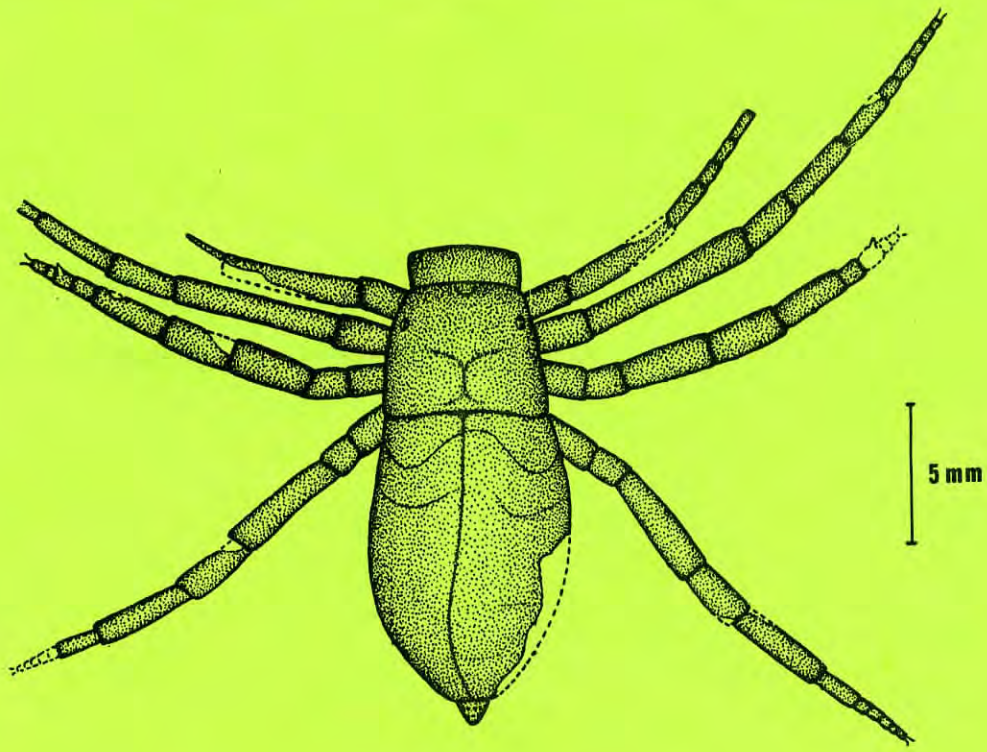
NEWSLETTER ON CARBONIFEROUS STRATIGRAPHY

Volume 11 July 1993



SCCS

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

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Newsletter on Carboniferous Stratigraphy

IUGS SUBCOMMISSION ON CARBONIFEROUS STRATIGRAPHY / VOL. 11 - 1993

Chairman's column

In these times of general economic stress, even global stratigraphical correlation seems to suffer. Travelling, a primary precondition for stratigraphic correlation, is becoming more difficult because of a lack of financial support. This is particularly trying since travelling formalities have now become much easier for "eastern" and "western" specialists. The huge and stratigraphically most important area of the former Soviet Union is much more accessible now for scientific visitors and collectors.

In spite of the problems, we have to go on with our "global correlation program" founded four years ago at the SCCS meeting in Provo/Utah. It is a challenge to overcome such difficulties and to find intelligent ways to succeed!

After the discussions in Liège in June 1993, we have asked the Mid-Carboniferous Working Group to endeavour to reach a decision on the most appropriate stratotype and to communicate this to the Subcommission by mid January 1994. We look forward to making this decision a landmark in the history of the Subcommission.

real workers are encouraged by difficulties!

We shall continue with our investigation of the potential biostratigraphic boundaries near the base of the late Tournaisian (BRENCKLE), the base of the Viséan (SEVASTOPULO), and in the youngest Viséan (BELKA). Particularly promising but of longer duration seems to be the research on a) the base of the *Protriticites* zone (VILLA) including the Russian Platform; and b) the boundary at the base of the Namurian *cancellatum* zone (KULLMANN).

Other interesting areas which are opening up include the possibility of a global correlation of early Carboniferous rocks with radiolarians, and the study of Bolivian sections for the global correlation of their marine and non-marine late Carboniferous successions. A further fascinating topic to be studied by stratigraphers concerns polar wandering during the interval from the latest Devonian into (and beyond?) the Permian.

Everybody interested in the Carboniferous is invited to cooperate within the framework of SCCS! Nobody will ever be excluded. Biostratigraphic studies from a local to regional scale are important tools which we need in order to refine our data. Only by this means will the Carboniferous subdivisions become universally acceptable. At present we lack a precise framework for the subdivision of the System. Let's go on and speed up the process of definition -- *real* workers are encouraged by difficulties!

Eva Paproth

THE COVER ILLUSTRATION

A reconstruction of the oldest Namurian ricinuleid

Curculioides adompha BRAUCKMANN, 1987 [Ricinuleida: Curculioidae] [the oldest ricinuleid]; Namurian B (Upper Marsdenian), Hagen-Vorhalle, Germany. From BRAUCKMANN, C. 1991. Arachniden und Insekten aus dem Namurium von Hagen-Vorhalle (Ober-Karbon; West-Deutschland). *Veröffentlichungen aus dem Fuhlrott-Museum,* **1**: 1-275; Wuppertal.

SCCS ANNUAL REPORT 1992-93

Membership:

The Subcommission has 22 *Voting Members*, including 2 Bureau Officers. In addition, there are 250 *Corresponding Members* on the mailing list.

SCCS holds biennial meetings, one in conjunction with the International Congress on Carboniferous Stratigraphy and Geology (four yearly intervals) and the other at a Field and General Meeting of the Subcommission midway between the Carboniferous Congresses.

Bureau Officers:

Chairman: Dr Eva Paproth, Schönwasserstr. 103, D-4150 Krefeld, GERMANY

Secretary/Vice Chairman: Dr B.A. Engel, Dept of Geology, Univ.of Newcastle, NSW 2308 AUSTRALIA

Activities 1992-93:

(A) Mid-Carboniferous Boundary Working Group

In the last year, several members of the Working Group have undertaken an informal preview of three further sections which the Group wished to investigate before voting on the final stratotype selection. These include the Nandan exposure, Guiling, China; the Gissar Ridge Section, South Tian Shan, Central Asia, Uzbekistan; and a section on the Plateau Saint-André, at the Col de Tantes in the High Pyrénées, France. The latter was inspected by the Working Group during the June 1993 Field & General Meeting.

The outcome of the deliberations at Liège was to limit the decision of the potential stratotype to three sections, a) Stonehead Beck, UK; b) Arrow Canyon, USA; and c) Aksu-I section, Uzbekistan. The WG was asked at the Liège General Meeting to submit their decision to the Subcommission by mid-January 1994.

(B) Project Groups

Leaders of the five Project Groups seeking potential stage boundaries in the Carboniferous have continued their investigations during 1993. Reports from the leaders were presented at the General Meeting held in Liège (June 1993). All groups will continue their investigations at least until the next SCCS meeting in Poland (1995) at the XIII Carboniferous Congress.

B.A. Engel, Secretary

STATEMENT OF INCOME AND EXPENDITURE 1991-92

INCOME		**$AUS** Definitive	**$US** Estimated
IUGS Grant for 1992 (rate 0.7761)		386.59	300.00
Donations of members		422.41	295.69
Bank interest		65.30	45.71
TOTAL INCOME		874.30	641.40
EXPENDITURE			
Stationery:		18.90	13.23
Printing Costs:	Newsletter 10	337.00	235.90
Postal Charges:	Nov.91-Nov.92	553.00	387.10
Sundry Expenses:	Typing	150.00	105.00
	Bank Charges	3.87	2.71
TOTAL EXPENDITURE		1062.77	743.94

Explanatory Note: Definitive income and expenditure are quoted in Australian Dollars. Unless otherwise indicated, all income and expenditure have been converted to US$ at an exchange rate of AUS$1.00=US$0.70.

BALANCE SHEET (1992)	**$AUS** Definitive	**$US** Estimated
Funds carried forward from 1991	1517.44	1062.21
PLUS Income 1992	874.30	612.01
LESS Expenditure 1992	1062.77	743.94
CREDIT balance forward to 1993	1328.97	930.28

BUDGET REQUEST FOR 1993

ITEM	BUDGET ESTIMATE (AUS$)	(US$)
Printing & Stationery		
Paper, labels, envelopes	72.00	50.00
Newsletter 11 (300 x 30 pages)	357.00	250.00
Postage Costs		
Bureau correspondence	72.00	50.00
Newsletter 11	600.00	420.00
Part-Time Typing/Drafting Assistance		
Bureau typing (Newsletter)	179.00	125.00
Drafting support for "CARBONIFEROUS OF THE WORLD", Volume 3	143.00	100.00
Conference Support		
Support for Liège Conference	300.00	210.00
PROJECTED EXPENDITURE	1723.00	1205.00

The Subcommission has been advised by circular from ICS that it will receive no IUGS funding in 1993.

REPORT ON LIEGE MEETING, JUNE 1993

The 1993 Field and General Meeting of the Subcommission on Carboniferous Stratigraphy (SCCS) was held in conjunction with a meeting of the Commission internationale de microflore du Paléozïque (CIMP) in the Department of Plant Palaeontology at the University of Liège, and at various field locations in Belgium, Germany and France during the period 7-16 June 1993.

The attending members of the Subcommission wish to place on record their gratitude to Professor Maurice STREEL and his colleagues in Belgium, Germany and France for their dedicated contributions towards the organisation of this meeting.

Some 93 registrants participated in the meetings and/or the associated field inspections. Delegates registered from Argentina, Australia, Austria, Belgium, Belorussia, Canada, Czech Republic, France, Germany, Ireland, Poland, Spain, The Netherlands, UK, Ukraine, and USA.

The program was as follows:

Mon. 7 June: Field inspection of Late Famennian to Namurian in the eastern Ardenne, Belgium. (Guidebook by R. DREESEN, E. POTY, M. STREEL & J. THOREZ).

Tue. 8 June: SCCS Meeting session in the University of Liège (24 papers).

Wed. 9 June (a.m.): SCCS Meeting plus reports by Project Leaders.

Wed. 9 June (p.m.): Field trip to Famennian reefal beds in the Vesdre Syncline, Eastern Ardenne, Belgium (Guidebook by R. DRESSEN, J.M. MARION & E. POTY) or additional papers by CIMP members.

Thu. 10 June (a.m.): Joint Meeting in University of Liège (8 papers).

Thu. 10 (p.m.) to Sat. 12 June: Travel to Hohenlimburg-Reh for field inspection of the beds near the Devonian-Carboniferous Boundary in the Rhenish Massif, Germany (Guidebook by R.T. BECKER, D. KORN, E. PAPROTH AND M. STREEL).

Mon.14 to Wed. 16 June: Field inspection of the Pyrénées area: biostratigraphy, sedimentology, paleoenvironments and tectonics. (Guidebook by M-F. PERRET, J.J. DELVOLVE, C. MAJESTE-MENJOULAS, J. DERAMOND, N. GERRERO, H. SCHULZE AND J. JOSEPH).

A list of the 32 papers presented at the conference follows:(Co-authors are not indicated).

AUSTIN - Evidence from the Gayle Limestone (N. England) regarding environmental controls over Brigantian conodont distribution.

BELKA - Facies and evolutionary signals in the conodont biofacies patterns across the D/C Boundary.

BLESS - Eustatic cycles around the D/C Boundary and the sedimentary and fossil record in Sauerland.

BLIECK - IGCP328 Early Carboniferous microvertebrates and their use in biostratigraphy and marine/non marine correlation.

BRAND - Brachiopods and oceanic geochemistry of the D/C Boundary interval.

BRENCKLE - A 'Mid-Tournaisian' intercontinental boundary: preliminary results of Eastern Russian Platform studies.

CLAOUÉ-LONG - Carboniferous time.

DUSAR - The early Carboniferous transgression on the Brabant Massif (W-Flanders, Belgium).

ENGEL - Australian Carboniferous Studies.

GIRARD - D/C and F/F conodonts and trilobites in the stratotype area (Montagne noire, France).

HANCE -Foraminifers from the C/C transition in Hunan, SE China.

HARTKOPF-FRODER - Latest Devonain miospore assemblages from the Bergisch Gladbach-Paffrath syncline, Bergisches Land region, Germany.

HERBIG - Eustatic forcing of latest Devonian and Dinantian Culm sequences, Rheinisches Schiefergebirge, Germany.

HIGGS - Last results on miospores found near the D/C Boundary in Sauerland.

KALVODA - Results from Moravia (Czech Republic) and comments on possible levels of the lower Carboniferous subdivision.

KORN - New results of the studies on the D/C Boundary in the Rhenish Massif.

KÜRSCHNER - Strontium isotopes in conodonts: D/C transition, the Northern Rhein, Slate Mts.

LEGRAND-BLAIN - Lower Carboniferous Brachiopod faunas in the Variscan Belts, Central and Southern France.

MATYJA - Sedimentological and paleontological record of the Late Famennian Hangenberg event and earliest Tn events in Pomerania, NW Poland.

MAMET - Nanbiancun algal microflora D/C Boundary in China.

MUCHEZ - Comparison of the sequence stratigraphy at the D/C transition in southern China and south Belgium.

POTY - Rugosa from the D/C transition in Hunan, SE China.

ROWE - Upper Famennian and Lower Carboniferous plants from the Rheinisches Schiefergebirge.

SCHÖNLAUB - The Alpine Carboniferous - Revised subdivision and correlation.

STEEMANS - Miospores from the D/C transition in Hunan, SE China.

STEMPIEN - Assemblages de spores et zonation près de la limite D/C, en Poméranie, NW Pologne.

STREEL - Quantitative palynology at the F/Fa and D/C boundaries in the Ardenne-Rhine Basin.

STREEL - Miospores from late Famennian varves and tillites of Brazil.

THÉRY - Attempt to a synthesis about Strunian in North Africa. Significance of the paleogeographical situation of Tassili N'Ajjers and its environment.

THOREZ - Genetic sequence stratigraphy in the latest Fa of the Ourthe Valley, Belgium.

WINKLER PRINS - Subdivision of the Carboniferous Time Scale.

WEYER - Ammonoid and coral sequence in the D/C Boundary beds of the Bohlen near Saalfeld, Thur. Mts.

MINUTES OF THE SCCS GENERAL MEETING - LIEGE 1993

AGENDA

1. Chairman's Report
2. Secretary's Report
3. Progress Report by Project Leaders:
   Project 1 - BRECKLE
   Project 2 - SEVASTOPULO
   Project 3 - BELKA
   Project 5 - VILLA
4/5. Mid-Carboniferous Boundary: Progress report, papers,discussion and decision.
   Stonehead Beck - papers by RILEY and VARKER
   Aksu section - paper by NEMIROVSKAYA
   Inishcorker (Ireland) proposal by BRAITHWAITE
6. Names for the two parts of the Carboniferous System
7. Future activities
8. Newsletter
9. Next Meeting
10. Other business
11. Closure

OPENING: The meeting was opened by the Chairman, Dr Eva PAPROTH at 9:00 a.m. on 9 June 1993 in the University of Liège, Belgium in the presence of 50 members and visitors.

ATTENDANCE: M.R.W.Amler, R.L.Austin, R.T.Becker, Z.Belka, K.Braithwaite, U.Brand, P.Brenckle, P. Bruckschen, J.L.Carter, J.Claoué-Long, C.Derycke, J.T.Dutro, B.A.Engel (Secretary), C.R.Gonzalez, E.Groessens, C.Hartkopf-Fröder, H-G.Herbig, J.Kalvoda, D.Korn, W.Kürschner, H.R.Lane, J-P.Laveine, M.Legrand-Blain, B.L.Mamet, H.Matyja, T.Nemirovskaya, E.Paproth (Chairman), M.Paszkowski, G.Peniguel, E.Poty, W.H.C.Ramsbottom, N.J.Riley, J.Roberts, N.P.Rowe, P.Sartenaer, H.P. Schönlaub, G.D.Sevastopulo, M.Stempien, M.Streel, R. Swennen, J.M.Thery, M.Vanguestaine, W.J.Varker, E.Villa, R.H.Wagner, B.Wajsprych, D.Weyer, C.F.Winkler Prins, Xu Shaochun, W.Ziegler.

AGENDA ITEM 1:
Chairman's Report

The last meeting, in 1991 in Buenos Aires, took place in the framework of the International Congress on Carboniferous and Permian Stratigraphy. The work of the Subcommission has concentrated for a long time on the global subdivision of the Carboniferous System. During this meeting, we are going to hear reports of Project Groups formed in 1989 at the Provo Field and General Meeting. At the Carboniferous Congress in Argentina (1991), it was signalled to the Project leaders that a preliminary evaluation needed to be presented to this meeting. Of the 6 original Project groups five remain:

-- **Group 1:** to look for a horizon in the late Middle to early Late Tournaisian (Kinderhookian--Osage Boundary) (P. BRENCKLE);

-- **Group 2:** to look for a horizon in the latest Tournaisian--earliest Viséan (mid-Osage) (G. SEVASTOPULO);

-- **Group 3:** to look for a horizon in the upper Viséan (Z. BELKA);

-- **Group 4:** to look at the base of the *Branneroceras branneri* zone. Group chairman Prof. KULLMANN informed me that the base of the *branneri* zone should be replaced by the base of the *Cancelloceras* zone (the beginning of the Yeadonian). -- The *Cancelloceras* horizon (in Gl) can be traced more widely than the *branneri* horizon. -- Prof. KULLMANN asked to be given more time to clear this up. He is busy with a database system GONIAT and after he has reached the *Cancelloceras* level, it will be easy for him to get the necessary data.

-- **Group 5** (former Group 6): looks for the base of the *Protriticites* zone (base of the Kasimovian) (E.VILLA). Work is in progress, as we are going to hear. Particularly in the younger Carboniferous, the easier approach to the Russian Platform will provide new opportunities.

The Mid-Carboniferous Boundary Working Group, chaired by Richard LANE, visited 2 candidate stratotype sections in 1992: the Pyrénées section (RAMSBOTTOM & PAPROTH) and the two sections in South China (RAMSBOTTOM, LANE, BRENCKLE, PAPROTH); the candidate section in Uzbekistan was visited in 1993 by BRENCKLE, LANE, NEMIROVSKAYA and PAPROTH.

The candidate sections in the French Pyrénées and in South China had been found interesting but inappropriate for a stratotype section. I have sent reports on both visits to Rich LANE. The following candidate sections therefore still remain in consideration:

1). Stonehead Beck, Yorkshire

2). Arrow Canyon, Nevada

3). Aksu-I, Uzbekistan

We have here to decide on these, as agreed two years ago in Argentina.

Beside these activities, the Subcommission received information from Gary WEBSTER on promising sections of rocks near the Mid-Carboniferous Boundary, in Nevada, with goniatites, conodonts and several other fossil groups being represented.

The Subcommission has received a call for nominations by the SCCS voting membership, for a renewed W.G. on the Carboniferous-Permian Boundary (nominated Chairman: Brian GLENISTER). -- Nominations should be supported by more than one SCCS voting member. They must be in writing and reach Prof. JIN (Nanjing, Chairman of the Permian Subcommission) by 10 July 1993 (with a copy to me). Written information will be sent to our voting membership soon.

Prof. BARSKOV of the Moscow University agreed to participate in Project group (5). I met him in Moscow this April, and he seemed to be quite positive about favorouble facies conditions on the Russian Platform.

The early Carboniferous in Germany seems to have been particularly favourable for radiolarians. A bio-zonation has recently been published by A. BRAUN & R. SCHMIDT-EFFING.

Information about a new IGCP 335 project on "Biotic recoveries from mass extinctions" has reached the SCCS. Please ask Brian ENGEL or me if you are interested in the first circular about the 1st meeting in Kielce, Poland, 27-29 Sept. 1993.

EVA PAPROTH, CHAIRMAN

AGENDA ITEM 2: Secretary's Report

The Tenth Newsletter was distributed in July 1992. The next Newsletter is due for release in early August 1993, being delayed a month or so to include a report of this Liège Meeting. Members should receive the Eleventh Newsletter about the end of September 1993.

Finance: Details of the 1991-92 expenditure are provided in this *Newsletter* (p.2). The Subcommission has a current balance (June 1993) of AUS$1317 (US$913) of which approximately AUS$1000 (US$692) will be required to produce and distribute the *Newsletter*. The Subcommission has recently received advice that it will not receive any IUGS subsidy in 1993. This is a serious decision which will rapidly place the Subcommission in a non-viable financial position.

The ever increasing cost of postage already represents a threat to the continued publication of the *Newsletter*, particularly so when it is remembered that not all the postal charges are paid by the Subcommission. In view of the decision of ICS to withdraw support in 1993, it will be necessary to review the feasibility of continuing with publication of the Newsletter after most of our credit balance has been consumed by the 1993 issue.

Donations: A small group of the members have availed themselves of the opportunity to make small (sometimes large) voluntary contributions towards the cost of the Newsletter. An appeal is made to all the membership to respond to the invitation to make a small donation when the next Newsletter is delivered. Details of how to make a contribution are repeated in all editions of the *Newsletter*.

BRIAN A. ENGEL, SECRETARY

AGENDA ITEM 3: Reports From Project Leaders

The Chairman then invited the Project Group Leaders to present their progress reports to the meeting. Verbal reports were presented by BRENCKLE, SEVASTOPULO, BELKA and VILLA with a written communication from KULLMANN being read by the Chairman. The full text of the presentation is reproduced in the next section of this *Newsletter*.

