals (Sungatullina *et al*., 2015), and the Naqing/Narao sections in Guizhou Province, south China (Qi *et al*., 2015).

Activities in Russia

The Usolka section in the southern Ural Mountains of Russia was proposed as a candidate section for the GSSP at the base of the Gzhelian (Chernykh *et al*., 2006; Davydov *et al*., 2008) but examination by members of the SCCS on a field trip to the locality in 2009 revealed the section required substantial new lithostratigraphic, sedimentologic and conodont-based biostratigraphic work before it could be considered as a candidate section. During 2013-2014, the section was extensively excavated to improve exposure and was resampled for conodonts (Sungatullina *et al*., 2015; Chernykh *et al*., 2015). Guzel Sungatullina (Kazan University) has been reevaluating the conodonts from the newly-exposed Usolka section and will continue that work in 2016.

Activities in China

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

The Project Group on Carboniferous Magnetostratigraphy Future plans are for Louise Hawkins and the Lancaster and Liverpool groups to sample the Cove Harbour section in more detail in early 2016, covering the interval from the Late Devonian to close to the Devonian-Carboniferous boundary. The Carboniferous-Devonian boundary can approximately be defined in the section based on previous palynology studies. Pending a grant funding decision which will be taken in mid-2016, work will continue into the Early Carboniferous in the Cove Harbour section, along with the Fife coast sections, and probably Bashkirian sections in Ebbadalen on Spitzbergen, coordinated through the work of Lars Stemmerik in these Spitzbergen sections.

The Project Group on Carboniferous and Permian Nonmarine and Marine Correlations The project group plans to continue their work on the correlation of the system and stage boundaries into the vast successions of Carboniferous and Permian continental deposits. In 2016 members of the project group will contribute to the compilation of a Pennsylvanian-Permian-Early Triassic nonmarine-marine correlation chart. The work will include drafting of charts for the basins members are currently concerned with along with providing supporting stratigraphic information.

Meeting-field workshop schedule with themes and anticipated results During the November 1st, 2015 - October 31st, 2016 fiscal year, there will be several conferences and field meetings in which the SCCS membership will participate but the most important one is the 35th International Geological Congress in Cape Town, South Africa from August 27 to September 4, 2016 http://www.35igc.org/. The SCCS will hold a general business meeting at the congress but individual workshops have not yet been planned. The SCCS Chairman has submitted a symposium proposal titled “The Carboniferous World: Assembly of Pangaea and Onset of Late Paleozoic Glaciations” under the scientific program theme: Phanerozoic Earth History, Stratigraphy and the Geologic Time Scale”. The symposium will provide a forum for discussion of the most relevant topics on Carboniferous geology, paleontology, and environments including: the terrestrial Carboniferous World, paleoceanography, glaciations and interglacials, assembly of Pangaea, reefs and carbonate mounds, and the biota.

4b. Specific GSSP Focus for 2016

Viséan-Serpukhovian boundary

5. SUMMARY OF EXPENDITURES IN 2015: STATEMENT OF OPERATING ACCOUNTS FOR NOVEMBER 1st, 2014 TO OCTOBER 31st, 2015

Prepared by Barry Richards, Chairman SCCS

(Accounts maintained in Canadian currency)

INCOME (November 1, 2014 – October 31, 2015)

IUGS-ICS Grant – April 6, 2015: $1,500.00 US =$1,771.50 Canadian	$1,771.50
Donations from Members; November 1, 2014 - October 31 2015	$0.00
Interest Bank of Montreal; November 1, 2014 - October 31, 2015	$0.00
TOTAL INCOME	$1,771.50

EXPENDITURES (November 1, 2014 – October 31, 2015)

Bank Charges: Bank of Montreal	$0.00
Travel and conference registration support for SCCS voting members and executives to attend and give presentations (XVIII ICCP, Kazan, Russia 2015; field meeting on Carboniferous substages in England, Oct., 2015)	$2,000.00
TOTAL EXPENDITURE	$2,000.00

BALANCE SHEET (2014 – 2015)