AGENDA ITEMS 4/5: Mid-Carboniferous Boundary

The Chairman of the Working Group, Dr LANE, reported that the Working Group held an open meeting the previous evening (8 June 1993) at which he had presented an overview of the charter of the group and the progress which had been achieved to date.

The SCCS meeting then heard papers read by LANE, RILEY, VARKER, NEMIROVSKAYA and BRAITHWAITE. Abstracts of the contents of these papers are reprinted with the report from the Working Group.

The meeting adjourned at 12:40 p.m. without taking a position regarding the nomination of a boundary stratotype. The membership was advised that it would re-convene at 8:30 p.m. that night (9 June 1993) in the Residence Blanc Gravier, Campus Sart Tilman.

The Chairman opened the adjourned meeting at 8:30 p.m. (28 attendees) and requested Dr LANE to continue his summary report on behalf of the Mid-Carboniferous Boundary Working Group. Dr LANE restated the discussion at the meeting of the MCBWG (8 June 1993) to limit the decision on a stratotype to three sections, namely Stonehead Beck, UK, Arrow Canyon, USA and Aksu-I, Uzbekistan.

The Chairman then outlined a bureau proposal that this meeting should debate the most appropriate time by which the Working Group should aim to make a final decision on the choice of a suitable stratotype section for the Mid-Carboniferous Boundary. The choice was that the WG should proceed to a postal vote based upon present knowledge or that it be deferred to the next meeting of the Subcommission in Poland, 1995.

It was therefore proposed by the Chairman that the Working Group should be asked to conduct a ballot on the three remaining sections under consideration and to transmit their decision to the Subcommission not later than 1 October 1993. The alternative proposal would be that a decision be deferred until 1995.

The Secretary informed the meeting of the procedural requirements to have a decision ratified. When the WG has voted, this decision is passed to the Subcommission which would conduct a postal ballot of all its voting members. Assuming they reach the required majority vote, the decision is then passed to the ICS Bureau, the next meeting of which is scheduled for March 1994. ICS in turn will conduct its own ballot and if successful the decision could be ratified by IUGS at the next International Geological Congress in Japan in 1995.

Any delays in meeting these deadlines would defer the final ratification of any decision until the next IGC in 1998.

Discussion on the request for a 1994 decision by the WG centred around the following points:

1. That members need to be informed of the published details of the Aksu Section. Dr Nemirovskaya responded that there were three papers available, one of which required revision of conodont designations. It was pointed out by visitors to this section that preservation of material was generally very poor, such that specific identifications of several faunal elements were very difficult, if not impractical. Dr Nemirovskaya indicated that some data could be prepared by the end of 1993.

2. Caution was expressed by several members about rushing into a decision on a section about which we know very little, and for which access was less than predictable. Visas are not available except at the border and in any case they required a formal invitation by the local institutions, with further ratification of this invitation being necessary before entry could be achieved.

3. It was considered to be too late to start working up fresh sections at this stage in the decision making process. Many other sections do have very good potential and even two further years would be insufficient time to produce adequate evidence upon which to make a sensible decision about the Aksu section.

4. Visitors to the Aksu section have indicated that the conodont sequence appears to be satisfactory at the boundary but that most other faunal elements are lacking or are too poorly preserved to be identified. The final choice of the stratotype will be based on conodont occurrence but the section must also contain associated faunal and floral components which will facilitate global corrrelation.

5. Caution was expressed about the use and misuse of geochemistry in the designation of the boundary strata.

6. Reservations were expressed about the use of deep water sections such as Stonehead Beck, where correlations have not been widely established with adjacent shallow water assemblages.

The motion was then put: **that the Subcommission recommend to the Working Group that it should endeavour to make a final decision on a suitable stratotype section for the Mid-Carboniferous Boundary and to transmit this decision to the Subcommission preferably no later than 15 January 1994.**

Unofficial vote: 26 in favour, 0 against, 2 abstensions.This decision was endorsed later by the 13 Voting members present.

The Chairman of the Working Group agreed to convey this motion to the members.

AGENDA ITEMS 6-11: Other Business

The Chairman briefly mentioned the further agenda items (names for early and late Carboniferous; future activities; Newsletter; date of next meeting; other business) but deferred further discussion to the next meeting in Poland in 1995.

The meeting closed at 11 p.m..

Donations

Now more than ever, the Subcommission needs your financial support. With the loss of our IUGS subsidy this year, we will probably not have sufficient reserves to enable publication of the next Newsletter in 1994, even if the subsidy is restored.

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PROJECT GROUP 1: A "mid-Tournaisian" intercontinental boundary: preliminary results of eastern Russian platform studies

Project Leader:
DR. P.L. BRENCKLE, Amoco Production Co., P.O. Box 3092, Houston, Texas, USA.

Other contributors: J.F. Baesemann (Amoco, Houston, TX); A.R. Ormiston (Amoco, Tulsa, OK); O.A. Shcherbakov (Polytechnical Inst., Perm); N.B. Gibshman (Gubkin Academy of Oil and Gas, Moscow); V.I. Poletaev, T.I. Nemirovskaya, A.I. Maslo (Ukrainian Academy of Sciences, Kiev); L.Z. Akhmetshina (Scientific Research Institute for Oil and Gas, Aktyubinsk, Kazakhstan); E.I. Kulagina, V.N. Pazukhin (Bashkirian Scientific Center, Ufa)

Biostratigraphic results from the 1989 Carboniferous Subcommission Field Meeting (BRENCKLE & MANGER, 1991) in Provo, Utah, showed that the middle part of the Tournaisian warranted further study to define an intercontinental boundary within the Lower Carboniferous. The Russian (East European) Platform is a prime region to look for a boundary stratotype at that level because it contains juxtaposed shelf, basinal and continental facies located within a paleoseaway extending from South China to Western Europe and North Africa.

As part of a broader stratigraphic study, Amoco in 1991 initiated an ongoing joint research program with institutes of the former Soviet Union to examine the distribution of "mid-Tournaisian" foraminifers, conoonts, radiolarians and brachiopods in the Middle and South Urals and the Pricaspian Depression. Results to date come mostly from shallow- shelf, kamaenid algal carbonates at the upper Kosaya Rechka section northwest of Perm in the Middle Urals, where an operational "mid-Tournaisian" Boundary was picked at the appearance of *Tuberendothyra tuberculata* within the foraminiferal succession *Eochernyshinella - Chernyshinella - Palaeospiroplectamm- ina - Septabrunsiina - Inflatoendothyra - Tuberendothyra - Spinoendothyra. Laxoendothyra parakosvensis*, the probable precursor to *T. tuberculata*, is rare at this locality and *Palaeospiroplectammina tchernyshinensis* is absent. Both are abundant elsewhere on the platform. Brachiopod occurrences adjacent to the boundary include *Eomartiniopsis waschkiricus*, *Eudoxina inflata*, *E.* cf. *media*, *Tulathyris?* cf. *uralica* and *Ziganella* cf. *upensis*. Conodont samples are not yet processed but recoveries are expected to be low because of the shallow-water environment. A basinal section collected nearby at Shirokovsky should provide information on that group as well as the radiolarians.

The Russian Platform is a prime region to look for a boundary stratotype

In addition to the Middle Urals sections, faunas are being described from "mid-Tournaisian" outcrops along the Usuyli River in Bashkiria and from boreholes in the northern Pricaspian Depression. Results from these studies will be used to produce a regional biostratigraphic overview of the eastern edge of the Russian Platform.

Reference

BRENCKLE, P.L. & MANGER, W.L. (Eds), 1991. Intercontinental correlation and division of the Carboniferous System. *Cour. Forsch.-Inst. Senckenberg, Frankfurt*, **130**:1-350.

PROJECT GROUP 2: A mid "Lower Carboniferous" Boundary

Project Leader:
DR GEORGE SEVASTOPULO, Geology Department, Trinity College, Dublin 2, Ireland.

The following proposals were put before the meeting of the Subcommission on Carboniferous Stratigraphy in Liège.

Proposal 1: Retain the present Tournaisian/Viséan Boundary

The advantages of this course of action are a) that it maintains a historically entrenched stratigraphical division; and b) that a stratotype has already been designated.

The disadvantages are that in the stratotype section the base of the Viséan coincides with the entry of *Eoparastaffella*, which is cryptogenic. *Gnathodus homopunctatus* which has been used to recognise the Viséan is also cryptogenic, and, moreover, *fide* BELKA 1985, first occurs in the Tournaisian in Poland.

Neither *Eoparastaffella*, nor *'Gnathodus' homopunctatus* can be used to recognise the base of the Viséan in North America.

Proposal 2: Seek a boundary coincident with the first occurrence of the conodont *Scaliognathus anchoralis* in the lineage *Scaliognathus praeanchoralis - Scaliognathus anchoralis.*

The advantages of this course of action would be that the boundary would be identified by the base of a lineage zone and thus isochronous correlatlon would be possible. In addition, sections demonstrating the succession of *Scaliognathus praeanchoralis - Scaliognathus anchoralis* are known. *Scaliognathus* occurs world wide in appropriate facies.

The disadvantages are that it is not known to what extent other

elements of the fauna and flora change at this level.

Proposal 3: Seek a boundary coincident with the appearance of primitive archaediscid foraminifera.

The advantage of this course of action would be that the boundary would be identified by the base of a lineage zone and thus isochronous correlation would be possible. In addition, sections demonstrating the earliest occurrences of primitive archaediscids have been described.

Some other faunal changes are believed to occur at this level, for example the entry of *Lochriea commutata*.

The disadvantage might be that it will prove difficult to identify the evolutionary first occurrence of archaediscids.

Please send your opinions to George Sevastopulo

If you have any preferences or opinions about any of these proposals, or any additional proposals, relevant information about faunal and floral ranges, and knowledge of sections which might serve as a stratotype, please write to George Sevastopulo, Geology Department, Trinity College, Dublin 2, Ireland.

PROJECT GROUP 3 : A Chronostratigraphic boundary in the late Viséan

Project Leader:
Dr Zdzislaw BELKA, Geol.-Pal. Inst., Universität Tübingen 1, Sigwartstr. 10, D-72076 Germany.

Dr Belka reported to the meeting that there has been very poor support for this project group. Very few specialists had agreed to join in the investigation and at this stage there were no potential sections available which would warrant detailed investigation. Conodont material from Poland is under investigation.

PROJECT GROUP 4 A boundary at the base of the Branneroceras branneri zone (base of G2: basal Westphalian, basal Bloydian)

Project Leader:
Dr Jürgen KULLMANN, Geol.-Paläont. Institut, Universität Tübingen, Sigwartstraße 10, D-72076 Tübingen, Germany.

Following the meeting in Buenos Aires (1991) I was asked to organise an international research group to investigate the possibilities of defining a boundary at the end of an early portion of the Upper Carboniferous or Pennsylvanian. In the meeting in Provo the proposal was made to define that boundary between Namurian and Westphalian, or Halian and Bloydian, possibly by means of the goniatite genus *Branneroceras*.

The significance of the boundary between the interval predominated by *Cancelloceras* and the entry of *Branneroceras* has been well known for a long time (RUZHENTSEV & BOGOSLOVSKAIA 1978; RAMSBOTTOM & SAUNDERS 1985). From the macropaleontological point of view there are two major breaks in goniatite lineages around the boundary under consideration: (1) The lower one occurs about at the boundary between the middle and upper Namurian and is marked by the entry of *Cancelloceras*, (2) the later one, at the beginning of the Westphalian and the Bloydian, can be characterised by the entry of true *Gastrioceras* as well as *Branneroceras*.

(1) *Cancelloceras* is an easily recognizable genus of the family Gastrioceratidae restricted to the Yeadonian (G1 in the European standard) and comprises about twenty species of more or less the same duration (KORN, D. & KULLMANN, J. 1993). The last species seems to disappear at the end of the Yeadonian, and their closely related descendants belong to *Gastrioceras* s.str. The genus is fairly known from North America and widespread in the Southern Urals, Uzbekistan, Ukraine; it is recorded from many places in Europe and North Africa.

(2) *Branneroceras* (eight species, cp. KORN,D. & KULLMANN, J. 1993) is an excellent guide fossil and represents the starting point of a long lasting trend in suture-line development characterising the family Schistoceratidae which concludes with *Schistoceras* at the end of the Carboniferous. It is well known from North America and many localities in North and South China, but records of European *Branneroceras* are questionable.

Cancelloceras is an easily recognizable genus

In both cases it will be difficult to find a section in which this boundary with fossiliferous beds below and above is well documented. The occurrence of the mentioned goniatites seems to be too spotty and there is no section described yet in which a fairly continuous succession of goniatites can be observed.

As it seems now, the definition of a boundary around the Namurian / Westphalian or Halian / Bloydian will need detailed studies on evolutionary changes in various fossil groups. Therefore, I would like to ask anyone interested in the problem to co-operate in this project. Comments and suggestions would be highly appreciated.

References

KORN, D. & KULLMANN, J. (1993). GONIAT Database System, version 2.31, Tübingen.

RAMSBOTTOM, W.H.C. & SAUNDERS,W.B. (1985). Evolution and evolutionary biostratigraphy of Carboniferous ammonoids.-- *Jour.Paleontology* **59:** 123-139, 5 figs., Lawrence,Kansas.

RUZHENTSEV,V.E. & BOGOSLOVSKAIA,M.F. (1978). Namiurskij etap v evoliutsii ammon- oidej. Pozdnenamiurskie ammonoidei.-- *Trudy Paleont. Inst. Akad. Nauk SSSR* **167:** 1-336, 108 figs., 44 pls., Moskva.

PROJECT GROUP 5: A boundary at the base of the Protriticites Zone.

Project Leader:
E. VILLA, Departamento de Geología, Universidad de Oviedo, c/ Jesús Arias de Velasco, s/n, 33005 Oviedo, Spain.

The Subcommission on Carboniferous Stratigraphy, at its meeting in Provo (September 1989), selected several stratigraphic intervals which should be worthy of further paleontological investigation worldwide, the aim being to detect evolutionary changes in various fossil groups which could be of potential use in establishing global correlation. One of the selected intervals was that roughly equivalent to the Moscovian-Kasimovian transition, for the study of which SCCS established a Project Group to look at the faunas at the base of the *Protriticites* Zone.

For almost three years I have endeavoured to gain the collaboration of a group of specialists representative of the main fossil groups throughout the Carboniferous areas in the world. First attempts were rather discouraging, since affirmative answers were slow to arrive. It was particularly difficult to establish positive contacts with specialists from areas, such as China and the former Soviet Union, which are very important for Carboniferous stratigraphy. In other cases, affirmative answers were not followed by any report.

The first list of members who agreed to participate included: Robert Coquel (France),Adriaan van Ginkel (The Netherlands), Hisayoshi Igo (Japan), Bernard Mamet (Canada), Mª Luisa Martínez-Chacón (Spain), Charles A. Ross (USA), Lin Rui (Canada), M. N. Solovieva (Russia), Robert H. Wagner (Spain), Cor F. Winkler Prins (The Netherlands) and Elisa Villa (Spain) (see *Newsletter on Carboniferous Stratigraphy*, v.9).

Last year saw many new members join the group, including some specialists who voluntarily offered to combine their investigations with those of the Working Group. We have now added the following names: Vladimir I. Davydov (VSEGEI, St. Petersburg, Russia), Maria V. Konovalova (TPO VNIGRI, Ukhta, Russia), Jürgen Kullmann (Geologisch-Paläontologisches Institut, Tübingen, Germany), Svetlana Remizova (Institute of Geology, Syktyvkar, Russia), Jasenka Sremac (University of Zagreb, Croatia), Katsumi Ueno (University of Tsukuba, Japan), Kozo Watanabe (Shinjuku, Japon) and Xiangning Yang (University of Nanjing, China).

We recently learned that James E. Barrick (Texas Tech University), Darwin R. Boardman (Oklahoma State University), Philip H. Heckel (University of Iowa), Garner L. Wilde (Texas), and Igor Barskov (Moscow State University) are also willing to cooperate, the latter together with a research team which includes A. S. Alekseev (Moscow University), N. V. Goreva (Geological Institute, RAS), T. N. Isakova (Geological Institute, RAS), G. A. Afanasjeva (Palaeontological Institute, RAS), M. Kh. Makhlina (Moscow Geological Survey), O. L. Kossovaya (St. Petersburg Geological Institute) and A. A. Shkolin (Palaeontological Institute, RAS). All this is most encouraging.

The list is still open to others who may be interested, especially those working in regions or groups which seem insufficiently represented.

Reports from local working groups

The Working Group members have generated some reports which summarise the first results. We have now information available from Cape Chaika, Phai-Khoi (V. I. Davydov), northern Timan (S. Remizova), Timan-Pechora (M. V. Konovalova), Spitsbergen (V. I. Davydov and I. Nilsson), the Donetz Basin (V. I. Davydov) and from the group of specialists working in the Cantabrian Mountains. All this information was presented at the Subcommission Meeting in Liège (June, 1993) in a paper by E. VILLA, V. I. DAVYDOV, M. V. KONOVALOVA and S. REMIZOVA.

The first step is the palaeontological characterisation of a stratigraphic interval

In some cases, the sections analysed do not comply with the recommendations of the SCCS, since they correspond to strata encountered in boreholes (e.g. Timan-Pechora), or to outcrops inaccessible by normal transport (e.g. Cape Chaika). However, the aim of the Working Group in this first step is rather the palaeontological characterisation of a stratigraphic interval, not the proposal of a stratotype. Therefore, any significant palaeontological information affecting this interval has been welcome. Proposals for a stratotype can only follow when our work gets to a more advanced stage.

Future plans

Other studies in progress in different parts of the world are expected to be finalised in the near future, thus providing more global information about the paleontological characterisation of levels roughly equivalent to the base of the *Protriticites* Zone. These will be reported on later.

Carboniferous Chronostratigraphic Subdivisions

C.F. WINKLER PRINS, Nationaal Natuurhistorisch Museum, Postbus 9517, 2300 RA Leiden, The Netherlands and R.H. WAGNER, Unidad de Paleobotánica, Jardin Botanico de Córdoba, Avda. de Linneo, s/n, 14004 Córdoba. Spain.

This chart presents a correlation scheme for the main chronostratigraphic subdivisions in the ex-USSR and western Europe (see WAGNER & WINKLER PRINS (*Carboniferous of the World*, Vol. **3**,(in prep.)). (* = type section in the Urals; ** = type section in the Donbass).

It represents a draft document presented for discussion and/or modification by SCCS members prior to its submission to ICS for incorporation in the Second Edition of the Geochronologic Standard Scale which the ICS Bureau has undertaken to prepare for publication. All comments and suggestions should be directed to the above authors.

Our future plans should include a more intensive study of other groups of fossils, e.g. conodonts and ammonoids, which have a larger (geographical) distribution than the fusulinids. At the same time, we should also continue, in our respective areas, the search for sections containing as many different groups of fossils as possible.

Finally, it would appear that our investigations should be extended to an interval approximately equivalent to the Khamonichesky Horizon, including the base of the *Montiparus* (or *Triticites)* Zone. *Protriticites* does not occur in the Carboniferous of North America, thus presenting a considerable impediment to potential correlations, whereas the *Triticites* Zone is recognized both in Eurasia and America. Therefore, with regard to the fusulinids, the base of latter zone may well offer a better perspectives for worldwide correlation.

During the Liège Meeting a report by the Moscow Basin Group dealing with the Demodedovo section in the southern part of the Moscow Basin was received and will be incorporated in future reports. The Project Group also welcomes the additional collaboration of Dr. H. P. Schönlaub (Geologische Bundesanstalt, Wien - conodonts, Carnic Alps), and Dr. T. Nemirovskaya and Dr R. Kozitskaya (Institute of Geol. Sci., Ukrainian Academy of Sciences, Kiev-conodonts, Donetz Basin).

WESTERN EUROPE		ex-USSR		APPROX.AGE
Autunian		Sokoljegorsky	L.Permian	
				290
		Noginsky	Gzhelian	
Stephanian	Stephanian C	Pavlovo-Posadsky		
	Stephanian B	Amerevsky		
		Rechitsky		
		Yauzsky	Kasimovian	
	Barruelian	Dorogomilovsky		
		Khamovnichesky		
		Krevyakinsky		
	Cantabrian			
		Myachkovsky	Moscovian	305
Westphalian	Westphalian D			
		Podolsky		
	Bolsovian			
		Kashirsky		
	Duckmantian			
	Langsettian	Vereisky		
				315
Namurian		Asatausky*	Bashkirian	
	Yeadonian	Tashastinsky*		
		Askynbashsky*		
	Marsdenian	Akavassky*		
	Kinderscoutian	Syuransky*		
	Alportian	Voznesensky**	Serpukhovian	
	Chokierian			
				M.C.B 320
		Zapaltyubinsky**		
	Arnsbergian	Protvinsky		
	Pendleian	Steshevsky		
		Tarussky		
				325
Viséan	Brigantian	Venevsky	Viséan	
	Asbian	Mikhailovsky		
		Aleksinsky		
	Holkerian	Tulsky		
	Arundian	Bobrikovsky		
	Chadian	Radaevsky		
		Kosvinsky		
				345
Tournaisian	Ivorian	Kizelovsky*	Tournaisian	
	Hastarian	Cherepetsky		
		Karakubsky**		
		Upinsky		
		Malevsky		
		Kalinovsky		355
Famennian	Strunian	Zavolzhsky	Famennian	

THE MID-CARBONIFEROUS BOUNDARY WORKING GROUP

The Mid-Carboniferous Working Group held a meeting commencing at 8 p.m. on 8 June 1993 in in the Residence Blanc Gravier, Campus Sart Tilman, Liège, Belgium.

Chairman: H.R. Lane, Amoco Production Co., P.O. Box 3092, Houston, Texas USA.

Attendance: M. Amler, K. Braithwaite, U. Brand, P. Brenckle, J.L. Carter, J., Claoué-Long, J.T. Dutro, B.A. Engel, R. Feist, C.R. Gonzalez, E.Groessens, H-G. Herbig, H.R. Lane, M. Legrand-Blain, T.Nemirovskaya, E. Paproth, W. Ramsbottom, J. Roberts, N.J. Riley, P. Sartenaer, H.P. Schönlaub, G.D. Sevastopulo, W.J. Varker, E. Villa, R.H. Wagner, C.F. Winkler Prins, W. Ziegler.

The WG Chairman opened the meeting with a statement of the charter of the Working Group and the progress which had been made with the investigation of nine potential stratotype sections:

1. Stonehead Beck, UK
2. Arrow Canyon, Nevada, USA
3. Granite Mountain
4. Aksu-I Section, Gissar ridge, Uzbekistan
5. Pyrénées section (Col de Tantes)
6. North China (Yushuliang section, Gansu Province)
7. South China (Baping, Guizhou Province)
8. South China (Guilin, Guangxi Province)
9. Zhelvakovaya Valley section, Ukraine

Brief biostratigraphic details of each section were presented by the WG Chairman. Of this list, only three sections were considered to remain on the decision list for a potential stratotype namely: Stonehead Beck, Arrow Canyon and the Aksu Section.

The meeting closed at 10:30 p.m.

Of the following papers, some were presented to the SCCS General Meeting on 9 June 1993, by members proposing or supporting particular candidate sections for the Mid-Carboniferous Boundary stratotype. Others are submissions by individual authors who have forwarded personal contributions to the Chairman or to the Newsletter editor.

1. Arrow Canyon Section, Nevada, USA

A Review of the Arrow Canyon Section

H.R. LANE, Amoco Production Co., P.O. Box 3092, Houston, Texas USA.

(Note: During introductory remarks on the activities of the Working Group, Dr LANE presented an illustrated review of this stratotype candidate which had been visted by the Subcommission in 1989).

Arrow Canyon was first proposed as a potential stratotype section in 1985 and was visited in 1989 during the Provo Field and General Meeting. Located in Nevada in the Great Basin Province extensional system, the site is government controlled and is readily accessible from Las Vegas.

The section exceeds 10,000 feet in thickness and is notable for its almost continuous exposure (95%+). Dr Lane presented a pictorial overview of the actual exposures, the lithotypes, and details of the actual location of the proposed boundary (Figure 2). Faunal content which includes conodonts, foraminifera, shelly macrofaunas but only a few goniatites was reviewed in some detail with particular emphasis on the conodont succession.

DR PAPROTH presented an illustrated sedimentological analysis of the Arrow Canyon section as exposed in the vicinity of the proposed boundary. The paper was provided by DR Barry RICHARDS, Institute of Sedimentary and Petroleum Geology, 3303 33rd St. NW, Calgary, Alberta T2L 2A7, Canada.

The South Syncline Ridge Section, Nevada - an alternative to Arrow Canyon

GARY WEBSTER, Department of Geology, Pullman, WA 99164-2812 USA.

(Note: The following correspondence was received by the Chairman in May 1993 from Dr Gary WEBSTER. An edited version is reproduced here).

In response to advice that the Subcommission meeting in Liège would seek to decide the stratotype for the Mid-Carboniferous boundary I would hope that the decision can be delayed to give time for significant new data to be published showing that a section better than any previously proposed exists in southern Nevada.

I am referring to the South Syncline Ridge section on the Nevada Test Site.This section clearly has more groups of fossils (conodonts, goniatites, brachiopods, foraminifera and possibly spores) within the boundary interval strata than the Stonehead Beck section and includes the goniatites which are not present in Arrow Canyon. With the presence of forams, conodonts and brachiopods, comparison with the Arrow Canyon section should allow an excellent correlation of basin and shelf faunas across the boundary interval. The goniatite faunas of Kane Springs Wash have been informally recognized for some time and are known to occur below the boundary interval. They are now known to correlate with the lower faunas of the South Syncline Ridge section. We can take key beds (i.e. the marker conglomerate among others) and lithologically correlate directly with Arrow Canyon from Kane Springs Wash. These key beds and intervening strata contain rich conodont, foram and brachi-

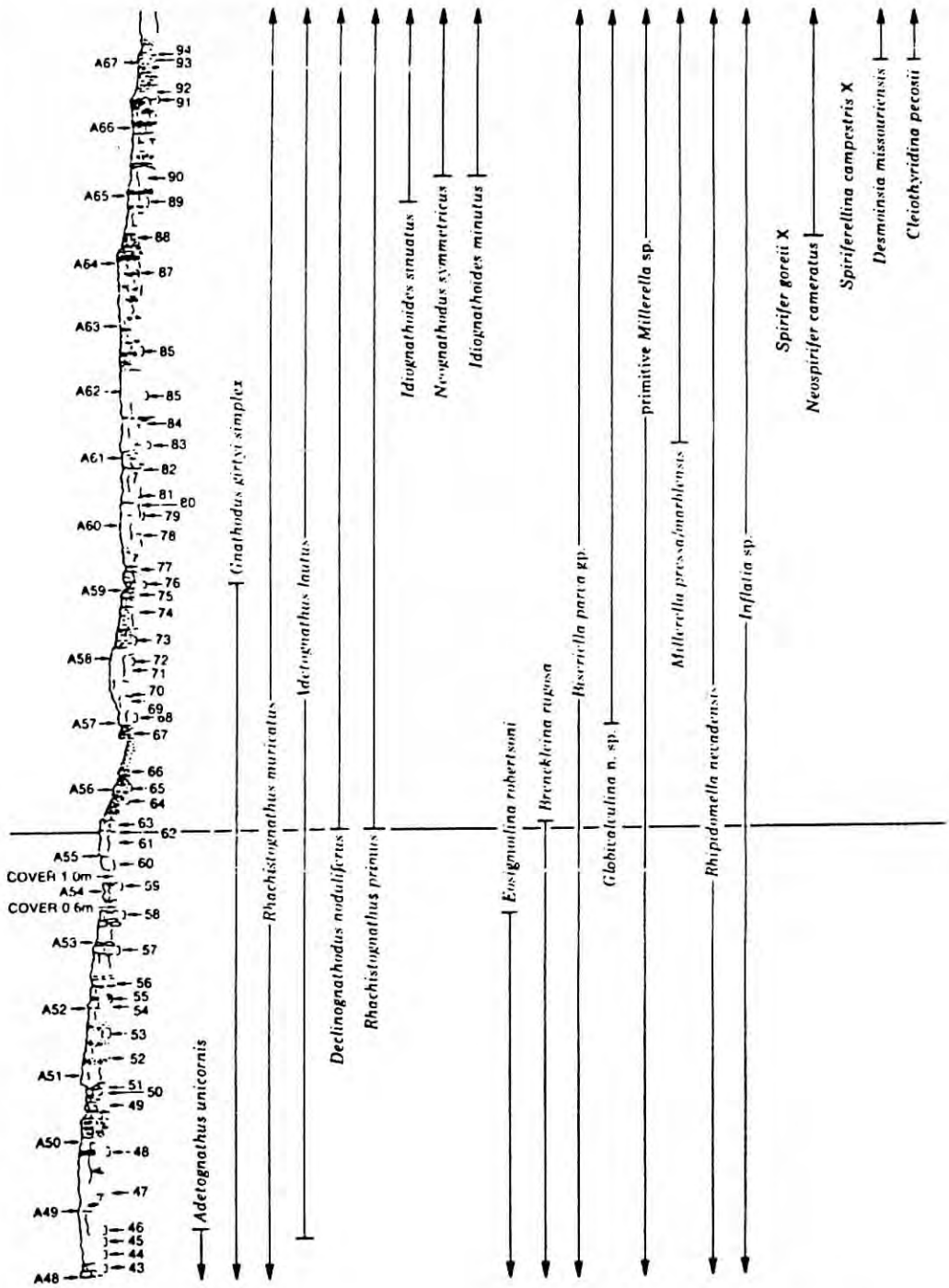

Figure 2. Ranges of important conodonts, foraminifers and brachiopods in a 30-meter interval of the Bird Spring Formation near the proposed level of the mid-Carboniferous boundary. «A» numbers on the left of the stratigraphic column are spaced every 1.5 meters in the exposure beginning at the base of the Indian Springs Formation. Numbers on the right of the stratigraphic column are sample positions. Taxa from *A. unicornis* through *Id. minutus* are conodonts, from *E. robertsoni* to *M. pressa/marblensis* are calcareous foraminifers and the remainder are brachiopods. Sequence between A53 and A55 not to scale.

opod faunas among other invertebrates allowing the correlation of basin and shelf faunas of the boundary interval. This would allow the recognition of a boundary stratotype and reference section(s) for these correlations, all within one region. This should lead to better international correlations at all levels.

Arguments might be put forward that the South Syncline Ridge section would be inaccessable to foreign nationals for US security reasons. The Syncline Ridge area is not located in a sensitive area requiring high security clearance, thus access may be obtained but security clearance would have to be applied for well in advance of a visit by foreign nationals.

This section contains more fossil groups than either Arrow Canyon or Stonehead Beck

We are currently planning a paper for *Geology,* presenting the preliminary analysis of the South Syncline Ridge section. This will include the measured section and reported fauna. Additionally, TITUS is in the final stages of preparation of a manuscript on the systematics of the Syncline Ridge *Homoceras* faunas. The manuscript will be submitted to *Journal of Paleontology*.

One last comment on the Arrow Canyon boundary interval. It is most noteworthy that these faunas are dominated by *Gnathodus* and *Rhachistognathus* which could support my interpretation that the conglomerates are sheet deposits of tempestite origin, not conglomerates formed from a low stand. Clearly they are of deeper water environments than those of the *Adetognathus* facies.

2. Stonehead Beck, N. Yorkshire, England

Geochronometry & Geochemistry of the European Mid-Carboniferous Boundary Stratotype Proposal, Stonehead Beck, North Yorkshire, England.

N.J. RILEY, J. CLAOUÉ-LONG, A.C. HIGGINS, B. OWENS, A. SPEARS, L. TAYLOR & W.J. VARKER.

Changes in Sr isotope ratios across the proposed Mid-Carboniferous Boundary stratotype at Stonehead Beck are in continuity with the steep gradient obtained for the standard Mid-Carboniferous Sr seawater curve. This is additional evidence to the sedimentology and biostratigraphy, which also indicates that there is no stratigraphical break at Stonehead Beck. The ammonoids at Stonehead Beck, as previously interpreted by RILEY *et al.* (1987), therefore provide the most refined calibration of the first appearance of the conodont definitive of the boundary, namely *Declinognathodus lateralis* and its accessory conodonts. Furthermore, clay mineral studies, in continuity with previous interpretation, indicate that the sequence was maintained in a subaqueous hemipelagic environment, in a basin centre, distal to influence from clay minerals derived from palaeosols.

the Namurian Series occupied a much shorter time interval than previously thought

Although the Sr seawater curve provides a relative geochronometry, absolute Zircon $^{206}Pb/^{238}U$ dates for the E_{2a3} and E_{2b2} ammonoid zones, which lie in the Arnsbergian Stage beneath the Mid-Carboniferous Boundary, have been obtained from K-bentonites in the Harewood Borehole, North Yorkshire, using SHRIMP analysis. These indicate ages of 314.4 ± 4.6 Ma (2%) and 314.5 ± 4.6 Ma (2%) respectively and are from 5.6 to 10.6 Ma younger than previously published Pendleian-Arnsbergian dates from 40Ar/39Ar analysis. Clay mineral studies suggest that the K-bentonites were sourced from immature island-arc batholiths and thus the age of the parent magma is likely to be closely contemporary to the marine sediments associated with the K-bentonites. These are stratigraphically the closest, most biostratigraphically refined and accurate geochronometric picks to the Mid Carboniferous Boundary yet obtained. They indicate that the Namurian Series occupied a much shorter time interval than previously thought, necessitating considerable revision of the standard Carboniferous time scale of HARLAND *et al.* (1982). Recalibration and steepening of the standard Sr seawater curve and renewed calculations of subsidence curves and Crustal Stretching Factor (ß) for the Central Pennine Basin of northern England are also implied.

Multielement conodont faunas from the proposed Mid-Carboniferous Boundary stratotype locality at Stonehead Beck, North Yorkshire, England.

W.J. VARKER, Department of Earth Sciences, The University, Leeds LS2 9JT, England.

A single-element taxonomy was used in earlier descriptions of conodonts from Stonehead Beck because of the combination of relatively low concentrations of specimens at many horizons and a strong under-representation of non-platform elements. Extreme care applied to laboratory techniques has greatly increased recovery from the two most productive horizons of the sequence, providing a further 10,000 specimens and enabling a multielement taxonomy to be applied. The impli-

cations of the increased productivity of elements and discrete element species are discussed. There were, in addition, 64 fused conodont clusters from one horizon, all of which are considered to be the remains of single conodont apparatuses.

A total of thirteen multielement taxa are recognised. None is new and in general their structure is well established. The revised conodont distribution pattern indicates the presence of Arnsbergian faunas dominated by *Gnathodus bilineatus bollandensis* at the base of the sequence, while at the top of the succession, there are Chokierian faunas with *Declinognathodus*. Between these relatively rich faunas, from a point 2.1 metres below the Arnsbergian/Chokierian boundary to 9.6 metres above, there is an impoverished fauna, often monospecific even in single element terms, with *Rachistognathodus minutus*.

3. Aksu-I Section, Gissar Ridge, Uzbekistan

Mid-Carboniferous Boundary Stratotype proposed at the Gissar Range, Middle Asia, Uzbekistan.

T.I. NEMIROVSKAYA, Inst. of Geological Sciences, Ukrainian Academy of Sciences, Chkalova Str. 55b, Kiev, 252054 Ukraine and I.M. Nigmadganov, Germana Lopatina Str. 80-35, 700003, Tashkent, Uzbekistan.

The Aksu-I section proposed as a candidate for the Mid-Carboniferous Boundary stratotype is located at the Gissar Range of South Tienshan, southern Uzbekistan. It is 140 km west of Dushanbe, the capital of Tadzhikistan (Figure 3). The boundary interval is about 20 m thick and was deposited in deep water. It is exposed on both limbs of a syncline whose axis lies within beds belonging to the Hlb ammonoid zone. The lower beds, containing *Eumorphoceras* 2 ammonoids, are mostly micrite and the overlying homoceratid-bearing strata are interbedded shale, chert and limestone. Abundant conodonts, common ammonoids and some radiolarian and ostracod identifications have been completed and will be presented in a later report. Calcareous forams are absent.

the Aksu section is the most complete of the candidate sections

The section (Figure 4) fulfils the main requirements of the boundary stratotype as it contains the contin- uous succession *Gnathodus bilineatus bollandensis - Gn. postbilineatus - Declinogathodus praenoduliferus - Decl. noduliferus* and the appearance of *Decl. noduliferus* is close to the boundary between the *Eumorphoceras* and *Homoceras* ammonoid zones.

The boundary interval is about 20 m thick and was deposited in deep waters. Its lower part consists of micrites with cherty interbeds and contains ammonoids of the *Eumorphoceras* 2 Zone. The overlying homoceratid-bearing strata are interbedded shales, cherts and limestones. Abundant conodonts, ammonoids, some radiolarians and ostracods occur.

The most important features of this section include:

1. A unique conodont assemblage spanning the Mid-Carboniferous Boundary which is unknown to the rest of the world includes the lineage *Gnathodus bilineatus bollandensis - Gn. postbilineatus - Declinognathodus praenoduliferus - Decl. noduliferus*

2. *Idiognathoides* appears in *Homoceras* 1 within the succession *Gnathodus bilineatus bollandensis - Gn. postbilineatus - Id. asiaticus* followed by the first appearance of *Id. sinuatus, Id. corrugatus* and *Id. sulcatus*.

3. Ammonoids of the *Eumorphoceras* 2 and *Homoceras* 1 zones co-occur in one sample NN-17 beneath the first appearance of the boundary defining conodont *Decl. noduliferus*.

Figure 3: Location of the Aksu sections. Akhuntau section, Gaz section and locality 7222 in Uzbekistan and Kirghizstan, Middle

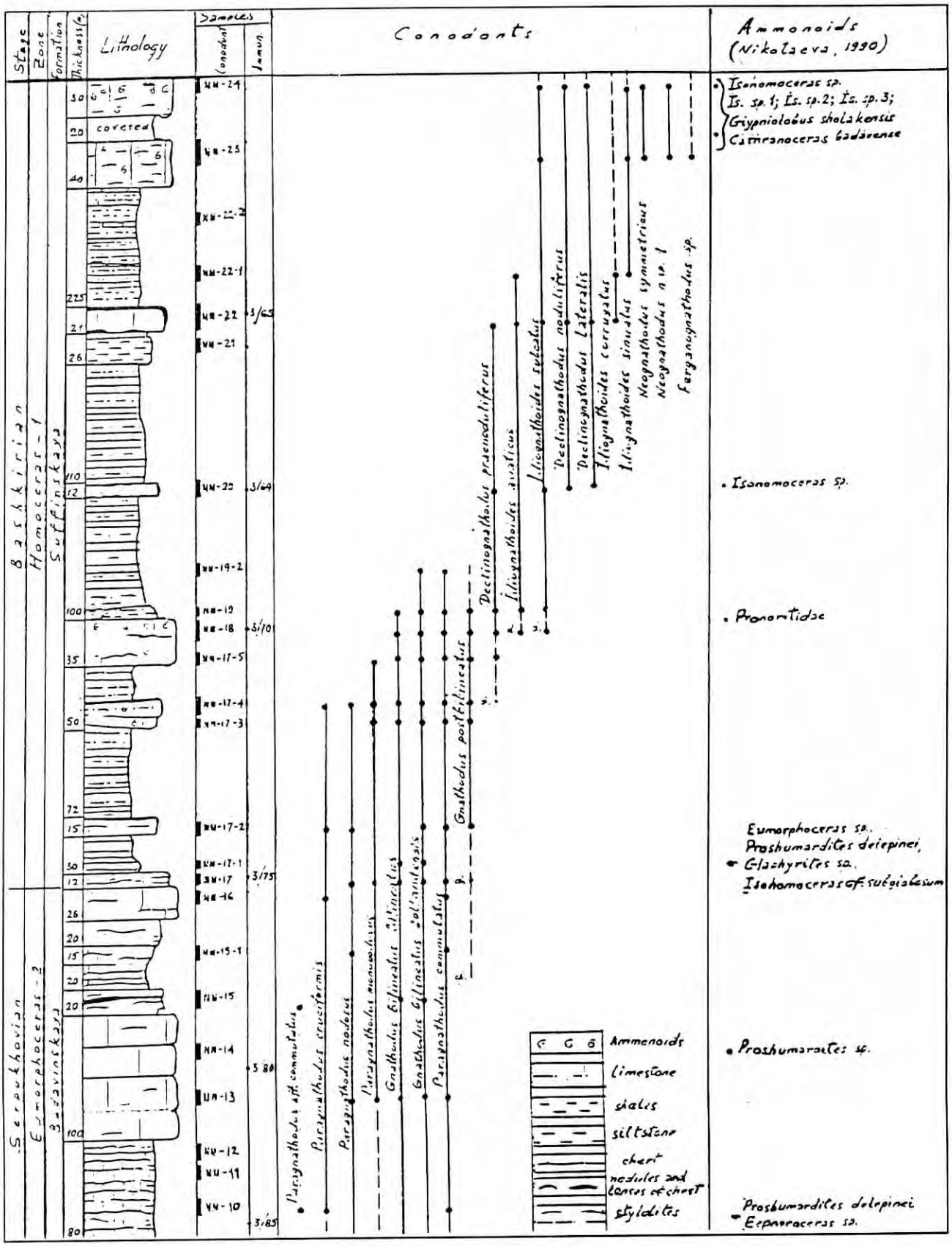

Figure 4: Conodont and Ammonoid distribution across the Mid-Carboniferous Boundary of the Gissar Ridge Section, Aksu-I (scale 1:20).

The overlap in eumorphoceratid-homoceratid ammonoid ranges and the presence of intermediate conodont species between the Early and Middle Carboniferous faunas strongly suggest that the Aksu section is the most complete of the candidate sections.

Other boundary sections are located in the the southern Fergana Valley of Kirgizstan. One of them is a basinal sequence identical to Aksu.

However, nearby at Gaz the boundary interval is represented by carbonate shelf deposits containing conodonts and a shelly fauna of forams, brachiopods bryozoans, crinoids and corals.The section is 530 m thick extending from the upper Serpukhovian to the lower Moscovian; the boundary interval is 70 m thick. Studies of most fossil groups are pending. *D. noduliferus* appears in sample KH5091. The section also contains the youngest advanced gnath-odids from the *bilineatus*-group and representatives of *Ferganagnathodus*. Gaz is a potential auxiliary boundary section because it contains fossil groups that complement assemblages seen in the deeper water sections. The Gaz section is also available for examination.