Funds carried forward from October 31, 2014	$1,688.93
Plus Income November 1, 2014 – October 31, 2015	$1,771.50
Total assets	**$3,460.43**
Less Expenditures November 1, 2014 – October 31, 2015	$2,000.00
BALANCE CARRIED FORWARD (to Nov. 1, 2015 - Oct. 31, 2016 fiscal year)	**$1,460.43**

6. BUDGET AND ICS COMPONENT FOR Nov. 1, 2015 - Oct. 31, 2016 fiscal year

PROJECTED EXPENSES

Support for voting members to participate in August 27th - Sept. 4th IGC 2016 in Cape Town South Africa, and September 2016 workshop in St. Petersburg, Russia	$3,000.00
TOTAL PROJECTED EXPENSES	$3,000.00
INCOME	
Carryover (from CREDIT balance at end Nov. 1, 2014 - Oct. 31 2015 fiscal year)	$1,460.43
Estimated donation	$00.00
TOTAL PROJECTED INCOME	$1,460.43
BALANCE	
Estimated (deficit) /credit from above	-$1, 539.57
BUDGET REQUEST FROM ICS for 2015	$2,000.00

APPENDIX A

7. SUMMARY OF CHIEF ACCOMPLISHMENTS OVER PAST FIVE YEARS (2011-2015)

Background: A vote by the ICS in late 1999 resulted in approval of the names Mississippian and Pennsylvanian along with a reconfirmation of the previous decisions of the SCCS to regard their rank as subsystems. In 2003 the SCCS voted to classify the two subsystems into Lower, Middle, and Upper Mississippian Series and Lower, Middle, and Upper Pennsylvanian Series, by a 74% majority of those 90% of the total membership who voted. This vote with its implicit acceptance of the stage names used in Russia as the global stage names for the Carboniferous now provides the Carboniferous with its official global series and stage names (Heckel & Clayton, 2006a, 2006b), and effort is now focused on selecting events and GSSPs for stage boundaries.

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

Initial work plans were outlined in the 2008 SCCS Annual Report submitted to the ICS: 1) the use of the first evolutionary occurrence of the conodont *Siphonodella sulcata* (Huddle, 1934) in the lineage

S. praesulcata Sandberg, 1972 to *S. sulcata* for boundary definition requires re-evaluation; 2) if the FAD of *S. sulcata* is retained for boundary definition, either the position of the GSSP at La Serre must be lowered or a more suitable section located, and 3) because the first appearance of *S. sulcata* may not be the best marker, other conodont lineages require evaluation. Later in the reappraisal, the multi-phase Hangenberg Event (Kaiser *et al*., 2008) was identified as a level of interest for boundary definition.

Progress

The *S. praesulcata* to *S. sulcata* conodont lineage used to define the boundary has been re-evaluated by several scientists including Kaiser & Corradini (2011), and the protognathodids, the other conodont group that had shown potential for boundary definition is being re-studied (Corradini *et al*. 2011; Corradini *et al*., 2013; Corradini *et al*., 2015). Up to 2015, the conodont studies were disappointing because it appeared that neither the siphonodellid lineage nor the protognathodids would be suitable for D-C boundary definition and other appropriate taxa had not been discovered. In 2015, however, Corradini *et al.* (2015) concluded that the FAD of the conodont *Protognathodus kockeli* (Bischoff, 1957) should be considered as a new index for boundary definition. By the end of the 2015 fiscal year, the geochemical and sedimentologic signatures of the mulita-phase Hangenberg Event (Kaiser *et al*., 2008) were well established, and it appears the base of the Hangenberg Black Shale has substantial potential for international correlation.

From the work completed through 2015, 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*. The search for better GSSP sections is progressing although potential events for boundary definition have been identified but not selected and voted on.

Task Group to establish the 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. Task-group Chairman George Sevastopulo is preparing the final report and should have it completed during the 2016 fiscal year. The report provides a brief resume of the GSSP and then lists successful attempts to identify the boundary in Eurasia by Jiri Kalvoda and others, and discusses the problems of identifying (and best approximation to) the boundary in North America and Gondwana.

Task Group to establish the 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. The *L. nodosa-L. ziegleri* lineage has become widely recognized in Western Europe, Russia and Asia (Nikolaeva *et al*., 2009; Qi *et al*., 2013). A proposal for using *L. ziegleri* for boundary definition is being written in preparation for discussion and a subsequent vote by the task group and SCCS. The Naqing (Nashui) section in south China and the Verkhnyaya Kardailovka section in Russia have the best potential as GSSP candidates. The FAD of *L. ziegleri* has been precisely located in both sections and preliminary sedimentologic and stable-isotope geochemical studies completed (Chen *et al.,* 2015; Kulagina *et al*., 2015; Richards *et al*., 2015).

The identification of the *Lochriea* lineage along with recognition of the ammonoid, ostracode, and foraminiferal zones in a deep-water (basinal), carbonate section at Verkhnyaya Kardailovka in the south Urals of Russia established that section as a strong GSSP candidate. The section has been thoroughly examined and synthesis published about the ammonoids, conodonts, and ostracodes (Pazukhin *et al*., 2010; Nikolaeva, 2013). Conodonts that are transitional between *L. nodosa* and *L. ziegleri* occur immediately below the FAD of *L. ziegleri.* From 2010 to 2012 the extensive covered intervals in the section were excavated and permanent aluminum marker pins placed at one meter intervals. Bed-by-bed sedimentologic analysis and preliminary stable-isotope geochemical analyses have been completed across the boundary (Nikolaeva *et al*., 2015; Richards *et al*., 2015, Richards *et al*., in press; Kulagina *et al*., 2015). Volcanic ash layers lie shortly below the proposed boundary level

and Schmitz and Davydov (2012) dated an ash sample from about 1.48 m below FOD of *Lochriea ziegleri*. Four dated zircons gave a weighted $^{206}Pb/^{238}U$ date of 333.87+/-0.08 Ma and that was interpreted as the eruptive age.

The Naqing (Nashui) section in southern Guizhou Province, China is the other strong candidate for a GSSP (Qi *et al.*, 2013) and conodonts spanning the Viséan-Serpukhovian boundary in the section have undergone intensive study. Conodonts within the *L. nodosa - L. ziegleri* lineage are well preserved and abundant. Elements transitional between *L. nodosa* and *L. ziegleri* are plentiful, occurring through several metres of section. A detailed stratigraphic section extending from the upper Viséan into the Bashkirian has been measured at Naqing and aluminum marker pins placed at one-metre intervals. A bed-by-bed sedimentologic and geochemical study across the boundary interval has been completed (Chen *et al*., 2015; Wang *et al*., 2015). Studies of the foraminifers (Groves *et al*., 2012) and Brenckle (in progress) indicate they can be used to bracket the level of the FAD of *L. ziegleri*, thereby facilitating correlations into shallow-water carbonate sections lacking diagnostic conodonts. The measurement and intensive study of several other sections (Yashui, Luokun, Narao, & Dianzishang sections) in the region from 2010 through 2015 is enabling the task group to place the Naqing section into its paleogeographic, stratigraphic, and lithofacies contexts (Chen *et al*., 2015). Volcanic ash beds were recently discovered in the upper Viséan and another in the lower Serpukhovian at Naqing and Narao. Zircons have been extracted from the ash samples and are being processed in the U.S.A. by Jitao Chen and Isabel Montanez with the ID-TIMS U-Pb age dating method.

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

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

Task Group to establish the Bashkirian-Moscovian Boundary An index for the boundary has not been selected. However, the conodont *Diplognathodus ellesmerensis* Bender, 1980 is considered to be a good potential candidate for boundary definition and the Naqing section in south China shows great potential for the GSSP (Qi *et al*., 2013). *D. ellesmerensis*, derived from *Diplognathodus* aff. *orphanus* (Merrill, 1972), is easily recognized by conodont workers and is one of the most widely recovered conodonts in the Pennsylvanian. The ancestor of *D. ellesmerensis* is probably a new species and its taxonomic status needs to be proven.

The conodont *Declinognathodus donetzianus* Nemyrovska, 1990 makes its first appearance near that of *D. ellesmerensis* and shows great potential as an auxiliary index for the boundary. Substantial work has gone into evaluating the *Declinognathodus marginonodosus—D. donetzianus* lineage for boundary definition but the lineage appears to lack a sufficiently wide geographic distribution. The fusulinid *Verella* is a useful indicator for the uppermost Bashkirian and *Depratina prisca* (Deprat) and *Aljutovella aljutovica* (Rauser) lowermost Moscovian markers.