Observations on Fossil Material collected by Dr PAPROTH during the visit to the Aksu-I section in May 1993.

Prof. Dr Wolfhart LANGER, Institut für Paläontologie, Universität Bonn, Germany. (Read by Dr PAPROTH).

Note: Beds 16 and 17 described below span the Serpukhovian-Bashkirian (*Eumorphoceras* 2-Homoceras 1) boundary of the Aksu-I section) (see Fig. 3).

BED 16: "Stinkkalk", without quartz silt. Matrix partly some progradient neomorphe microsparite. Hints of pedoides seem to be of neomorphic origin (clotted structure). Most spectacular components are circular calcisized cross-sections; because of the diagenesis I cannot clearly say these may be spumelariide radiolarians or calcispheres; in two cases hints of wall layers seem to be observable, as they may be seen in calcispheres; but, as mentioned above, everything is blurred.

Additional components are arcuate shells ("filaments"). Their microstructre cannot be seen better with light microscopical means and it is suggested that they may belong to thin walled, unornamented ostracods.One section was observed through a questionable little ammonoid.-- A sack-like unknown individual.

After 3 days solution in weak acetic acid, 4 specimens of *Hindeodella* and one fragment of *Paragnathodus* have been found, together with one *Ammodiscus* (foraminifera) and a delicate porifera sclerite (Triaxon).

Although no concentric bioturbation textures are visible, endobenthos may have existed. -- No lamination!; few stylosutures; diaclases with several generations of cement.

Diagnosis: biogenes (radiolarians? and ostracoda) containing mudstone. In small parts transition to wackestone possible.

BED 17: Rock similar to sample 16. The "radiolarians" are less abundant. Filaments and particularly some biomorphe small ostracoda are conspicuous. Intraclasts are rare.

If the questionable radiolarians are indeed radiolarians, both mudstones are pelagic. If the questionable calcispheres are indeed calcispheres, a similarity to the Belgian "Marbre Noir" may exist. --- But not a single foraminifer, no trace of brachiopods, and no algae were observed.

Perhaps "primitif" foraminifers may be found if more material is studied.

4. Other Sections

The Stratigraphy and Sedimentology of a Mid-Carboniferous section at Inishcorker, County Clare, Eire.

KAREN BRAITHWAITE, Department of Earth Sciences, University of Leeds, England, LS2 9JT.

A section in the Clare shales spanning the Mid-Carboniferous interval is exposed on the island of Inishcorker in the river Shannon, County Clare. The succession ranges from the mid-Pendelian to lower Kinderscoutian and is superbly exposed in low coastal cliffs.

Continuous deposition during the lower-middle Namurian in Ireland

The sequence on Inishcorker was deposited in the centre of the Western Irish Namurian Basin and comprises a persistent deep-water succession. This basinal setting allowed continuous deposition throughout the lower-middle Namurian resulting in the complete Irish ammonoid biostratigraphy being displayed in the marine bands present in the central parts of the section. The Clare shales are black and organic-rich, with occasional calcareous bullions and septarian nodules. Marine bands are predominantly associated with the bullion horizons.

A section spanning E_{2c2} to H_{2b1} in age has been thoroughly examined to establish the ammonoid biostratigraphy and the faunal content of the marine bands. Conodont extraction is in progress. Geochemical analyses have also been undertaken to help determine how the salinity, organic productivity and oxygen levels varied with time, using C/S ratios, Total Organic Carbon (T.O.C.) and gamma-ray spectrometry methods.

Future Activities

(Subsequent to the Liège meetings Dr LANE has distributed the following correspondence to the members of the Working Group).

Dear Member MCBWG

At the recent meeting of the Subcommission on Carboniferous Stratigraphy held in Liège, Belgium, the SCCS asked the Mid-Carboniferous Boundary Working Group to have a final recommendation for a boundary stratotype to Chairman Paproth by January 15, 1994.

In the Working Group deliberations in Liège, it was decided to limit the stratotype candidates to three exposures. These are as follows:

1. **Arrow Canyon Section, Nevada, USA**
2. **Stonehead Beck Section, England**
3. **Aksu-I Section, Uzbekistan**

In the next several months I will be sending each of you detailed information about these three exposures for your deliberations. After you have received all three supplements, I will contact you for your vote and report those consolidated results to Chairman Paproth and Secretary Engel.

H. Richard Lane June 15, 1993

URGENT NOTICE

COMPTE RENDU OF THE CARBONIFEROUS CONGRESS

BUENOS AIRES, 1991

The Compte Rendu of the XII ICC-P is in the final proof stage. Almost 80 original papers, conferences and other general items are covered in 1100 pages (2 volumes). The CR is expected to be published late this year. Dr. S. Archangelsky is asking those who are interested in purchasing a copy to contact him at the address given below. The cost of both volumes will be approximately US$130 (including surface mail and handling). This call for an expression of interest **excludes those who atended the Conference** - they will automatically receive their copies as part of their registration. Since only a limited number of volumes will be published, preference will be given to those who show interest by sending a letter at this time. An index is available upon request.

Dr. S. Archangelsky, Div. Paleobotanica, Museo Argentino de Ciencias Naturales B.Rivadavia, Av. A. Gallardo 470, Buenos Aires, 1405, Argentina.

MEA CULPA

The editor regrets the error of not having checked with Professor Ralph Langenheim before publishing the anonymously distributed "Press Release" which appeared in *Carboniferous Newsletter* ***10,*** p.25. The editorial assumption that this was a piece of self-directed humour was unjustified and the source should have been verified before publication.

This notice serves to place on record an unreserved apology for any embarrassment caused to Professor Langenheim by the publication of this "filler" item.

Notes from ICS Bureau Minutes, 27-28 March 1993

(**Note:** These minutes, detailing the activities of ICS Subcommissions, are reproduced for the information of members.)

1. Revision of ICS Statutes

Criticism of the manner in which commission officers are elected has resulted in the preparation of a new draft of the statutes. The Bureau officers approved the draft which will be circulated to the full commission for comments and approval.

Changes include a proposed new procedure for the election of officers and other modifications necessitated by the abolition of independent Intersystem Boundary Working Groups.

2. Revision of ICS Guidelines

Since their establishment in 1986, the guidelines have proved to be a major progress in stratigraphic methodology. However, improvements to the present version of the guidelines seem necessary. The Bureau will draft an updated version and circulate it to the full commission for comments.

3. Revitalization of the International Stratigraphic Lexicon

No work has been done since 1977 on the lexicon. The lexicon is an immeasurably valuable source of regional lithostratigraphic information and should, therefore, be updated. Secretary general had proposed to Chairman to reactivate the lexicon as a global computer data base with the aid of and input by geological surveys of IUGS adhering members or their equivalents. The proposal received favorable response from IUGS Secretary general.

4. Review of Work Progress/ Achievements and of Work Plans of Constituent Bodies

The current goal of the commission is:

- to prepare an updated version of the "International Stratigraphic Guide," first published in 1976, and

- to establish stratotypes (GSSPs) for all chronostratigraphic boundaries to stage level, from Terminal Proterozoic to the end of the Cenozoic erathem.

The final version of the guide was received by the Bureau from the past chairman of the SC on Stratigraphic Classification prior to the meeting for the Bureau's final review and its forwarding to IUGS for printing. The SC and its past chairman are commended for their effort of several years of untiring work in putting this updated version together.

The Bureau reviewed the work of individual bodies. To date, eighteen stratotypes have been established and ratified by IUGS. Notes on particular aspects of each Subcommission follows:

The SC on Precambrian is making further progress in establishing a new Precambrian time scale which includes a four-fold division of the Archean and division of the Terminal Proterozoic.

The SC on Cambrian was active in the definition of the base of the Cambrian system. No further progress toward definition of Cambrian stages was made. Chairman will investigate the work plans of the SC and its claim of having published 30 important papers, as stated in the 1992 annual report.

The SC on Ordovician, which was established in 1974, has **not** yet produced any definition of stages. Instead, it is publishing global correlation charts and is studying "series" of nine global graptolite-conodont zones. Chairman will encourage the SC to direct its activities toward the definition of stages.

The SC on Silurian has completed the task of defining stage boundaries. The SC is now compiling a global standard for graptolite/conodont zonation and is working on global correlation charts and paleogeographic maps (first vice chairman).

The SC on Devonian will have all stages defined by end 1993 and is working toward biostratigraphic correlations between marine and continental realms, syntheses of sea-level changes, extinction events and taxon ranges. Another project is the correlation of established stratotypes into the non-marine realm.

The SC on Carboniferous has so far defined the base of the system and is expending a major effort in defining the boundary of the Mid-Carboniferous series. The SC is working on five (six?) other boundaries which are partly not stage boundaries. Chairman will inquire about details on the non-stage boundaries.

The SC on Gondwana will review its present organization, in particular the functioning of its six working groups and the scope and structure of the sponsored symposia. Chairman will inquire about the results of the SC's review.

The SC on Permian has not yet defined any stages. The report shows that a certain progress has been made but a work plan concerning definition of stage and series boundaries seems difficult to execute. Correlation of the Permian/Triassic boundary in marine and continental realms is planned by the SC. Second vice chairman will inquire about details of the work plan of the SC.

The SC on Triassic has agreed on the subdivision of the Triassic into stages, but has not yet defined any stratotypes. Chairman communicated that the SC is becoming active again and results should be forthcoming.

The SC on Jurassic has not yet defined any stage boundaries. Chairman will solicit information on the progress of the SC towards definition of stage stratotypes.

The SC on Cretaceous has not yet defined any stages. Chairman advised that the SC has recently been reorganized and results should be forthcoming. The SC plans to work toward definition of stage stratotypes and correlation of ammonite scales and scales of other fossil qroups.

The SC on Paleogene has defined two stratotype boundaries to date. The SC plans to work actively toward definition of the remaining stratotypes. The publication of a volume on the "*Paleogene of the World*" is planned.

The SC on Neogene has not yet defined any stratotype boundaries, but is planning to formulate soon the definition of three such boundaries. Chairman will inquire about specific plans of the SC.

The SC on Quaternary has so far defined only the base of the system but it is currently questioning the feasibility of that definition. (An informal working group was created at the IGC in 1992. It will study the problem and propose, if necessary,

the establishment of a formal working group.) The SC is planning to establish one more stratotype within the Quaternary.

The SC on Stratigraphic Classification has completed its assigned task of preparing a revised edition of the guide. The SC will remain active primarily as a forum for discussion and consultation on stratigraphic principles, definitions, and nomenclature.

The SC on Geochronology is making significant contributions in radiometric calibration. Its emphasis centers currently on an integrated stratigraphic approach applied to the Miocene series.

The WG on Correlations between Oceanic and Continental Records has established a computer data base for **Eurasia and Africa** and is currently expanding such base to include North and South America. Data compilation and interpretation will be completed within two years.

The Committee on Quantitative Stratigraphy did not provide a report.

5. ICS Financial Statement 1992 and Budget 1993

The financial statement and budget was prepared by secretary general and presented. It was approved by the other officers.

6. Preparation of Annual Reports to ICS and IUGS

To streamline the future preparation of annual reports, chairman and secretary general had drafted a circular letter to the SCs advising them on the requirements for preparation of annual reports. The proposal was discussed and approved by the other officers.

7. ICS Funding Policy

The variability of funding requested from ICS regarding subjects and amounts requires the establishment of a uniform policy so that individual bodies are funded fairly. For that purpose, Chairman and Secretary general had drafted the proposal of a circular letter on fundable budget categories and regulations for the division of IUGS-supplied funds. The proposal was discussed and approved by the other officers.

8. Second Edition of the Geochronologic Standard Scale

First vice chairman proposed and the other officers accepted that the new edition of the scale will be undertaken as a joint Bureau effort. **Input will be solicited from the SCs.**

9. 30th International Geological Congress, Beijing, China (1996)

Second Vice Chairman distributed the program of the congress proposed by the Preparatory Committee. The Committee has scheduled sessions on stratigraphy and geochronology. The sessions on stratigraphy encompass biostratigraphy, event stratigraphy - sequence stratigraphy - cyclic stratigraphy, quantitative stratigraphy, chronology - subdivision - global correlation of Late Proterozoic, and multiple stratigraphy. The sessions on geochronology include crustal evolution of the first two billion years, geological time scale and stratification boundaries, Tertiary and Quaternary geochronology, and new techniques of geochronology.

In addition, the Chairman proposed to participate in the colloquia with an ICS symposium on the interdisciplinary approach of stratigraphy ("Stratigraphy as an Interdisciplinary Science"). Papers are to be given by speakers who have been invited by the commission. The chairman will provide details to the Preparatory Committee.

Second Vice Chairman proposed to hold a second ICS colloquium on the new stratotypes that will be ratified since the 29th IGC and on stratotypes in continental deposits. This proposal was seconded by the other officers and will be included by Chairman in the letter to the Preparatory Committee.

Second Vice Chairman presented a proposal of field trips on "Stratigraphy" and "Paleontology" planned in conjunction with the congress.

10. Preservation of GSSPs

The chairman of the SC on Paleogene advised the Bureau of problems concerning locating the GSSP of the base Paleogene (El Kef, Tunisia). Chairman will clarify this specific situation and take steps to assure that it can be located and will remain exposed (Minister of National Economy already contacted).

Further, the officers agreed to modify the guidelines so that they are specific about the requirements on permanent demarcation, access and exposure of GSSPs. It will be important in the future that the government of the country where a GSSP is to be proposed gives its prior written guarantee about proper demarcation, access and preservation of the site.

Next ICS Bureau Meeting:
End of March 1994 in Neuchâtel, Switzerland.

ICS Funding Policy

In the statutes of IUGS, the commissions and subcommissions are defined as "bodies of expert scientists appointed to *coordinate* long-term international cooperative investigations to establish standards in appropriate fields, and to *encourage international cooperation* in the advancement of knowledge in various disciplines and problems in the geological sciences" and their work is defined as "*projects or meetings arranged in collaboration with affiliated organisations,* the International Geological Congress, other nongovernmental bodies, and intergovernmental bodies." Joint programs, such as the "International Geological Correlation Programme (IGCP)" can be included here. It is not the function of ICS to finance research, publications, field work, etc. The funding that ICS can provide to its subcommission has to be seen in the context of the IUGS statutes.

For this purpose, the following budget categories were established for ICS subcommissions:

SC Newsletters
Conferences/Meetings, minor or major
Attendance Support (related to SC activities)
General Expenses, Intersystem WG (temporarily)
SC (including other WGs & RCs)

Requests for funding for 1993 from individual subcommissions ranged widely, from less than US$500 to up to US$10,850.

In order to strike a balance between the different subcommissions and to distribute IUGS funds on an impartial basis, the ICS Bureau is now setting reasonable ceilings for the above budget categories in its annual request for funding by IUGS. The ceilings will be set anew each year by the ICS Bureau to represent a balanced average. Determining factors will be the requests received from the subcommissions and the funds that can reasonably be expected from IUGS. In the final allocation of funds to the subcommissions, the ceilings will be adjusted by the percentage of IUGS's changes to ICS's request for funds.

A contingency fund will be formed automatically which represents 10% of the ICS budget. Its prime purpose is to cover unforeseen, urgent expenses of the commission.

Principally, the subcommissions should avoid negative balances. However, if they occur they can be covered up to 10% of the funds allocated to the subcommission by IUGS – at the discretion of the bureau.

In the future, these ceilings, the results of the annual review of individual subcommissions' recent work progress and achievements, and their work program for the year in question as presented in the annual report will guide the ICS Bureau in its preparation of the request for IUGS funds. It will be important that funding requests in the annual reports be presented in an unambiguous manner.

The definition of intersystem boundaries is for ICS a goal of top priority. To ensure continuance of work after the integration of Intersystem Working Groups into subcommissions, these WGs were funded separately by ICS in 1993. Thereafter, the subcommissions will be responsible for funding of the Intersystem WG. The subcommissions are asked to consider this priority of ICS in their future internal distribution of funds.

J. Remane, Chairman, ICS
K. Gohrbandt, Secretary General, ICS.

Sequence Stratigraphy

As you are certainly aware, Sequence Stratigraphy as a new branch of (interpretative) stratigraphy is gaining acceptance. The newly revised edition of the *International Stratigraphic Guide,* prepared by the Subcommission on Stratigraphic Classification and currently going to press, addresses Unconformity-bounded Units which were first defined by the Subcommission in 1987. It is planned that the next International Geological Congress (Peking, 1996) will hold a session on Sequence Stratigraphy and the ICS bureau proposes to participate in the Colloquia of the Congress with a colloquium on the Interdisciplinary Approach of Stratigraphy.

We realize that concepts and interpretations of Sequence Stratigraphy are still in flux.However, we feel that the time has come when the Commission should become actively involved in this facet of stratigraphy.

The purpose of this circular letter is to obtain the input of your Subcommission on this matter. Could you, therefore, communicate with the members of your Subcommission to find out about their experiences and opinions on Sequence Stratigraphy and transmit this information to the bureau. We would like to hear from you by August 16, 1993.

K. H. Gohrbandt, Sec. Gen.
Prof. J. Remane Chairman ICS

IGCP PROJECT 272: Late Palaeozoic and Early Mesozoic Circum-Pacific Events, 1992

DR J.M. DICKINS, Project Leader, Australian Geological Survey Organisation, P.O. Box 378, Canberra, ACT 2601 Australia.

The following meetings were held:

1. Chicago, USA and field visit, Jackson, Wyoming to Boise, Idaho, 28 June - 11 July: 40 participants from 5 countries.

2. Kyoto, Japan (29 IGC), 24 August - 3 September: Symposium - Approx. 60 from 14 countries: Business meeting - 18 from 13 countries.

3. Vladivostok, eastern Siberia and field visit Vladivostok, Nakhodka and Dalnegorsk, 6-13 September: 60 from 7 countries.

Symposia and field visits have now been held (incl. the 1992 program) in eastern Australia, New Zealand, Brazil, Argentina, USA, Japan and eastern Siberia (Primorye and Sikhote-Alin).

This year's activities have provided information particularly on the following events:

1. The remarkable nature of the mid-Permian (twofold Permian subdivision). This was examined on the craton and terranes of North America and in Primorye and is marked in all these areas by regression followed by widespread transgressive and/or angular unconformity. In Primorye and in western America and to a lesser extent in cratonic North America, large scale predominantly intermediate and acidic vulcanism occurs. Discussion at the meetings indicated this has world-wide character and is often accompanied by the beginning of strong compressive folding. In the Upper Permian most sedimentary basins in the world have volcanics (often ignimbritic) and or volcanic detritus, a feature quite different from that of the present world. This time is also important for mineral formation as, for example, in both cratonic and terrane North America. The project has not been able to follow this up to any extent and this would be an objective for further work.

2. Although questions remain on stage definitions, further information shows the Midian-Dzhulfian boundary (Middle to Upper Permian of Japanese scale) is another time of strong, tectonic, volcano-magmatic, environmental and biological change.

3. The major regression of the uppermost Permian. In North America, both craton and terrane, a distinct hiatus is present compared with eastern Asia (Japan, China, Indo-China, Vietnam, Thailand and Primorye) although in Primorye and Japan a distinct angular unconformity is found.

4. A distinct event at the beginning of the Anisian was tabulated in New Zealand, China and in the Tethyan and North American regions. This could form the basis of further synthesis.

5. The end Ladinian and Carnian-Norian (Middle to Upper Triassic) event is complex and the project has pointed the way to how synthesis might be undertaken.

6. A major change occurs at the Triassic-Jurassic boundary with a breakup of the widespread carbonate platforms by deep tensional faulting and the initiation of a vast episode of predominantly basic volcanism with strong changes in the environment affecting the sea, land and atmosphere and its life. Next to the end Palaeozoic and the end of Cretaceous, is the major change of life associated with this boundary.

As 1992 is the last active year of the project, a summary of the overall achievements follows:

The objective of the project was to identify geological events in the Late Palaeozoic and Early Mesozoic in the Circum-Pacific particularly in terms of their correlation in time and to compare them with other parts of the world.

Major event stratigraphy of the Carboniferous to Jurassic interval

A major outcome has been to show that significant events are coincident or closely associated in time with the units of the Standard World Geological Stratigraphical Scale on which the World Standard Geological Time Scale is based. In addition, although it was not an objective of the Project, an important contribution has been made towards developing the reliability and preciseness of the Permian and Triassic time scales.

All the events tabulated below are associated with strong regressive-transgressive events, giving considerable confidence in their recognition.

1. The late Carboniferous is a time of significant continentality. This is terminated by widespread marine transgression in the earliest Permian accompanied by a change from marked compression to predominantly tensional and vertical movement and greater basic magmatic activity. The biological change, although distinct, is not major.

2. The mid-Permian is again marked by a major regression, distinct biological change, remarkably widespread folding and predominantly acidic and intermediate volcanic activity.

3. The project has been able to tabulate for the first time a major change within the Upper Permian associated with the Midian-Dzhulfian boundary where there are important biological, sea-level and tectonic and magmatic-volcanic events. This boundary has often been taken as the top of the Middle Permian.

4. More work has been done on the Permian-Triassic, not only marked by perhaps the most far reaching regression of the Phanerozoic and major extinctions but apparently traumatic volcanism, angular unconformity and strong compressive and apparently vertical movements.