An evolutionary lineage of *Declinognathodus marginonodosus—D. donetzianus* occurs in the Basu River section in the southern Urals of Russia, 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. *D. ellesmerensis* has not been reported from the Basu River section but may be present in the underlying covered interval.

A detailed stratigraphic section extending from the upper Bashkirian through the Moscovian has been measured at Naqing, Narao, and Luokun and the FAD of *D. ellesmerensis* precisely located. Aluminum marker pins have been placed at one-meter intervals in these sections. Jitao Chen and Isabel Montanez are well advanced with their detailed sedimentologic and stable-isotope geochemical study across the B-M boundary in the Naqing and adjacent sections and may complete their work in 2016.

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

MOSCOVIAN-KASIMOVIAN BOUNDARY

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

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

KASIMOVIAN-GZHELIAN BOUNDARY

Members of the Kasimovian-Gzhelian Boundary task group plan to use the FAD of the conodont *Idiognathodus simulator s.s.* (Ellison, 1941) to define the boundary. Up to 2015, the immediate ancestor of *I. simulator* was considered to be *Idiognathodus eudoraensis* (Heckel *et al.*, 2008; Barrick *et al*., 2008). Unfortunately, the ancestry of *I. simulator* (=*Streptognathodus simulator*) is no longer agreed upon and needs to be investigated more carefully and another index may need to be proposed and voted on. Qi *et al.* (2015) found a new species in south China that they claim is the ancestor for *I. simulator*. In the Moscow Basin, *I. simulator* is apparently in the evolutionary lineage *S. praenuntius* Chernykh–*S. simulato*r–*S. postsimulator* (Alekseev and Goreva, 2015).

Three sections are currently being considered as potential candidate sections: the type Gzhelian in the Moscow Basin (Alekseev and Goreva, 2015), the Usolka section in the southern Urals (Sungatullina *et al*., 2015; Chernykh *et al*., 2015), and the Naqing/Narao sections in Guizhou Province, south China (Qi *et al*., 2015). In 2013-2014, the Usolka section, once proposed as a potential candidate of GSSP for the base of the Gzhelian Stage (Davydov *et al*., 2008), was extensively excavated to better expose the boundary level. Sungatullina *et al*., (2015) and Chernykh *et al*. (2015) completed a preliminary assessment of the conodonts across the boundary in that section. Alekseev and Goreva, (2015) consider the type section of the Gzhelian in the Moscow Basin has good potential for the GSSP and are actively working on it. The other potential candidate intervals for the GSSP lie within the Naqing (Nashui) and Narao sections in south China and are undergoing a thorough biostratigraphic, sedimentologic and geochemical investigation. Within the sections, the presence of the lineage containing *I. simulator* has been proven by Yuping Qi and his colleagues. In 2013 and 2014, sedimentologic and stable-isotope geochemical investigations at the Naqing and Narao sections were initiated by Chen Jitao and Isabel Montanez and by 2015 they were well advanced.

Project Group on Carboniferous Magnetostratigraphy During the last several years, there was considerable progress in refining and integrating the magnetostratigraphy previously obtained from the Maritime Provinces in Canada and the Mauch Chunk Formation in the Appalachian Basin of the eastern USA by integrating magnetostratigraphy with palynostratigraphy through the work of Opdyke *et al*. (2014). An integrated graphical summary compiled from sections and sources described in their study with existing magnetostratigraphic data from lavas in the Asbian-Brigantian substages described in Hounslow *et al*. (2004) demonstrates a clear and validated pattern of polarity changes through the Brigantian, Pendleian and lower Arnsbergian substages (late Viséan and Serpukhovian), from several overlapping sections. Opdyke *et al*. (2014) clearly identify the base of the Kiaman reverse superchron in the *Raistrickia saetosa* biozone (approximately near the base of the Langsettian substage), which they place at ~318 Ma using the 2012 timescale of Davydov *et al*. (2012).