5. The events of the Lower-Middle and Middle-Upper Triassic are similar in character to the Midian-Dzhulfian. Strong compression was associated with deep crustal fracturing or "rifting" accompanied by strong magmatic-volcanic activity with a consequent effect on the environment.

6. At the Triassic-Jurassic boundary there is apparently a major change in earth structure, ending for example, the carbonate platforms characteristic of the Triassic and their palaeoecological and life systems. The Jurassic is marked by widespread deep crustal fracturing sometimes referred to as the breakup of Pangaea, basic magmatic-volcanic activity, major changes in the environment and a major change in life within the Phanerozoic, possibly second in magnitude only to that of the Permian-Triassic and the Cretaceous-Tertiary changes.

With the exception perhaps of the Carboniferous-Permian, major biological changes accompany the events detailed above. The biological changes in between appear to be of a lesser order as for example the changes between the stages of the interval between the mid-Permian and the Midian-Dzhulfian boundary and between the two stages between the Midian-Dzhulfian and the top of the Permian.

In the work of the project, there is a distinct indication that the times of major change recognized, coincide with important mineralization and formation of deposits of commercial importance. This might be of interest for further amplification. No close association between climate and palaeomagnetic change with these events has so far been recognized, although a distinct world warming may occur at the mid-Permian from the development of cosmopolitan marine faunas at this time.

Consideration of terranes has not been within the scope of the project, but the work has shown some interesting relationships such as the similar stratigraphical development of the western North American terranes and the adjacent cratonic area. The terranes largely differ in their magmatic-volcanic development. Papers recording the outcome of the project are to be published by Cambridge University Press.

For those participating and interested in the project, the new Project 356, Correlation of Tethyan, Circum-Pacific and marginal Gondwana Permo-Triassic, now approved by IGCP, may provide scope for further work. Those interested may contact Dr DICKINS (address above) or Professor Yin Hongfu, Depar-tment of Geology, China University of Geosciences, Wuhan, Hubei, 430074, China.

The Carboniferous-Permian Boundary Working Group

Prof. JIN YUGAN, Nanjing Inst. of Geology & Palaeontology, Chi-Ming-Ssu, Nanjing 210008, China. (Letter dated 10 June 1993 to SCCS Chairman).

Carboniferous & Permian Subcommission Voting Members have been advised that the intersystem Working Group (1993-96) is being reorganised.

After consulation with the ICS and our own executive members, Dr PAPROTH (Chairman SCCS) and Dr JIN YUGAN (Chairman SCPS) have agreed that the Nominating Committee should consist of WU WANGSHI (Chairperson of WGCP), B.R. WARDLAW (Secretary of WGCP) and JIN YUGAN. They have proposed the following slate of Voting Members for the new Carboniferous/Permian Boundary Working Group:

B.I. Chuvashov (Russia, forams) C.M. Henderson (Canada, conodonts), J. Utting (Canada, palynoflora), C.A. Ross (USA, fusulinids), B.R. Wardlaw (USA, conodonts), J. Yanagida (Japan, brachiopods).

Nominated in 1993:
V.I. Davydov (Russia, fusulinids), C.B. Foster (Australia, palynoflora), H. Kozur (Hungary, conodonts), Wang Zhihao (China, conodonts), Zhou Zuren (China, ammonoids).

Nomination for Chairman:
B.F. Glenister (USA, ammonoids).

Members retired in 1993:
N.W.Archbold (Australia) M.V. Durante (Russia), M. Hunicken (Argentina), R.Igvat (Thailand), Rui Lin (China), Wu Wangshi (China).

Further nominations from the Voting Members of both subcommissions are sought. We recommend that nominations be supported by more than one Voting Member. **Nominations must be in writing and must reach JIN by 10 July 1993,** with a copy to E. PAPROTH.

It is expected that about thirteen (13) persons will be elected by both Subcommissions as new Voting Members of the Working Group.

Since it has not been possible to contact all SCCS Voting Members at short notice, please take this as a request to contact Prof. JIN and Dr PAPROTH as soon as possible if you wish to put forward any nominations.

MEMOIRES DE L'INSTITUT GEOLOGIQUE DE L'UNIVERSITE DE LOUVAIN

Communications scientifiques présentées en hommage au Professeur Raphaël CONIL

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Revised correlation of Carboniferous and Early Permian units of the Southern New England Orogen, Australia.

J. ROBERTS, Department of Applied Geology, University of New South Wales, Kensington, NSW, J. CLAOUÉ-LONG and P.J. JONES, Australian Geological Survey Organisation, Canberra, ACT, Australia.

Preliminary correlations in the Late Carboniferous and Early Permian of eastern Australia by SHRIMP zircon dating, published by ROBERTS *et al.* (1991a) and ROBERTS *et al.* (in press a), has been superseded by new data and a revision of field relationships (Figure 5). Major reassessments include:

1). the age of the top of the *Levipustula levis* Zone;

2). the age and correlation of the top of the glacigene Seaham Formation; and

3). the age of the base of the Permian succession in eastern Australia; these are documented in forthcoming Special Publications by CLAOUÉ-LONG *et al.* (in press) and ROBERTS *et al.* (in press b, c).

Levipustula levis Zone

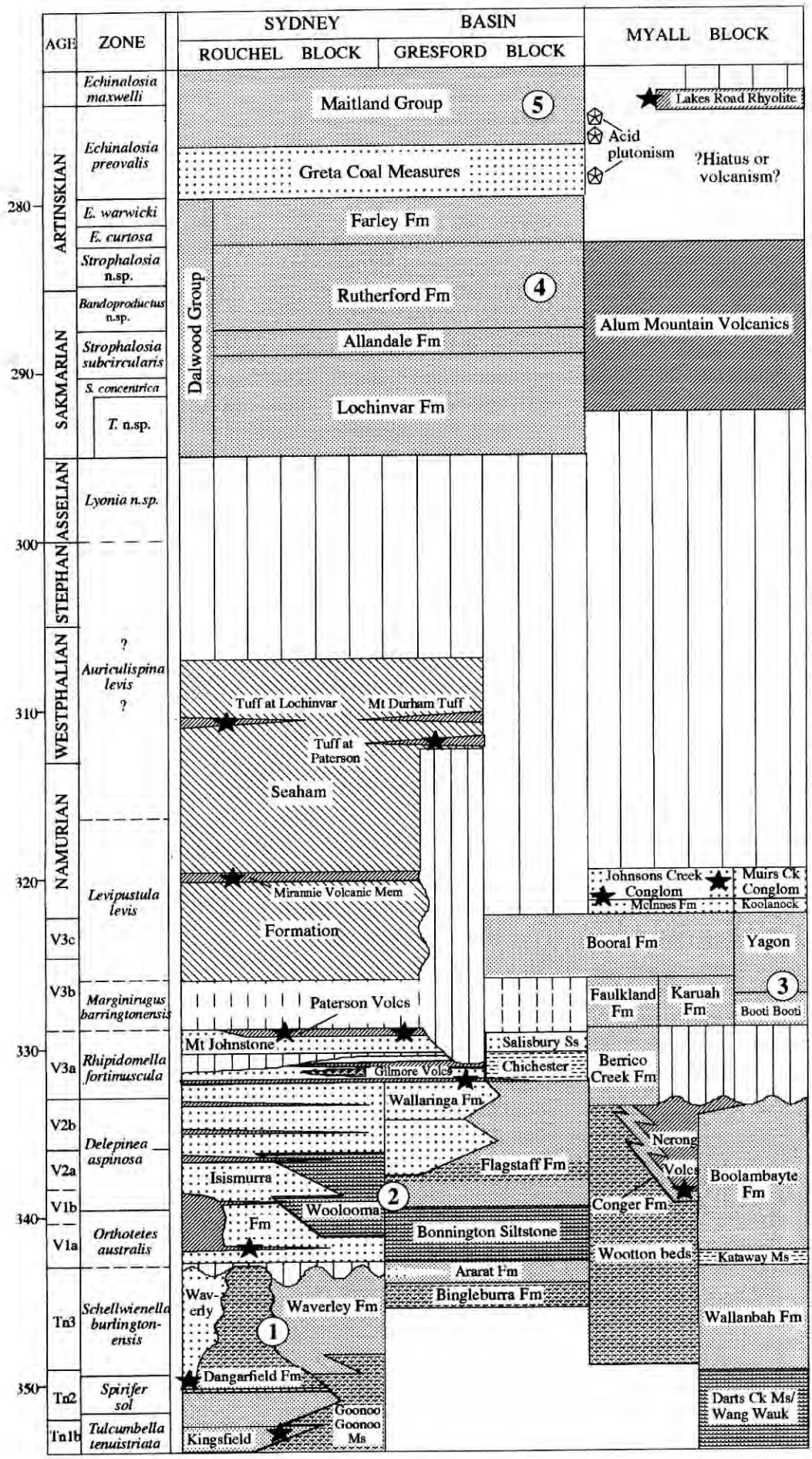
On the basis of surprisingly young zircon ages for rhyolite units in the Booral and McInnes Formations of the southern New England Orogen (SNEO), it has been suggested that upper levels of the *L. levis* Zone might be Early Permian in age (ROBERTS *et al.*, 1991a). New SHRIMP dating has produced further Permian ages for rhyolite units low in the Booral Formation (beneath the first occurrence of *L. levis*) and in the Koolanock Sandstone (above the *L. levis* Zone). The measured ages cluster in the range 278-275 Ma, close to that of the Permian Alum Mountain Volcanics. All of the dated rhyolites were sampled on the basis of their identification as erupted flow units, but we have been prompted to re-examine this attribution. We were motivated in part by finding reversals in the age succession of the rhyolite units, by the similarity of their ages to the known age of Permian volcanism elsewhere (FLOOD *et al.*, 1988), and by the difficulty of understanding how rhyolitic flows might have been erupted into the deep water fossiliferous marine sediments of the Booral Formation.

Zircon ages from felsic sills do not constrain the age of the associated sediments

The dated rhyolites lack lateral continuity: different sections through the Booral and McInnes Formations, and the Johnsons Creek Conglomerate in the northern part of the Stroud-Gloucester Syncline (ROBERTS *et al.*, 1991b, figs 32-34) have rhyolite units at different stratigraphic levels. As some vitrophyres within the Carboniferous Copeland Road and Buckets Gap Formations in the northwestern part of the Stroud-Gloucester Sycline (CAMPBELL & MCKELVEY, 1972) have been mapped as sills, we examined the nature of the contacts of the dated rhyolites to determine whether they were sills or flows. Outcrop is restricted, but we were able to find one exposed upper contact of a dated rhyolite with siltstone of the Booral Formation on Berrico Trig Road. The contact is clearly intrusive, with rhyolite penetrating the siltstone along veins and fractures, igneous flow structures bending upwards into spaces within the lower surface of the siltstone, and angular blocks of siltstone stoped away from the contact to float within the magma. On this firm basis we now interpret 'rhyolites' mapped within the northern Stroud-Gloucester and Myall Synclines as a suite of felsic sills intruded into the Carboniferous formations during a period of Permian volcanism. Their zircon ages, therefore, do not constrain the age of the associated sediments.

Undoubted pyroclastic volcanics within the Johnsons Creek Conglomerate, the uppermost Carboniferous unit which overlies *L. levis*-bearing formations in the Stroud-Gloucester Syncline, have now been dated with SHRIMP and are latest Viséan or Namurian in age. Hence within the Myall region of the SNEO, the *L. levis* Zone may be latest Viséan and is unlikely to have the extensive range suggested earlier. In the Hastings Terrane on the eastern margin of the SNEO the *L. levis* Zone is located both above and below the early Namurian ammonoid *Cravenoceras kullatinense* (ROBERTS *et al.*, 1976; ROBERTS *et al.*, (in press d)), but its upper limit of age has not yet been determined. There is a similar difficulty in determining the upper limit of the *L. levis* Zone in the Yarrol Syncline, Queensland. There, the *L. levis* Zone in the Branch Creek and Poperima Formations immediately follows the *Marginirugus barringtonensis* Zone of the underlying Baywulla Formation, which contains the first appearance of the conodont *Gnathodus bilineatus* (JENKINS *et al.*, in press), and is overlain by poorly fossiliferous assemblages in the Rands Formation. Taxa ranging up from the *L. levis* Zone characterise the greater part of the Rands Formation, but the *Auriculispina levis* Zone is present at the top (*sensu* DEAR *et al.*, 1971).

This major reassessment of the age of the Johnsons Creek Conglomerate, McInnes and Booral Formations (and their equivalents) also affects the range of the plant *Nothorhacopteris*. This genus which first appears in the Mt Johnstone Formation and in the SNEO is present within all


AGE
ZONE
SYDNEY BASIN
ROUCHEL BLOCK
GRESFORD BLOCK
MYALL BLOCK
Echinalosia maxwelli
Echinalosia preovalis
E. warwicki
E. curtosa
Strophalosia n.sp.
Bandoproductus n.sp.
Strophalosia subcircularis
S. concentrica
T. n.sp.
Lyonia n.sp.
Auriculispina levis
Levipustula levis
Marginirugus barringtonensis
Rhipidomella fortimuscula
Delepinea aspinosa
Orthotetes australis
Schellwienella burlingtonensis
Spirifer sol
Tulcumbella tenuistriata
ARTINSKIAN
SAKMARIAN
ASSELIAN
STEPHAN
WESTPHALIAN
NAMURIAN
V3c
V3b
V3a
V2b
V2a
V1b
V1a
Tn3
Tn2
Tn1b
280
290
300
310
320
330
340
350
Maitland Group
5
Greta Coal Measures
Farley Fm
Rutherford Fm
4
Allandale Fm
Lochinvar Fm
Dalwood Group
Lakes Road Rhyolite
Acid plutonism
?Hiatus or volcanism?
Alum Mountain Volcanics
Tuff at Lochinvar
Mt Durham Tuff
Tuff at Paterson
Seaham
Miramie Volcanic Mem
Formation
Paterson Volcs
Mt Johnstone
Gilmore Volcs
Wallaringa Fm
Isismurra
Woolooma
Fm
2
Waverley Fm
Wav-erly
1
Dangarfield Fm
Goonoo Goonoo Ms
Kingsfield
Johnsons Creek Conglom
McInnes Fm
Muirs Ck Conglom
Koolanock
Booral Fm
Yagon
3
Booti Booti
Faulkland Fm
Karuah Fm
Salisbury Ss
Chichester
Berrico Creek Fm
Flagstaff Fm
Nerong Volcs
Conger Fm
Boolambayte Fm
Bonnington Siltstone
Wootton beds
Kataway Ms
Ararat Fm
Bingleburra Fm
Wallanbah Fm
Darts Ck Ms/ Wang Wauk

of the overlying Carboniferous units. Its range is therefore Late Viséan to Westphalian, a substantially smaller interval of time than previously suggested (ROBERTS *et al.*, 1991a; ROBERTS *et al.*, (in press a)).

Seaham Formation

The age of the Seaham Formation and its stratigraphic relationship with Permian sediments of the Sydney Basin have been confused by misinterpretation of the succession within the Cranky Corner Basin (McCLUNG, 1980; KEMP *et al.*, 1977). Whereas McCLUNG (1980) interpreted the Carboniferous to Permian succession as conformable, unpublished mapping east of the Cranky Corner Basin (BENSON, 1976) clearly indicates an angular unconformity between the Seaham and Lochinvar Formations; BRIGGS & ARCHBOLD (1990) also suggest an angular discordance between the two units within the Cranky Corner Basin.

Seaham Formation spans Late Viséan-Early Westphalian with a long hiatus to the Permian

Our previous interpretation (ROBERTS *et al.*, 1991a; ROBERTS *et al.*, (in press a)) queried the upper limit of the Seaham Formation. Three zircon dates in the Seaham Formation now demonstrate that deposition began before the end of the Viséan and continued into the Westphalian, and that there was a long hiatus prior to deposition of Permian sediments of the Sydney Basin. The youngest age from the upper part of the Seaham Formation is for a volcanic unit 50 m below the Lochinvar Formation in BROWNE'S (1927) Winders Hill section. Slightly younger Seaham Formation may exist in the Carboniferous inlier at Mt View near Cessnock where the formation unconformably overlies the Matthews Gap Dacite Member of the Pokolbin Hills Volcanics, which has been dated by conventional zircon methods at 309±3 Ma (GULSON *et al.*, 1990), and is in turn overlain by conglomerate at the base of the Permian Dalwood Group (BRAKEL, 1972).

Base of the Permian in the SNEO

Coal-bearing sediments interbedded with the Alum Mountain Volcanics (JENKINS & NETHERY, 1992) contain both Stage 3a and 3b palynofloras with the possibility, based on a single occurrence of *Granulatisporites trisinus*, of extension into Stage 4 (HELBY, in ROBERTS *et al.*, 1991b). The volcanics have been taken as one of the lowest units of the Permian in the SNEO. A zircon age of c.274 Ma for the Lakes Road Rhyolite at the top of the Alum Mountain Volcanics has been used to suggest a middle Permian age for the Stage 3 Palynoflora and equivalent biostratigraphic units, and to indicate a middle Permian onset of deposition for the Permian succession in the SNEO (ROBERTS *et al.*, 1991a).

Preliminary SHRIMP ages for volcanics in the Warwick district in southeast Queensland suggest that Permian deposition there commenced much earlier, within the interval 295-300 Ma. The dated samples are rhyolitic and tuffaceous units from an apparently single stratigraphic level (BERG, 1973) within an outlier of Permian sediments resting with angular unconformity on the Early Carboniferous Texas beds at Alum Rock homestead (OLGERS *et al.*, 1974). Although there are complications from minor faulting, the tuffs overlie sediments containing the *Trigonotreta* n.sp. Zone, and the rhyolite underlies sediments containing the *Strophalosia subcircularis* Zone (D.J.C. BRIGGS pers. comm.; BRIGGS, 1993).

There is therefore an apparent 20 Ma discrepancy in age for units at the base of the Australian Permian (cf. ARCHBOLD & DICKINS, 1989; BRIGGS, 1993). This might be interpreted in two ways: either:

1). volcanism within the Alum Mountain Volcanics was more prolonged than previously recognised, with the Lakes Road Rhyolite being erupted during Stage 4 (i.e. Artinskian or possibly younger); or

2). the Lakes Road Rhyolite, in common with other 'rhyolitic' rocks in the district, is intrusive. Further field work is required to resolve this problem.

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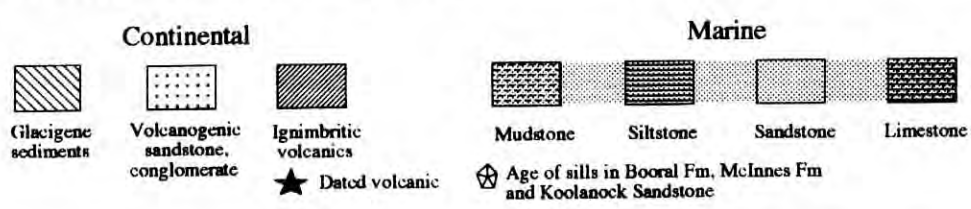
Figure 5 (opposite). Australian correlation chart based on biozones and SHRIMP ion microprobe zircon ages for Carboniferous formations of the southern New England Orogen and Permian Formations of the Sydney Basin. Modified from ROBERTS et al. (in press b).



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Canadian Studies

ERWIN L. ZODROW, Curator Fossil Plant Collections, University College of Cape Breton, Sydney, Nova Scotia, Canada BIP 6L2.

1). Westphalian C coal balls: Nova Scotia, Canada.

In May 1992, Drs P.C. Lyons (USGS) and A.T. Cross (Michigan State Univ.) discovered in situ coal balls for the first time in Nova Scotia, Canada. They occur throughout the 13-metre thick Foord Seam which is low in sulfur. A reference and type collection of nearly 400 coal balls was made the same year by Drs P.C. Lyons and Zhifeng Gao (University College of Cape Breton); the collection is curated by Erwin L. Zodrow. Results so far obtained from the coal ball studies (papers will be published shortly) show that the siderite-calcite-dolomite mineralogy is atypical of known Carboniferous coal balls which are composed of calcite-dolomite. What we are trying to do first is to devise a geochemical model for the deposition of the coal balls, relying to a large degree on stable carbon and oxygen isotopic data from the principal siderite mineral, and the Foord coal. This will be followed by histological and taxonomic studies of the coal balls to investigate patterns of changing plant communities and plant evolution during Foord time. Preliminary work with peel sections shows that the coal balls contain a rich flora. However, one puzzle remains: why the absence of coal balls from the Westphalian D - basal Cantabrian coal beds in the Canadian Carboniferous?

2). Modelling of *Lobatopteris* Wagner: fractals arrived.

At the XII Carboniferous Congress, Buenos Aires (1991), E.L. Zodrow read a paper on

morphological analysis of a lobatopterid frond (Carboniferous marattialean fern) and hypothesised that it is a fractal object (has the properties of self-similarity and fractional dimension). Following this, my algebraist colleague, Dr. M. Heggie, and I collaborated and successfully modelled the frond using fractal geometry (to appear in *Palaeontographica* Abt. B, Festschrift Professor Dr. H-J. Schweitzer). This introduces a new research tool into the study of Carboniferous palaeobotany. Used were interactive computer graphics in combination with principles of fractal geometry to mathematically establish the best fit between the self-similar structure that plays the role of an idealised lobatopterid frond (botanical object) and an iterated function system (set of affine transformation).

Fractal geometry, a new research tool in Carboniferous palaeobotany

In the course of the investigation, we discovered that only four simple affine transformations are required to model the characteristics of the frond. This is significant as it indicates that the fractal geometry underlying the morphologically complex lobatopterid frond is simple insofar as it admits a succinct mathematical description. The fractal dimension of the frond is approximately 1.5 (not quite a 'square'). Interested researchers are now in a position to investigate fractal-taxonomic potential to its fullest, computer-create fractal species and evaluate their botanical counterparts by modelling and comparing fractal dimension. Of special interest is the subject of fractal-geometric comparison of fossil and extant marattialean species to determine lineage of evolution.

This is the first time that computer graphical and fractal methods have been used in this context. Further results will be presented at the XIII Carboniferous Congress, Krakov, Poland.

3). Microchemistry of some Carboniferous medullosan cuticles.

We have [see *Carboniferous Newsletter*, July 1992] succeeded in separately analyzing the coalified layer and its contained cuticle of two Carboniferous medullosan fronds from the Sydney Coal Basin, Nova Scotia, Canada. These are *Macroneuropteris scheuchzeri* (Hoffmann) Cleal, Shute et Zodrow, and *Neuropteris ovata* (Hoffmann) var. *simonii* (Bertrand) Cleal and Zodrow. In regards to *N. ovata* var. *simonii*, which is an index fossil for Westphalian D, we now have detailed information about it. This includes knowledge of its frond architecture, its morphological variability, cuticular characteristics, and microchemistry of the cuticle. Unfortunately, results indicate that it is too early to say whether or not a chemotaxonomic potential exists by which to characterize and separate medullosan species.

A Preliminary Evaluation of the Kinderhookian-Osagean Boundary Interval in Wyoming and Idaho, Western USA

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Early Carboniferous stratigraphic units in the Cordillera of the western USA containing equivalents of the Kinderhookian and Osagean strata of the Midcontinent are widespread and include a number of different facies. Many of these sections possess continuous deposition across the Kinderhookian-Osagean (hereafter referred to as K-O) boundary interval which is represented by a regional unconformity in the Midcontinent type sections of the two series. Stratigraphic sections wherein conodont and/or foraminiferal occurrences have been studied that provide significant information for possible subdivision of the Lower Carboniferous are scattered from Montana to southern Nevada and also occur in Arizona and New Mexico. Most of the sections have widely spaced sample intervals and/or barren intervals, while in others sampling intervals are unknown. Many lack carbonate microfacies information and a few have recognised unconformities at or near the K-O boundary.

Three stratigraphic sections were selected for study of the Kinderhookian-Osagean boundary in the western USA. These sections are:

1). A shelf margin section (Little Tongure River) in north central Wyoming;

2). A restricted basin (Strawberry Creek) in western Wyoming; and

3). A shallow water offshore platform (Gardner Canyon) in eastern Idaho.

Each section is believed to have continuous deposition across the K-O boundary and was sampled at 1m or less intervals for conodonts, foraminifera, and carbonate microfacies.

Previous suggestions by various authors for recognition of the K-O boundary based on conodonts have been:

1. Last occurrence of *Siphonodella*
2. First appearance of Gnathodus typicus M2
3. First appearance of Polygnathus communis carina
4. Evolutionary lineage of Pseudopolygnathus multistriatus; and
5. Evolutionary lineage of *G. cuneiformis*.

Conodont recoveries from the three sections varied from poor in the shelf margin section to excellent in the offshore platform. We consider that the overall conodont distribution pattern of

the K-O boundary interval is generally reflected in the Gardner Canyon section. That pattern suggests the conodont abundance and diversity did not significantly recover from an extinction event, which occurred in the latter part of the range of *Siphonodella*, until about the first occurrence of *Polygnathus communis carina*. An interval above the last occurrence of *Siphonodella* contains conodont faunas consisting almost entirely of long ranging taxa and is called the nondiagnostic interval. This nondiagnostic interval occurs within each of the three measured stratigraphic sections. Portions of the stratigraphic sections within which the nondiagnostic interval appears are represented by different depositional environments. This observation suggests that the nondiagnostic interval represents a time of low conodont diversity after the extinction event, although the cause of this event is unclear. The nondiagnostic interval has been recognised worldwide (SEVASTOPULO & NUDDS, 1987; among others). Although the timing of the disappearance of *Siphonodella* may be synchronous it has not been demonstrated to be an internationally synchronous event.

Conodont abundance and diversity depleted by an extinction event near K-O boundary

Although *Gnathodus* species, including *G. typicus* M2 and *G. cuneiformis*, have been recovered above the last occurrence of *Siphonodella* and below the first occurrence of *P. communis carina*. Their occurrences are extremely uncommon in this part of the section. Thus, it can be inferred that the utilization of the first occurrences of either *G. typicus* M2 or *G. cuneiformis* as the worldwide K-O boundary marker would be impractical, and probably only of regional use.

In our study, we concur with CARMAN (1987) among others, that *P. communis carina* only occurs well above the last occurrence of *Siphonodella* and that the range of *P. communis carina* below the base of the *G. typicus* Zone is incorrect. We propose that *P. communis carina* should be reconsidered as a potential K-O boundary marker as its first occurrence throughout the Cordillera may approximate a time plane and evolutionary lineages may be present in some sections. In addition there is a marked increase in the abundance of most long ranging taxa at this same level.

The evolutionary lineage of *Pseudopolygnathus multistriatus* has not been established. We found that *Ps. multistriatus* M1 is dominant within the *S. isosticha*-Upper *S. crenulata* Zone, while *Ps. multistriatus* M2 first occurs above the last occurrence of *Siphonodella*. In particular, the first appearance of *Ps. multistriatus* M2 is very close to the horizon of the first occurrence of *P. communis carina*, and both taxa are common to abundant in a 2 kg sample. Therefore, it is concluded that (1) precise definition of an internationally correlatable K-O boundary horizon between the last occurrence of *Siphonodella* and the first occurrence of *P. communis carina* and/or *Ps. multistriatus* M2 is impractical, but a boundary interval is recognizable, and (2) if an internationally correlatable chronostratigraphic horizon within the Kinderhookian/Osagean (or late middle Tournaisian-early late Tournaisian) boundary interval is based on conodont faunas, *P. communis carina* and *Ps. multistriatus* M2 might be the best potential markers for this purpose. These taxa are distributed worldwide and have been widely employed in the study of Lower Mississippian conodont zonations. However, more work remains to be done, especially on the evolutionary lineage of *Ps. multistriatus*.

Foraminifera have long been used for correlation of the Lower Carboniferous strata of the western United States. Also, there has been less disagreement on which taxa should serve as biostratigraphic markers than in the conodonts. However, correlations were often based on widely spaced sampling intervals and application of acme or assemblage zones. These practices greatly degrade their international utility. Certain evolutionary advances in the Early Mississippian foraminifera,such as the secretion of secondary deposits, made some groups, especially the tuberculate foraminifera, easily identifiable for use in biostratigraphic correlation.

Most previously proposed K-O boundary horizons are not practical

Recently, BRENCKLE (1991) has suggested the use of the first occurrence of the tuberculate foraminifera, primarily *Tuberendothyra tuberculata* as the marker for the K-O boundary. But the sporadic nature of its occurrence (MAMET AND SKIPP, 1970, and this study), and its possible diachronous relationship with respect to the siphonodellid conodonts between the Midcontinent and western North America (BRENCKLE AND GROVES, 1987, and this study), suggest that the tuberculate foraminifera, by themselves, do not make an adequate K-O boundary marker.

In summary, in the western US Cordillera a number of sections are identified that contain continuous deposition across the K-O boundary interval which is represented by a significant regional unconformity in the Midcontinent. A number of the Cordilleran sections have had detailed stratigraphic studies of the conodonts and foraminifera. However, the sparse and perhaps diachronous occurrence of the tuberculate foraminifera and

conodonts within the K-O boundary interval in the Cordilleran sections suggests that most previously proposed boundary horizons are not practical. We suggest that the best candidate for a K-O boundary marker in the Cordillera may be the first occurrence of *Polygnathus communis carina*. Additional study of this horizon will be required to fully evaluate its usefulness.

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The First North American Occurrence of Homoceras and Isohomoceras (Pennsylvanian Ammonoidea)

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With the exception of an abstract recently published by the present author (TITUS AND MANGER, 1992), *Homoceras* age ammonoid faunas have never been reported previously from North America in the literature. In fact, several papers have explicitly stated that *Homoceras* faunas are absent from North American Mid-Carboniferous strata (e.g. BRENCKLE *et al.*, 1977). During field work in the Spring of 1989, the author discovered two localities on the Nevada Test Site (central Nye County, Nevada) that yield the homocerid genera *Isohomoceras* and *Homoceras*. The localities are located on the north and south ends of a large southwest trending Permo-Carboniferous outcrop called Syncline Ridge and will subsequently be referred to as the NSR and SSR localities respectively.

The sections are within the highest portion of informal unit "J" of the Eleana Formation, which is composed chiefly of mudstone, and is now thought to be a different sedimentary sequence than that of the type Eleana. Subsequent investigations have shown that both the SSR and NSR localities contain continuous shale sequences across the Mid-Carboniferous (mid-Namurian) boundary, though one of them, the NSR locality, is faulted and largely covered. Both localities have yielded diverse invertebrate macrofaunal assemblages, adjacent to the boundary, that include gastropods, bivalves, brachiopods, corals, conularids, trilobites, nautiloids, and crinozoan columnals.

The SSR locality yields both latest Mississippian and earliest Pennsylvanian ammonoids (TITUS, 1992), is relatively unfaulted, and contains abundant micro and other macrofauna. The oldest ammonoids known from the SSR section include *Glaphyrites, Zephyroceras,* and *Delepinoceras thalassoide* (Delepine). This fauna is typical late Namurian A and similar faunas are known from many places in North America, Europe and Asia. Above the last occurrence of *D. thalassoide,* a completely different ammonoid fauna dominated by *Isohomoceras* and *Proshumardites* appears. This fauna has analogies with the *Isohomoceras* faunas of Europe and Asia and has only been described in detail from the stratotype proposal, Stonehead Beck, in England (RILEY, 1987). Several metres above the appearance of *Isohomoceras*, true *Homoceras* appear, with coarsely ornamented forms of the *beyrichianum* group soon following. On this basis, the entire Chokierian is represented in the Syncline Ridge area (TITUS, 1992), which was the deepest part of the Antler Basin.

Homoceras ammonoid faunas in North America

The NSR locality has only yielded the homocerid genus *Isohomoceras*. Lower Namurian strata at the same locality has yielded a prolific ammonoid fauna first described by GORDON AND POOLE (1968), that is slightly older than that of the SSR locality. It is believed that the higher Chokierian, as well as the actual boundary interval and latest Mississippian strata, are faulted out at the SSR locality. These new ammonoid faunas represent the first unequivocal documentation of the Chokierian interval in the western hemisphere and the oldest Pennsylvanian ammonoid faunas known anywhere in North America. The extreme rarity of *Homoceras* in North America can now be demonstrated to be the result of widespread unconformities and extensive exposures of facies unfavourable to ammonoids. Faunal endemism is not a factor.

Conodonts recovered (Pa elements) from the Mississippian portion of the section include typical late Mississippian forms such as *Adetognathodus unicornis* (Rexroad and Burton), *Gnathodus girtyi simplex* Dunn, *Gnathodus bilineatus* Roundy, *Lochriea commutatus* (Branson and Mehl), and interestingly, primitive *Declinognathodus*, c.f.

D. noduliferous inaequalis Higgins. The appearance of *Declinognathodus* before the boundary in this section is the only pre-*Homoceras* zone occurrence of this taxa known in the world. No conodonts have been recovered from the *Homoceras* interval to date. Work is currently underway to tie the well known shelf sequences further east (e.g. Arrow Canyon) to the SSR section.

A manuscript on the taxonomy of the Pennsylvanian ammonoids is in the final stages of preparation. The taxonomy and biostratigraphy of the lower Namurian ammonoids will be incorporated into the author's dissertation and published separately.

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Oldest Pennsylvanian Rocks in Forest City Basin

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Four cores recently drilled in the Forest City Basin in northwestern Missouri provided the opportunity for palynologic correlation of lower Pennsylvanian rocks in that basin with strata in the Illinois Basin. The cored interval includes the base of the Pennsylvanian to the base of the Desmoinesian (Westphalian D). The oldest Pennsylvanian rocks in the Forest City Basin, the McLouth Sandstone, were found to be Morrowan (Westphalian A) in age, the same as the Caseyville sandstones in the Illinois Basin. Previously, these rocks had been considered to be Atokan in age (Westphalian B and C). A younger, unnamed formation and the Riverton Formation contained spore assemblages comparable to those found in the lower half of the Tradewater Formation (formerly Abbott Formation) in the Illinois Basin; these formations are of Atokan age.

W. B. HOWE and KENNETH DEASON of the Missouri Division of Geology and Land Survey recognised the potential significance of these cores and approached R.A. PEPPERS to determine the age of these Lowest Pennsylvanian rocks in the Forest City Basin of Missouri. This study extends to the sandstone dominated Pottsville/Caseyville facies of the lower Pennsylvanian westward into the Forest City Basin. Results were recently presented in a poster session at the 1993 meeting of the North-Central Section of the Geological Society of America.

The earliest Carboniferous and the Devonian-Carboniferous Boundary in Argentina

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The Carboniferous System overlies Devonian and older rocks in southern and western Argentina. Early Carboniferous sediments were deposited at two separate areas: the western Precordillera and central Patagonia. However, the latest Devonian-earliest Carboniferous contact only occurs in the northern Precordilleran Rio Blanco Basin.

The Malimán Formation is a Lower Carboniferous preglacial sequence in the Rio Blanco Basin. It bears Tournaisian floral and faunal assemblages. The northern equivalent of the Malimán Formation in the Rio Blanco Basin is the Agua de Lucho Formation (GONZÁLEZ & BOSSI, 1986). Invertebrate fossils from these two formations are grouped in the *Protocanites scalabrinii - Rossirhynchus chavelensis* Assemblage Zone, or Malimanian Fauna (GONZÁLEZ, 1993). They also furnished abundant lycophytes that are being studied. The Malimán Formation does not extend to the southern Precordilleran Calingasta-Uspallata Basin. The central region of the Precordillera between these two basins, shows only continental, glacigenic sediments of probable Middle Carboniferous age overlapping Devonian and older deposits. In the Calingasta-Uspallata Basin, the El Ratón Formation bears an Early Carboniferous flora (ARRONDO, L972). No marine invertebrates were found in this Formation but its flora may be equivalent to that of the Malimán Formation. The El Ratón Formation discordantly overlaps the Middle Devonian El Planchón Formation (KERLLEÑEVICH, 1967).

A fairly good exposure of the Devonian-Carboniferous Boundary is available in the southwestern border of the Rio Blanco Basin, 10 km north of Malimán. This is the classic locality, and perhaps the only one known in Argentina, where the contact of fossil-bearing, oldest Carboniferous and youngest Devonian sediments are exposed. Detailed studies (FURQUE, 1963, 1979; BALDIS & SARUDIANSKY, 1975) have shown that in the southern segment of the Rio Blano valley, the Malimán Formation unconformably covers the Chigua Formation bearing Upper Givetian - Lower Frasnian invertebrates (FURQUE & BALDIS, 1973). The fossil record indicates that almost all of the Upper Devonian is missing between these formations, and the lapse involved is the Jagüelian Interval (GONZÁLEZ, 1989). The Late Devonian Precordilleran Orogeny (FURQUE & CUERDA, 1984) folded and faulted Devonian and older rocks, and marks the Devonian-Carboniferous Boundary. The earliest Carboniferous sediments were deposited in continental basins of the uplifted areas. Recently, the occurrence of a continuous Devonian - Carboniferous section was suggested at the Rio Blanco Basin. This assumption is based on a few tentatively identified plant remains (CINGOLANI *et al.*, 1990), but detailed taxonomic studies are necesary. This section should be of "Malimanian age", and probably correlated with the Jagüel Formation. This can be compared with the Zorritas Formation in northern Chile, which yields a Middle Devonian (Eifelian) fauna in its lower section and an Early Carboniferous fauna in its upper section. These two sections are separated by almost 500 m of unfossiliferous sediments (NIEMEYER *et al.*, 1985; ISAACSON *et al.*, 1985). However the position of the Devonian/Carboniferous Boundary is not clear, as pointed out by DUTRO and ISAACSON (1990).

The Rio Blanco Basin probably had a different tectonic history from the Sierra de Almeida Basin during the Late Paleozoic. However these two areas were linked paleogeographically by an arm of the sea during the Tournaisian, and their faunas have much in common. A similar paleogeographic connection was again established during the Late Carboniferous, when an arm of the sea from the "Pacific" flooded the Rio Blanco Basin. It is possible that subsidence in the Sierra de Almeida Basin and deposition of the Zorritas Formation has been continuous at the Devonian-Carboniferous Boundary, but this seems not to be the case in western Argentina.

The Devonian-Carboniferous boundary beds may be continuous in northern Chile, but are unconformable in western Argentina

In Central Patagonia, the Tepuel Group is a continuous sequence, and perhaps the most representative of Late Paleozoic age in Argentina. Its oldest unit, the Jaramillo Formation, furnished *Archaeosigillaria* cf. *conferta* (Frenguelli), dated from the earliest Carboniferous (ARRONDO, 1972). No marine fossils, but a few unidentifiable, probably brackish water, molluscs were found in this formation. The Jaramillo Formation is usually regarded as equivalent to the Malimán Fromation; however, the main problem of this correlation is that *Archaeosigillaria* is only found in Patagonia, but not in the Precordillera nor any other region of Argentina. In the type locality, the Jaramillo Formation conformably underlies the Middle Carboniferous Pampa de Tepuel Formation, so that it may be younger than the Malimán Formation, perhaps Viséan.

The relationship of the Jaramillo Formation with older rocks is unknown. The pre-Carboniferous basement in Patagonia consists of rocks of different lithologies that crop out in two localities at the northern and eastern borders of the Languiñeo-Genoa Basin. In these localities the Pampa de Tepuel Formation represents the most extensive flooding, as well as the greatest glaciation in Patagonia, that occurred during the "Barrealian age" (*Levipustula* fauna). In Meseta Catreleo, at the eastern border of the basin, the Carboniferous basement consists of a granitic stock that intrudes a sandy formation, the age of the intrusive being estimated from early Paleozoic to Devonian (LESTA, 1969). At the Arroyo Pescado area, at the northern border of the basin, patches of Carboniferous glacigenic sediments unconformably cover undated schists. The absence of fossils does not allow the assignation of these schists to the Devonian, but an Early or Middle Paleozoic age was estimated (ROLLERI, 1970). An account of the pre-Carboniferous basement in Patagonia was made elsewhere (GONZÁLEZ, 1984).

The Tepuel Group of Central Patagonia is the most representative sequence of Late Paleozoic age in Argentina

Carboniferous fossils were not found in the Sauce Grande Basin of eastern Argentina. Instead, post-glacial sediments bearing Early Permian *Eurydesma* fauna and *Glossopteris* flora of "Bonetian age", unconformably overlap Early Devonian rocks of the Ventana Group (HARRINGTON, 1972).

Conclusions

The Early Carboniferous was a period of marine and/or continental deposition in western and southern Argentina. The Malamanian faunal and floral assemblages in the northern Precord-

illera suggest a Tournaisian age, these being probably the oldest Carboniferous deposits in Argentina. Early Carboniferous plant-bearing formations of Precordillera and Patagonia bear different lycophyte associations, and a correlation between them should be revised. Tournaisian marine invertebrates only occur in the northern Precordilleran Rio Blanco Basin, and this association was linked with faunas of the upper Zorritas Formation of Northern Chile.

The Devonian-Carboniferous Boundary may be in a continuous stratigraphic sequence in northern Chile, but it is certainly unconformable in western Argentina. A classic locality for the Devonian-Carboniferous Boundary in Argentina is the southwestern border of the Rio Blanco Basin. In this area, the Tournaisian Malimán Formation unconformably overlies the Middle Devonian Chigua Formation.

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Carboniferous Research in Brazil

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1. Amazon and Solimões Basins, Northern Brazil

Conodonts. The taxonomy of Carboniferous conodonts from Monte Alegre, Itaituba and Nova Olinda Formations in the Amazon Basin and equivalent Juruá, Carauari and Fonte Boa Formations, Solimões Basin, Northern Brazil has been dealt with by VALESCA B. LEMOS (1992a, b); ten genera and twenty-eight Morrowan-Atokan species have been identified in the fauna.

Fusulinids. Fusulinids identified in cores from the Carboniferous Itaituba Formation of the Amazon Basin, Northern Brazil at well 1-NO-1-AM, include, among others, *Profusulinella* and *Eoschubertella* in the upper part and *Millerella marblensis, M. pressa, Eostaffella pinguis, Monotaxinoides transitorius* and *Hemigordius harltoni* in the rest of the sequence. The assemblages identified suggest a Morrowan-Atokan age for the section examined by SAVINI & ALTINER (1989).

Sequence Stratigraphy. LEMOS & MEDEIROS (1989) described a series of basin wide transgressive-regressive cycles of black shales, carbonates and evaporites in the Morrowan-Atokan Monte Alegre, Itaituba And Nova Olinda Formations of the Amazon Basin, Northern Brazil. Distribution of conodonts was controlled by the marine cycle transgression. They decrease in the upper part of the Carboniferous section under the increasingly arid conditions.