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

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

8. OBJECTIVES AND WORK PLAN FOR NEXT 4 YEARS (2016-2019)

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

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

A suitable section for the GSSP must be located because recent studies at the GSSP section on La Serre Hill in south France 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 & Kaiser, 2009; Kaiser, 2009). Several sections in Western Europe and those in south-central China, which had been proposed as GSSP candidates prior to selection of the La Serre section, will be carefully re-examined.

The task group will continue to explore the possibility of using either a sedimentological or geochemical event such as a component of the multiphase Hangenberg extinction event (Kaiser, 2005; Cramer *et al.*, 2008) for boundary definition. The event presents potential for correlation into both shallow and relatively deep-water marine facies; consequently, the task group wants to know how the

phases of the Hangenberg are represented in different facies and how well they can be correlated globally.

Tournaisian-Viséan Boundary By 2003 work by the 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 chairman George Sevastopulo plans to complete the final report within the 2016 fiscal year.

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. The task group plans to complete a proposal for submission to the task group and SSCS voting membership for a vote on either accepting or rejecting the FAD of *L. ziegleri* for GSSP definition. Two sections, Verkhnyaya Kardailovka (Nikolaeva, 2013; Pazukhin *et al*., 2010) and Naqing (Qi *et al*., 2013), present the best potential for the GSSP, and the ongoing integrated biostratigraphic, sedimentological and geochemical studies of those sections will continue to project completion. Most of the field work has been completed at both localities and the remaining objective is to complete the sample study and compile the final synthesis. Identification of the *L. nodosa-L. ziegleri* lineage and recognition of associated conodont, ammonoid, ostracode, and foraminiferal zones in the richly fossiliferous section near Verkhnyaya Kardailovka in the southern Urals establishes that section as a strong candidate for the GSSP. In the Naqing section in southern Guizhou Province, China the *Lochriea* lineage has been intensively studied and the FAD of *L. ziegleri* precisely located. Field work is essentially complete at Naqing and the remaining objective is to complete the analytical work and prepare the final synthesis for publication.

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

Bashkirian-Moscovian Boundary Task Group The high-priority plans for the 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. Two conodont lineages show substantial potential for boundary definition and their evaluation requires immediate completion: 1) derivation of *Declinognathodus donetzianus* from *D. marginodosus* and 2) the lineage containing *Diplognathodus ellesmerensis*, which appears at the base of the Moscovian in the Naqing section (Nashui) in Guizhou Province, China (Qi *et al*., 2007, 2009) and has been widely recognized globally.
In former years it was thought that *Diplognathodus coloradoensis* Murray & Chronic, 1965 was the immediate ancestor of *D. ellesmerensis*; however, additional work has demonstrated it has a different ancestor, *Diplognathodus* aff. *orphanus* (Merrill, 1972), and that relationship requires evaluation.

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

The **Moscovian-Kasimovian Boundary and Kasimovian-Gzhelian Boundary Task Groups**
MOSCOVIAN-KASIMOVIAN STAGE BOUNDARY

During the next four years, the group needs to decide which conodont to use as the index for the M-K boundary and then prepare a proposal and have it voted on by the task group and SCCS. After such a

proposal is made and voted on, additional taxonomic work and comparison of morphotypes from different regions can be continued. After selecting the event marker for the boundary, the task group will select a GSSP candidate section for a vote by the SCCS and ICS.

Until 2013, the task group had concluded the first appearance datum (FAD) of either *Idiognathodus sagittalis* Kozitskaya, 1978 or *Idiognathodus turbatus* Rosscoe & Barrick, 2009 had the best potential as a marker for the base of the Kasimovian (Villa & task group, 2008; Ueno & task group, 2011). Now, a lower level defined by the first occurrence of *Idiognathodus heckeli* Rosscoe & Barrick, 2013, which is considered as the direct ancestor of *I. turbatus*, is newly proposed as a more appropriate position of the base of the Kasimovian. The FAD of *I. heckeli* is a better position because its first appearance is closer to that of the traditional definition of the Kasimovian than that of either *Idiognathodus sagittalis* or *Idiognathodus turbatus*. *I. heckeli* is also present in the Naqing section in Guizhou Province of south China, which would allow that section to serve as the GSSP for the base of the Kasimovian.