CAI of Carboniferous Conodonts. The CAI of conodonts was determined and a generalised CAI map was obtained for the Monte Alegre, Itaituba and

Nova Olinda Formations (Morrowan-Atokan), Amazon Basin, Northern Brazil (ROCHA- CAMPOS, 1992). Isograds varying from 1 to >5 in general agree with isopach patterns of the overburden, but indicate higher thermal levels probably due to heating by Mesozoic intrusives.

2. Parnaíba Basin, Northern Brazil

Facies Studies. Depositional systems characteristic of extensive desertic, evaporitic basin and carbonate platform environments have been identified in the Piauí Formation (Pennsylvanian), Parnaíba Basin, Northern Brazil (LIMA FILHO & ROCHA-CAMPOS, 1992).

Palaeontology. ANELLI *et al.*, (1992) interpreted the life habit of 14 bivalve genera from the carbonates of the Piauí Formation. The fauna that includes cosmopolitan genera, such as *Aviculopecten, Oriocrassatella, Wilkingia, Schizodus, Permophorus, Palaeonucula, Phestia* is typically "Tethyan", with strong affinities with those from the Pennsylvanian of the US.

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Contribution to Carboniferous stratigraphy and corals in China

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Abstracts of some recently published papers include:

(a) Lower Carboniferous faunas:

HUANG ZHUXI & DUAN JIYIE 1992. The Early Carboniferous corals of Dachaidan area in the northern margin of the Chaidamu Basin,Qinghai province. *Professional papers of Carboniferous corals of China,* 152-166. 15 genera and 20 species are described. These are common elements of *Yuanophyllum* Zone and *Thysanophylloides* Zone in South China.

(b) Upper Carboniferous fauna

WU SHIZHONG & LIN YINGDANG 1992. Early Late Carboniferous stratigraphy and Rugosa in the Taizihe Valley, eastern Liaoning, China. *Professional papers of Carboniferous corals of China,* 64-109. Two coral assemblages, *Taiziheophyllum-Caninophyllum* assemblage and *Arachnastraea-Benxiphyllum* assemblage in ascending order, are defined in the Benxi Formation. The Early Late Carboniferous corals comprise 36 species belonging to 21 genera, among which 2 genera, 26 species and 3 subspecies are new.

PENG XIANG-DONG, LIN YINGDANG and LI YENG 1992. The Late Carboniferous strata and coral fauna in the southern part of the North China Platform, *Professional papers of Carboniferous corals of China,* 113-149. A new coral assemblage, *Cyathocarinia-Lophotabularia-Gshelia,* is proposed. The authors systematically describe 22 genera (1 new genus) and 37 species (14 new species). Stratigraphical value of described fauna and Carboniferous-Permian Boundary are discussed.

A Research Programme on the Kasimovian of the Cantabrian Mountains

Dr LUIS C. SÁNCHEZ DE POSADA, Depto. de Geología, Universidad de Oviedo, 33005 Oviedo, Spain.

The Carboniferous deposits of the Cantabrian Mountains have been undergoing investigation for some time, so there exists nowadays a good overall knowledge of their main stratigraphic and paleontological features. The most extensive outcrops are to be found on the eastern half of the Cantabrian Zone, where thick series of Carboniferous strata crop out along the Central Asturian Coalfield, Ponga, Picos de Europa and Pisuerga-Carrión units. From Tournaisian to Kasimovian, most of these successions are composed of marine strata, especially in the easternmost units.

For several years the paleontological research group of the University of Oviedo has been

devoted to the study of diverse fossil groups (mainly ostracods, brachiopods, conodonts, fusulines) of Carboniferous age, with the ultimate aim of establishing in detail the faunal succession and the biozonation of the Cantabrian Carboniferous. Most recently (1989-1991) a Research Project from the Spanish DGICYT supported investigations that were mainly focused on strata ranging in age from Tournaisian to Moscovian, although some Kasimovian levels were also studied. The results have been published in several papers and a summary of these works can be seen in SÁNCHEZ DE POSADA *et al.*, 1990, and SÁNCHEZ DE POSADA *et al.*, 1992.

Extensive, fossiliferous Kasimovian deposits in the Cantabrian Mountains

Data obtained in the investigations mentioned above suggested that the Kasimovian deposits in the Cantabrian Mountains could be more extensive and richer in fossil content than had previously been supposed, thus advising us to concentrate our efforts on the study of this part of the Carboniferous succession. A new Project, devoted to the study of the Kasimovian of the Picos de Europa area and supported by the Spanish DGICYT, is currently in progress and will be carried out for the next years (1992-1994). First results are quite encouraging, since the study of diverse sections has revealed the existence of Kasimov-ian levels not previously known in the Cantabrian Mountains. These investigations also include the study of the uppermost Myachkovsky, so embracing the interval of interest for Project 5.

The team of specialists involved in these studies includes Prof. L. C. Sánchez de Posada (ostracods), Dr M. L. Martínez Chacón (brachiopods), D. C. Méndez (conodonts), Dr E. Villa (fusulinids) and Prof. Truyols, all from the University of Oviedo. Invaluable occasional collaboration is also being given by Dr A. C. van Ginkel (fusulinids, National Museum of Natural History, Leiden), Prof. J. Kullmann (ammonoids, University of Tübingen), Prof. B. Mamet (algae, University of Montreal), Dr S. Rodríguez (corals, Complutense University of Madrid) and Dr R. M. Rodríguez (spores, University of León).

References

SANCHEZ DE POSADA, L. C., MARTINEZ CHACON, M. L., MENDEZ FERNANDEZ, C., MENENDEZ ALVAREZ, J. R., TRUYOLS, J. & VILLA, E. 1990. Carboniferous Pre-Stephanian rocks of the Asturian-Leonese Domain (Cantabrian Zone) *in* R. D. DALLMEYER & E. MARTINEZ GARCIA (Eds) "Pre-Mesozoic Geology of Iberia". *Springer-Verlag. Berlin, Heidelberg*, 24-33.

SANCHEZ DE POSADA, L. C., MARTINEZ CHACON, M. L., MENDEZ FERNANDEZ, C., MENENDEZ ALVAREZ, J. R., TRUYOLS, J. & VILLA, E. 1992. El Carbonífero de las regiones de Picos de Europa y Manto del Ponga (Zona Cantábrica, N de España): fauna y bioestratigrafía. *Revista Española de Paleontología, Nº Extr.*, 89-108.

Upper Silesian Stratigraphy, Czech Republic

DR J. DVORÁK, Czech Geological Survey, Brno Branch, Leitnerova 22, 602 00 Brno, Czech Republic.

Dr Dvorák has provided a stratigraphic table (Figure 6) of the Czech part of the Upper Silesian Coal Basin, Northern Moravia. Of interest is the relative thickness of the clastic formations versus the coal, and their relative time distribution. The Coal seam Prokop is the first bed not folded by the Variscan deformation which ended in Moravia between E_{2b} / E_{2c}.

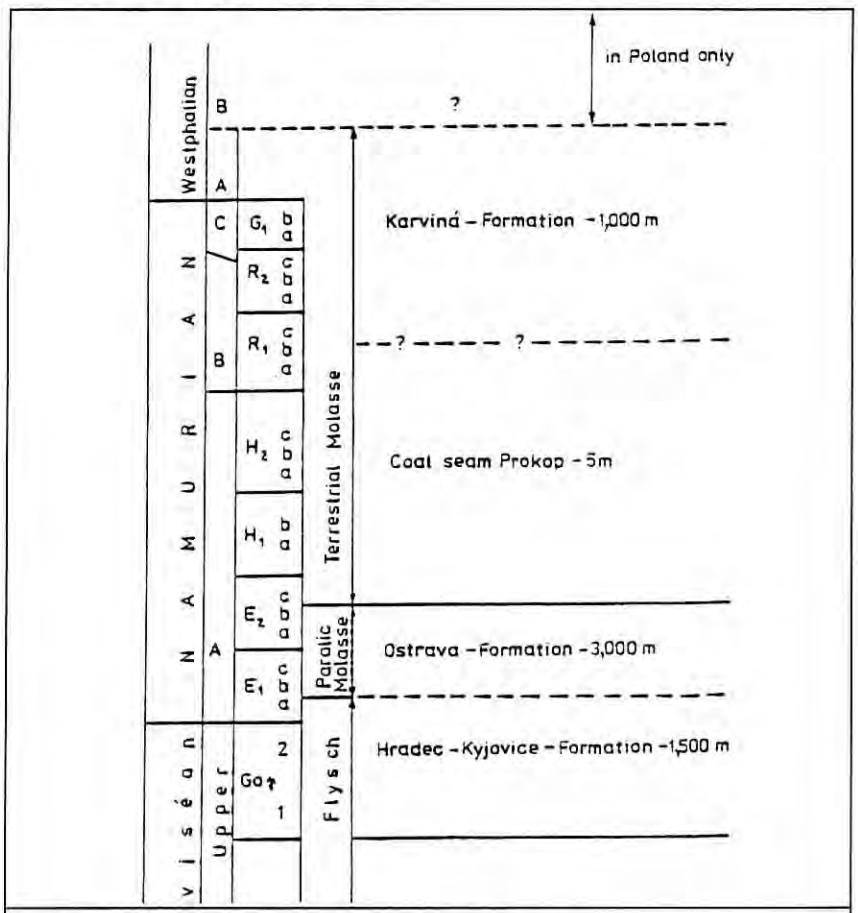

Figure 6: Upper Silesian Coalbasin (CR-part only)

Contribution to geology and palaeontology of Carboniferous deposits of the Czech Republic

JIŘÍ PEŠEK, IVO CHLUPÁČ and STANISLAV OPLUŠTIL, Dept of Geology of Mineral Deposits, Fac. of Science, Charles University, 128 43 Praha 2, Albertov 6, Czech Republic.

Carboniferous sediments, volcanites, pyroclastics and other volcanogenic rocks are found in less than one-tenth of the territory of the Czech Republic. Upper Carboniferous sediments are usually coal-bearing, and consequently they were in the past and still are exposed by numerous coal mines. Many localities of the Lower and Upper Carboniferous are characteristic of very good as well as artificial exposures showing relatively rich marine fauna (of the Lower Carboniferous to the Namurian A) or exhibiting numerous plant impressions (of the Namurian A to the Upper Stephanian). Several conferences organised in 1992 and in early 1993 such as "Present problems of coal mining" (held at Malenovice near Ostrava in April 1993), the Fourth conference on "Problems related to geology of coal deposits in large depths" (held at Zbýšov near Brno in September 1992) argue for high activity of Czech geologists in the field of coal geology.

The Seventh conference on geology of coal was held at the Faculty of Science, Charles University, January 26-28, 1993. This conference was organised to commemorate the unreached 65th birthday of the distinguished and significant Czech coal geologist Dr Václav Havlena, Associate Professor at Charles University who prematurely passed away. A total of 33 papers were presented at the conference. More than half of them were focused on the Upper Carboniferous of the Czech Republic. Nine authors dealt mostly with Tertiary coal-bearing sediments. Three papers were devoted to the reserves of fossil fuels. The spectrum of lectures dealing with the Upper Carboniferous was rather diverse: micro- and macrophytopaleontology (2 papers), tectonics (4), coal tonsteins (2), erosion and splitting of coal seams (1), red beds (1), geophysics (3). Proceedings of the conference were published (212 pages). The majority of papers, however, are only in the Czech or Slovak languages with no foreign language summary.

The organization of the conference and publishing of the proceedings were sponsored by Leco Instrumente GMBH.

Abstracts of some recently published papers:

DVOŘÁK, J. 1991. Geology of the carbonate evolution of the Devonian and the Lower Carboniferous near Grugov, Přerov, Sobíšky and Hranice (Northern Moravia). - *Scripta - Geology (Fac. Sci. Masaryk Univ. Brno)*, **21**, 37-62. Brno.

The sediments of Middle Devonian to Upper Viséan age were described. In the time of a transgression of the sea the reef-limestones were deposited. The termination of the reef sedimentation was accompanied by the slow regression of the sea and a considerably decelerated subsidence. Nodular micritic and biodetritic limestones were deposited. A very differentiated sedimentation pattern is documented in individual blocks conditioned by different subsidence of the basement. Uplift and tilting of the blocks took place simultaneously with the thrust which is reflected in the character of sedimentation.

DVOŘÁK J. 1992. Mutual relation of pre-flysch and flysch facies in the Moravian Paleozoic. - *Věstník Českého geologického ústavu*, **67(5):** 363-369. Praha.

The pre-flysch and flysch facies were previously considered to be discrete units, sharply separated from each other by hiatus and folding. However, biostratigraphic studies demonstrate these facies to pass each other both vertically and horizontally. The patterns of both sets differ substantially, and the flysch facies join very varied pre-flysch facies thus resembling a discordance. The flysch basin was formed as gradually synsedimentary deformed synclinorium with a conspicuous linearity which corresponds to a zone of maximal subsidence.

WAGNER W. & STANĚK S. 1991. Lagerstätten spaltbarer Tonschiefer in Europa mit besonderer Rücksicht auf den mährischs-schlesischen Kulm (in Czech). - *Geologický průzkum*, **33, 5:** 135-138. Praha

The splitting shale represents at present an incompletely evaluated mineral resource. In the past, it was widely used as roofing slate, and the Culm facies in Moravia and Silesia belonged to most important sites of economic significance in central Europe.

ZAPLETAL J. 1991. Slide paraconglomerates in Lower Carboniferous of Nízký Jeseník Mts. (Culm of Moravian-Silesian Belt, Bohemian Massif). *UAPO, Fac. r. nat. vol.* **103,** *Geographica-Geologica* **XXX,** 105-112. Praha.

The paper presents a summary evaluation of episodic slice paraconglomerate bodies in Culm sediments of the Nízky Jeseník Mts. (the Moravian-Silesian part of the Bohemian Massif). Two paraconglomerate types were established: pebbly mudstones and pebbly sandy mudstones. The slide bodies were deposed in sediments of the Fammenian-Tournaisian and the Upper Viséan flysch fore deeps, paraconglomerates are rich on the clastic material from older products of weathering and rocks afflicted with superficial denudation. Their origin was connected with movements of Variscan median mass and

Brunovistulicum between Devonian and Carboniferous and in Upper Viséan.

ZAPLETAL J. 1992. The Mírov Conglomerate - the oldest member of the flysch Variscides in Moravia (in Czech).- *Geologický průzkum* **34, 6:** 182-183. Praha.

The Mírov Conglomerate represents the lowermost part of the Mohelnice Formation at the base of the Culm facies (Upper Devonian or Lower Carboniferous). The pebble material is of local origin and does not support the concept of wide-range horizontal movements in the area studies.

Carboniferous of the Intrasudetic Basin

JANUSZ KUCHCIŃSKI, Biuro Geologiczne - Geonafta, Plac Staszica 9, 64-920 Piła, Poland.

In reference to the article by ZDZ. BELKA in *Przeglad Geologiczny* **8** , 478-479, I have forwarded a publication about the application of macrofloristic investigation of Carboniferous in the Intrasudetic Basin. The literature about this problem has increased from that time, but so far my opinion has not changed. In the article, I have stated my opinion that the boundary limit between lower and upper Carboniferous should be fixed between the Namurian A and B periods.

DEVONIAN-CARBONIFEROUS BOUNDARY VOLUME

EDITORS - M. STREEL, G. SEVASTOPULO & E. PAPROTH

Publication - Annales de la Société Géologique de Belgique 115 (fasc. 2), 405-708, June 1993.

Price - 500 Belgian Francs plus 650 Belgian Francs postage.

Contact - Prof. M. Streel, Services Associés de Paléontologie, University de Liège, Place du XX Août 7, 4000 Liège, Belgium.

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AMLER, M.R.W. - Shallow marine bivalves at the Devonian-Carboniferous Boundary from the Velbert Anticline (Rheinisches Schiefergebirge)

AVCHIMOVITCH, V.I.- Zonation and spore complexes of Devonian and Carboniferous Boundary deposits of Pripyat depression (Byelorussia)

AVCHIMOVITCH, V.I., TURNAU, E. & CLAYTON, G.- Correlation of uppermost Devonian and Lower Carboniferous miospore zonations in Byelorussia, Poland and Western Europe

BECKER, R.T.- Analysis of ammonoid palaeobiogeography in relation to the global Hangenberg (Terminal Devonian) and Lower Alum Shale (Middle Tournaisian) events

BLESS, M.J.M.- Comparison between eustatic T-R cycles around the Devonian-Carboniferous Boundary and the distribution of the ostracode taxon *Pseudoleperditia* gr. *venulosa*

BLUMENSTENGEL, H.- Ostracodes from the Devonian-Carboniferous Boundary beds in Thuringia (Germany)

BRAND, U.- Global perspective of Famennian-Tournaisian oceanography: geochemical analysis of brachiopods

BRAND, U. & LEGRAND-BLAIN, M.- Paleoecology and biogeochemistry of brachiopods from the Devonian-Carboniferous Boundary intervals of the Griotte Formation, La Serre, Montagne Noire, France

BRAUCKMANN, C., CHLUPAC, I. & FEIST, R.- Trilobites at the Devonian- Carboniferous Boundary

BYVSHEVA, T.V. & UMNOVA, N.I.- Palynological characteristics of the lower part of the Carboniferous of the Central Region of the Russian Platform

CLAOUÉ-LONG, J.C., JONES, P.J. & ROBERTS, J.- The age of the Devonian- Carboniferous Boundary

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HOUSE, M.R.- Earliest Carboniferous Goniatite recovery after the Hangenberg Event

KORN, D.- The ammonoid fauna change near the Devonian-Carboniferous Boundary

KÜRSCHNER, W., BECKER, R.T., BUHL, D. & VEIZER, J.- Strontium isotopes in conodonts: Devonian-Carboniferous transition, the northern Rhenish Slate Mountains, Germany

MAMET, B.- The Nanbiancun algal microflora: a study of the Devonian-Carboniferous Boundary in China

NEMIROVSKAYA, T.I., CHERMNYKH, V.A., KONONOVA, L.I. & PAZUKHIN, V.N.- Conodonts of the Devonian-Carboniferous Boundary section, Kozhim, Polar Urals, Russia

O'LIATHAIN, M.- Stratigraphic palynology of the Upper Devonian-Lower Carboniferous Succession in North Devon, Southwest England

SCHÖNLAUB, H.P.- The Devonian-Carboniferous Boundary at Grüne Schneid Section (Carnic Alps), a review

VAN STEENWINKEL, M.- The Devonian-Carboniferous Boundary: comparison of the Dinant Synclinorium and the northern border of the Rhenish Slate Mountains, a sequence-stratigraphic view

WINTER, J.- Identification of a bentonic ash layer by crystal morphology of its zircon population (Bed 79, Hasselbachtal, Rheinisches Schiefergebirge)

BLESS, M.J.M., BECKER, R.T., HIGGS, K., PAPROTH, E. & STREEL, M.- Eustatic cycles around the Devonian-Carboniferous Boundary and the sedimentary and fossil record in Sauerland (Federal Republic of Germany)

BECKER, R.T. & PAPROTH, E.- Auxiliary stratotype sections for the global stratotype section and point (GSSP) for the Devonian-Carboniferous Boundary: Hasselbachtal

WANG Cheng-Yuan.- Auxiliary stratotype sections for the global stratotype section and point (GSSP) for the Devonian Carboniferous Boundary: Nanbiancun

Dr KUCHCINSKI, provided copies of two papers from which the English summary has been reproduced:

KUCHCIŃSKI, J., 1984. Podstawowe Zagadnienia Stratygrafii Makroflorystycznej Utworów Karbonskich Niecki Sródsudeckiej. *Przeglad Geologiczny*, **7-8**: 345-347, 1 Table. (In Polish).

The author presents an outline of main achievements and of problems of macrofloristic stratigraphy of the late Palaeozoic Intra-Sudetic trough. The here presented schematical review reflects a lot of stratigraphical problems of the trough under study. The Intra-Sudetic trough is filled up by series of deposits referred to the age from Carboniferous up to Upper Cretaceous, inclusive. In spite of a generally uniform flora of that period, some floristic differences may be observed, here. On account of its situation, the flora of the trough discussed here, is closely related to that of the Bohemian basins and of the Upper Silesian Basin. Additional spore, petrographic-lithological and cartographic examinations may still lead to numerous changes in the present day opinions on the geological history of this area of Sudetes.

KUCHCIŃSKI, J., 1986. Flora Karbonska Pomorza. *Przeglad Geologiczny*, **9**: 527-529. (In Polish).

This paper deals with remains of macroflora found in core material of the Carboniferous in Pomerania (NW Poland). In that area, Dinantian (Lower Carboniferous) rocks are developed in marine littoral-neritic facies, and the Silesian (Upper Carboniferous) - in continental-limnic facies and red in colour in middle and upper parts of the section. The succession also displays thin (0.1-0.3 m thick) coal layers. The macroflora is represented by single specimens in the Lower Carboniferous, and limited assemblages in the Upper (but imprints only in red-coloured rocks). The record of macroflora well evidences the Lower Carboniferous, and Westphalian B and C, whereas that for the Westphalian D remains debatable. Macrofloral remains of the Namurian, Westphalian A and Stephanian age are still not known from this region.

Carboniferous Research in Poland

DR. STANISLAV SKOMPSKI, Institute of Geology, Warsaw University, PL-02-089 Warszawa, Al. Zwirki i Wigury 93, Poland.