KASIMOVIAN-GZHELIAN BOUNDARY

The ancestry of the chosen index for the base of the Gzhelian is the highest priority goal of the task group. 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 had been the task-group's main objective. However, the ancestry of *I. simulator* (=*Streptognathodus simulator*) is no longer agreed upon and needs to be investigated more carefully and another index may need to be proposed and voted on. Qi *et al.* (2015) found a new species that they claim is the ancestor for *I. simulator*. In the Moscow Basin, *S. simulator* is apparently in the evolutionary lineage *S. praenuntius* Chernykh–*S. simulato*r–*S. postsimulator* (Alekseev and Goreva, 2015).

Three sections are currently being considered as potential candidate sections: the type Gzhelian in the Moscow Basin (Alekseev and Goreva, 2015), the Usolka section in the southern Urals (Sungatullina *et al*., 2015), and the Naqing/Narao sections in Guizhou Province, south China (Qi *et al*., 2015). The group needs to determine which of these will make the best section for the GSSP.

The Project Group on Carboniferous and Permian Nonmarine and Marine Correlation The project group plans to continue their work on the correlation of the system and stage boundaries into the vast successions of Carboniferous and Permian continental deposits. In 2016/2017 members of the project group will contribute to the compilation of a Pennsylvanian-Permian-Early Triassic nonmarine-marine correlation chart and associated manuscript. The work will include drafting of charts for the basins that members are currently concerned with along with providing supporting stratigraphic information. Subsequent to completing the correlation chart, project-group members will search for event markers within the nonmarine successions they are working on to facilitate correlation with the global stages, the bases of which are based on marine taxa.

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

9. ORGANIZATION AND SUBCOMMISSION MEMBERSHIP

In addition to the three executive voting members, the SCCS has 17 rank-and-file voting members and approximately 280 corresponding members (see latest issue of Newsletter on Carboniferous Stratigraphy for contact information).

9a. ***NAMES AND ADDRESSES OF CURRENT OFFICERS AND VOTING MEMBERS***

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9b. ***WORKING GROUPS/TASK GROUPS AND OFFICERS***

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

Task Groups and officers

The joint Devonian-Carboniferous Boundary GSSP Reappraisal Task Group [base of Carboniferous is also the base of the Lower Mississippian Series and Tournaisian Stage] is a task group that was established in early 2008 and is chaired by Markus Aretz (France; aretz@get.obs-mip.fr). Carlo Corradini is the Vice-chairman. Aretz has summarized the recent work of the group through October 31st 2015 in this annual report.

Task Group to establish the Tournaisian-Viséan Boundary [which is also the base of the Middle Mississippian Series] is chaired by George Sevastopulo (Ireland; gsvstpul@tcd.ie). Using e-mail communications from the chairman, the recent activities of the group are summarized herein through October 31st 2015.

Task Group to establish the Viséan-Serpukhovian Boundary [which is also the base of the Upper Mississippian Series] is chaired by Barry Richards (Canada; barry.richards@canada.ca), who summarized the recent work of the group through October 31st, 2015 in this annual report.

Task Group to establish the Bashkirian-Moscovian Boundary [which is also the base of the Middle Pennsylvanian Series] is chaired by Alexander Alekseev (Moscow State University, Russia; aaleks@geol.msu.ru), who summarized the recent work of the group through October 31st, 2015 in this annual report.

Task Group to establish the Moscovian-Kasimovian Boundary [which is also the base of the Upper Pennsylvanian Series], and the **Kasimovian-Gzhelian Boundary** is chaired by Katsumi Ueno (Japan; katsumi@fukuoka-u.ac.jp). Ueno summarized the recent work of the group through October 31st, 2015 in this annual report.

Project Group on Carboniferous magnetostratigraphy is chaired by Mark Hounslow (United Kingdom) m.hounslow@lancaster.ac.uk, who summarized the recent work of the group in this annual report.

The Project Group on Carboniferous and Permian Nonmarine and Marine Correlations is chaired by Jörg W. Schneider (Germany) Joerg.Schneider@geo.tu-freiberg.de. The project group was established in 2013. Their recent work is summarized in this annual report.

9c. INTERFACES WITH OTHER INTERNATIONAL PROJECTS

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

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