Dr Skompsi has written detailing his research interests and recent publications.

Research topics:

Carboniferous stratigraphy: calcareous algae and conodonts;

Carbonate sedimentology: development and decline of carbonate platforms; cyclic sedimentation

Publications:

SKOMPSKI, S. 1992. Conodont stratigraphy of the Carboniferous deposits in the Lublin Coal Basin (E Poland) [in Polish, symp. abstract]. *Przeglad Geologiczny*, 1992/11, 609.

SKOMPSKI, S. 1993 (in press). Shell structure and affinity of the microproblematicum *Saccamminopsis*. *Lethaia*.

SKOMPSKI, S. 1993. Microfacies analysis of limestones as a key to the origin of Yoredale type cyclicity. [in Polish, symp. abstract]. *Przeglad Geologiczny*, 1993/5, 335.

NEMIROVSKAYA, T., SKOMPSKI, S., VARKER, V.J. *et al.* (in preparation). The conodont base for the Viséan/Namurian Boundary.

Type Archaediscacean Foraminifers (Carboniferous) from the Former Soviet Union and Great Britain

PAUL L. BRENCKLE, Amoco Production Company, PO.Box 3092, Houston. TX77253, USA.

With a Description Of Computer Modeling of Archaediscacean Coiling by C.J. GRELECKI, Amoco Production Company, P.O. Box 3385, Tulsa, OK 74102, USA.

Cushman Foundation for Foraminiferal Research, Special Publication No.30, p.1-59, 1993, 7 pls.

Archaediscacean foraminifers (Archaediscidae and Asteroarchaediscidae) are excellent biostratigraphic markers found worldwide in Lower and Middle Carboniferous shelf carbonates. Their utility, however, is compromised because the morphology of many species is not clearly understood due to inadequate original descriptions and illustrations or to subsequent misuse of names in the literature. This report reevaluates type specimens previously described in 16 Soviet and British papers representing many of the early taxonomic works on the group. The first author (PLB) examined and photographed most specimens on-site during a United States National Academy of Sciences exchange visit in 1984. Proposed nomenclatural changes include designation of lectotypes for *Archaediscus karreri* BRADY 1873, and *Trochammina robertsoni* BRADY 1876, and a new species name, *aliminimus*, for *Archaediscus minimus* GROZDILOVA & LEBEDEVA 1953, a primary homonym of *A. timanicus minimus* REITLINGER 1950.

Owing to their small size and preservation in limestone, archaediscaceans are usually examined in unoriented, whole-rock

thin sections. This method of study presents problems for identification in that the thin section expression of internal coiling patterns depends not only on morphology but also on orientation. Because the influence of orientation has generally been overlooked, many seemingly discrete coiling patterns and, hence, species described in the literature are probably synonymous. To deal with this problem, the second author (CJG) developed a computer program to construct and "thin section" three-dimensional models of selected archaediscacean coiling patterns. The results provided valuable insights for distinguishing morphologic changes from artifacts of orientation and greatly influenced interpretation of the Soviet and British type specimens.

Notes on Russian Research

IGOR S.BARSKOV, Paleontological Institute, Russian Academy of Science, Profsojuznaia 123, Moscow 117868 RUSSIA and DR.VERA TCHIGOVA, Department of Paleontology, Geology Faculty, Moscow State University, Moscow 119899 RUSSIA.

Dr Barskov reports that one of the main directions of research includes the correlation and interpretation of the DC Boundary between different regions of Russia, especially in subsurface sections. Dr.Vera Tchigova - Chairman of the Russian Working Group on CD Boundary - has been coordinating these studies and has collected considerable material from the borehole sections of Cis-Urals and Orengurg regions.

Dr Barskov also reports that he has accepted an invitation to join the SCCS Project Group 5 and will coordinate the studies on this topic in Moscow Basin and adjoining areas. Moscow State University conodont group and some students in the Paleontological Institute of the Academy of Science have collected specimens from the main reference Moscovian/Kasimovian sections near Moscow. They plan to revise the old macrofaunal collections and review the distribution and ranges of different fossils at the boundary.

Middle Carboniferous of the Urals (Stratigraphy and Fusulinids)

R.M. IVANOVA, Institute of Geology and Geochemistry, Ekaterinburg, RUSSIA.

There are two stages in the Middle Carboniferous of the Urals: the Bashkirian and the Moscovian.

First, the Bashkirian stage was discovered in the Bashkiria Mountains. Its stratotype is in the western slope of the South Urals along the Askyn River. It is described by Z.A. SINITSYNA & I.I. SINITSYN (1987). The Bashkirian stage embraces six foraminiferal zones:

1)*Plectostaffella bogdanovkensis*
2)Semistaffella variabilis
3)Pseudostaffella antiqua
4)Ps. praegorskyi - *Profusulinella staffellaeformis*
5) Ozawainella pararhomboidalis
6) Aljutovella tikhonovichi.

The above zones are represented by the following horizons: Bogdanovsky, Syuransky, Akavassky and Askinbashsky of the Lower Bashkirian substage; Tashastinsky and Asatausky of the Upper Bashkirian.

The Early Bashkirian deposits are widely extended, though there is some break, having the same volume as the *Homoceras* zone, in several sections of the boundary of the Lower and Middle Carboniferous. The Late Bashkirian deposits of the Urals are not widespread. At that time, terrigenous deposits were accumulated in the east slope and some breaks took place in sedimentation.

The regime of normal shallow-water basin with carbonaceous sedimentation was kept in the western slope. The sandstone-clayish-carbonaceous deposits of the Uraimian suite were accumulated only in the eastern part of it. All horizons of the Bashkirian stage are composed of, mainly, thin-or middle-layered limestones with thin interlayers of dolomites, marls, limestone conglomerates and argillites. Algal limestones, complicated by Donezelleae or Bereselleae limestone, conglomerates and breccias are characteristic.

There are sectione with a predominance of micrite without organic remains in the Ufimian amphitheatre of the western slope of the Urals. In the Early Bashkirian Age (Syuranian and Akavassian time) algae-stromatolitic and algal bioherms were widely distributed; in the Late Bashkirian - algal and stromatolitic limestones with *Palaeonubecularia*.

A long, narrow archipelago of isles formed in the Urals at this time which was why the area of water was reduced in comparison with the Early Carboniferous. However, isolation of basins on the west and east slopes of the Urals was weak.

The boundary between the Lower and Middle Carboniferous of the Urals takes place at the base of the foraminiferal zone of *Plectostaffella bogdanovkensis*. It corresponds with the foundation of the zone *Homoceras* and formation of signs of the conodont genus *Declinogathodus* (*D. noduliferus inaequalis*, *D. noduliferus noduliferus*, *D. lateralis*). Ammonoid zone *Reticuloceras - Bashkortoceras* corresponds to Syuranian horizon. Such understanding of "within-coil" boundary at the foundation of genozone *Homoceras* is reflected in the New Unifying Scheme of the Urals, 1990. It corresponds to the evo-

lutionary boundary of the foraminiferal development, and as well it corresponds to the Resolution of the International Committee on Carboniferous Stratigraphy. The boundary between parts of the zonal foundation *Plectostaffella bogdanovkensis* corresponds to the Mississ- ippian and the Pennsylvanian boundaries of the North American continent.

Concentrated species formation of the genus *Plectostaffella*; development of the genus *Millerella, Seminovella*; fixing of axis-oscillation of weaving up to 90° of Eostaffellidae; formation of three layered walls of Biseriamminidae; complication of additional mouths of Lasiodiscidae; concentrated development of small compressed *Neoarchaediscus, Endothyra bowmani, Semiendothyra surenica, Planoendothyra aljutovica, Endotaxis brazhnikovae, En. planiformis* are mostly typical for the Bogdanovsky horizon, responding to the *Plectostaffella bogdanovkensis* zone.

Zonal foraminifera of Bashkirian and Moscovian stages have similar composition on the western and eastern slopes of the Urals and over the Volga-Uralian region

The Bogdanovsky horizon corresponds approximately to the Donbass Voznessensky horizon and the upper part of the Koykebiltausky horizon of the Tian-Shan. All the rest horizons correlate with the same-age horizons of the Volga-Uralien region. The thickness of each horizon is from 15 m to 90 m.

The Moscovian stage was discovered by S.N. NIKITIN in Podmoscovian Hollow in 1890. In the Urals it includes following fusullinidae zones:

1) *Aljutovella aljutovica - Profusulinella prisca*
2) *Aljutovella priscoidea - Profusulinella librovichi*
3) *Fusulinella schubertellinoides - Fusulina schellwieni*
4) *Fusulinella colaniae*
5) *Fusulinella vozhgalensis - Wedekindellina uralica*
6) *Fusulina kamensis - F. elegans - Putrella brazhnikovae*
7) *Fusulinella bocki - Pulchrella* ex *gr. pulchra*
8) *Fusulina cylindrica*.

Zone 1 corresponds to the Verean horizon; zones 2 and 3 to the Kashirsky; zones 4-6 to the Podolsky; zones 7-8 to the Myachkovsky horizon.

The boundary between substages passes between the Kashirsky and Podolsky horizons or at the foundation of the zone *Fusulinella colaniae*. The boundary between the Middle and Upper divisions of the Carboniferous - at the base of strata with *Obsoletes* and *Protriticites*.

The Zninsky horizon, proposed by M. N. SOLOVIEVA is indistinct in the Urals because of the absence of genus *Hemifusulina* in the complexes of the Kashirsky horizon.

The most typical section of the Moscovian stage in the Urals is represented by the terrigenous-carbonate rocks, often with predominance of limestone conglomerates and breccias. It is mostly characteristic of the Podolsky horizon. Only the Myachkovsky horizon, composed of carbonate rocks in the south of Mugod- zhary, is an exception. Vereisky and Kashirsky sections are represented predominantly by terrig-enous, flysh-like formation. The quantity of limestone interlayers of terrigenous rocks increases from north to south. Vereisky and Kashirsky deposits are 40-125 m thick, Podolsky 300-1000 m, Myachkovsky 300 m thick.

In the Moscovian age, a chain of islands or narrow and long land separated the basins, which connected only in the southern part of the Urals.

B.I. CHUVASHOV subdivided several facies zones in the Eastern slope of the Urals:

1)Western zone of rough-fragmental and shoreline formations with packets, interlayers, inclusive of gypsum and anhydride; thin interlayers of carbonate with marine fauna
2)Western zone of sea flysh thickness (grey-coloured)
3)Central zone of wide development of carbonates. The main part consists of packets and interlayers of limestone forms the Upper Kashirsky and Podolsky horizons
4)Eastern sandstone-clayey flysh zone
5)Eastern zone of rough-fragmental red-coloured deposits with packets of volcanites.

Deposits of the Moscovian stage of the Western slope of the Middle and South of the Urals are know as Asyamssky and Serginsky suites. The regularity of arrangement of facies zones is the same as in the eastern slope. Facies zones are difficult to correlate due to the effects of overthrust tectonics.

Zonal foraminiferal complexes of the Bashkirian and Moscovian stages have similar composition on the western and eastern slopes of the Urals as well as in the vast territory of the Volga-Uralian region. This is probably the logical explanation for the single stratigraphic scheme existing for the Urals and Russian platform which places the Carboniferous in a single Eurasian biogeographical area. In this case, stratotypes of the Uralian horizons of Moscovian stage could be treated as hypostratotypes.

Stratigraphy of the Carboniferous System of the Urals

Dr O.A.SHCHERBAKOV, Polytechnical Institute, Komsomolskiy Avenue, 29-a, 614600, Perm, Russia.

The Carboniferous research group on the Urals has working for the last six years on the

composition of the Ural Unified Stratigraphical Scheme. The Scheme was constructed on the basis of the complex biostratigraphic zones of various ranks. The horizons and other stratigraphic units correspond to these biostratigraphic zones. According to this scheme, the Carboniferous system is subdivided into three series: Lower, Middle and Upper. The lower boundary of the system is located at the base of *Siphonodella sulcata* zone and the upper boundary in the base of *Daixina sokensis* zone. The boundary between the Lower and Middle Carboniferous is placed in the base of *Homoceras* zone. The boundary between the Middle and Upper Carboniferous is placed in the base of *Protriticites pseudomontiparus-Obsoletes obsoletus* zone.

The Lower Carboniferous includes three stages: Tournaisian, Viséan and Serpukhovian. Two subregional schemes are composed for the Lower Carboniferous; one for the western slope and the other for the eastern slope of the Urals.

The Lower Carboniferous of the western slope includes the following horizons: Humerovsky, Malevsky, Cherepetsky and Kizelovsky in the Tournaisian stage; Kosvinsky, Pesterkovsky, Ilychsky, Druzhininsky, Tulsky, Aleksinsky, Mikhaylovsky and Venevsky in the Viséan stage; Kosogorsky, Protvinsky and Staroutkinsky in the Serpuchovian stage.

The Lower Carboniferous of the Eastern slope includes the following horizons: Humerovsky, Rezhevsky, Pershinsky and Kizelovsky in the Tournaisian stage; Kosvinsky, Obruchevsky, Burlinsky, Ust-Grehovsky, Zhukovsky, Kamenskuralsky, Averinsky and Bogdanovichsky in the Viséan stage; Suntursky, Hudolasovsky and Chernyshevsky in the Serpuchovian stage.

The Middle Carboniferous for both slopes includes two stages: Bashkirian and Moscovian. The Bashkirian stage is divided into the following horizons: Siuransky, Akavassky, Askynbashsky, Tashastinsky and Asatausky. The Moscovian stage includes the following horizons: Vereysky, Kashirsky, Podolsky and Myachkovsky.

The Upper Carboniferous for both slopes consists of two stages: Kasimovian and Gzhelian. The Kasimovian stage includes the following horizons: Kreviakinsky, Hamovnichesky and Dorogomilovsky. The Gzhelian stage is subdivided into the following horizons: Dobrianinsky, Pavlovoposadsky and Noginsky.

The new stratigraphical scheme for the Carboniferous system of the Urals is very detailed and reflects complicated facies peculiarities of the region.

XIII ICC-P, Preliminary Registration Form

Family name: . . . . . .

First names . . . . . .

Degree . . . . . .

Female/male: . . . . . .

Institution : . . . . . .

Address: . . . . . .

. . . . . .

. . . . . .

Phone, fax, telex: . . . . . .

Student: yes . . . . . , no . . . . . .

Accompanying persons: . . . . . .

Please write in capitals. One person per form.

I plan to offer a contribution:
yes. . . . . no. . . . . oral . . . . . poster . . . . . .

Provisional title / authors/; underline the co-author who will present the lecture, if more than one author:

. . . . . .

. . . . . .

. . . . . .

will participate in excursion/s/: yes. . . no . . . . .

will pay in cash, or other . . . . . .

will participate in exhibition; yes . . . .no. . . . .

Please return this preliminary questionnaire by **15 March 1993** to the Secretary-General of the Polish Organising Committee. (See notice for address)

CONFERENCE NOTICES

XIII INTERNATIONAL CONGRESS ON CARBONIFEROUS-PERMIAN (XIII ICC-P) - 28 August to 2 September 1995, Kraków, Poland

INVITATION: The Permanent Committee and the Polish Organizing Committee extend to you a cordial invitation to attend the XIII International Congress on Carboniferous - Permian which will be held in Kraków, Poland from 28 August to 2 September 1995.

ORGANIZERS:
Panstwowy Instytut Geologiczny/Polish Geological Institute
Polish Organizing Committee of the XIII ICC-P

President:
Prof. dr. hab. Krzysztof JAWOROWSKI

Vice-President:
Dr Maciej PODEMSKI

Secretary-General:
Prof. dr. hab. Sonia DYBOVA-JACHOWICZ

Chairman of the Scientific and Programme Sub-Committee: Dr Ryszard WAGNER

Chairman of the Excursion Sub-Committee:
Hubert KIERSNOWSKI M.Sc.

CONGRESS TOPICS:
1. Global Syntheses: Palaeogeography, Plate Tectonics, Palaeoclimate
2. Stratigraphy and Palaeontology; Biostratigraphic Global Correlations
3. Sedimentology, Analysis and Reconstruction of Sedimentary Basins
4. Tectonics and Magmatism
5. Post-Depositional Transformations of Organic Substance; Coal Petrology and Geochemistry
6. Economic Geology /with special reference to coal, coalbed methane and hydrocarbons/
7. Ecological Impact of Coal Mining and Related Industries Activities

The official language of the Congress is English

PRE- AND POST-CONGRESS FIELD EXCURSIONS:
Several field excursions to important Carboniferous-Permian Sections in Poland and/or adjacent countries will be arranged

OTHER MEETINGS:
During the Congress there will be an opportunity for international organizations or working groups to meet/IUGS Subcommissions on the Carboniferous and Permian, International Committee of Coal Petrology, Commission Internationale de la Microflore du Paleozoique, IGCP Projects and others/. Please, contact the Polish Organizing Committee as soon as possible, if you wish to include such meetings in the programme, for convenient scheduling.

EXHIBITION AND SPONSORSHIP OPPORTUNITIES:
A comprehensive trade exhibition will be conducted in tandem with the Congress. In view of the importance of coal, coalbed methane and other mineral commodities to our daily lives, industry and especially to the environment, the organizers feel that manufacturers and suppliers of scientific instruments, environmental friendly appliances and services to the profession will welcome the opportunity to participate. Opportunity will also be provided for high profile sponsorship.

ACCOMPANYING MEMBERS:
Accompanying members will have an opportunity for short sight-seeing excursions, cultural events, and / or longer tours during the Congress

REGISTRATION FEE: US$ 300 /subject to change/

CORRESPONDENCE:
Further inquiries relating to the first circular of the Congress should be addressed to:

XIII ICC-P Secretary-General
Prof. dr. hab. Sonia DYBOVA-JACHOWICZ
Panstwowy Instytut Geologiczny
Oddzial Górnoslaski
1 Królowej Jadwigi
41-200 Sosnowiec, POLAND.

Phone: /48 32/ 66 20 36 or (38)
Fax: /48 32/ 66 55 22

NOTICE:
Please notify us of names and addresses of other persons or institutions in your country or elsewhere who might be interested in attending the XIII Congress ICC-P and should be included in the mailing list.

Early responses are important to the Secretary-General of the Polish Organizing Committee in order to formulate the scientific programme, field trips, etc.

A REPLY FORM IS PROVIDED FOR YOU TO PHOTOCOPY ON PAGE 40

INTERNATIONAL SYMPOSIUM ON PERMIAN STRATIGRAPHY, ENVIRONMENTS & RESOURCES - 28-31 August 1994, Guiyang, Guizhou, China

with INTERNATIONAL MEETINGS OF PANGEA PROJECT GSGP, IGCP 359 & IGCP 306

Laboratory of Palaeobiology & Stratigraphy, Nanjing Institute of Geology & Palaeontology, Chinese Academy of Sciences, NANJING, CHINA

INVITATION:
The Organizing Committee extends to you a cordial invitation to attend the International Symposium on Permian Stratigraphy, Environments and Resources which will be held in conjunction with meetings of **Pangea Project, GSGP, IGCP 359** (Correlation of Tethyan, Circum-Pacific and Marginal Gondwanan Permo-Triassic) and **IGCP 306** (Stratigraphic correlation of Southeastern Asian Palaeozoic-Mesozoic) **in Guiyang, Guizhou, China** trom 28-31 August 1994.

THE VENUE, GUIYANG:
Guiyang is the provincial capital of **Guizhou,** which is characterised by fully developed carbonate sequences from Sinian to Triassic, fantastic karst landscape, interesting geology, and highly diverse lifestyle and culture of local minority nationalities. The Permian marine sequences are fully developed around **Guiyang** and have been extensively studied and therefore, may prove to be of great significance to global correlation of the Permian. Foreign participants can reach there directly from Hong Kong by international airlines, or via Beijing, Shanghai, Guangzhou etc. by domestic airlines.

ORGANIZING COMMITTEE:
Chairman: Sheng Jin-zhang (Academic Member of Chinese Academy of Sciences, Nanjing Institute of Geology & Palaeontology)
Vice-Chairman: Wang An-guo (Vice-Chairman, The Science & Technology Association of Guizhou Province) Sun Shu (Academic Member of Chinese Academy of Sciences, GSGP) Members: A. Baud (SCTS), B. F. Glenister (WGCP), Hou Hong-fei (IGCP 306), E. Paproth (SCCS), Yin Hong-fu (IGCP 359)
Secretary General: Jin Yugan (Chairman, Laboratory of Palaeobiology & Stratigraphy, NIGP)

SCIENTIFIC TOPICS:
- Systemic and internal boundaries of Permian
- Palaeontology of Permian Faunas and Floras
- Global environmental change from Permian to Triassic
- Economic geology of Permian: coal, oil, phosphate, etc.
- Stratigraphic correlation of Palaeozoic & Mesozoic in Southeastern Asia
- Permian-Triassic mass extinction & radiation.

FIELD EXCURSIONS:
Pre-Symposium
1. Meishan section of Permian-Triassic Boundary, Changxing,
Zhejiang (Nanjing-Changxing-Shanghai-Guiyang, 4 days)
2. Shangsi section of Permian-Triassic Boundary, Guangyuan,Sichuan (Chengdu-Shangsi-Chengdu-Guiyang, 3 days)

POST-SYMPOSIUM:
3. Continental Permian in North Tianshan (Guiyang-Urumqi -Talongkou-Beijing, 7 days); participants interested in oil potential of Tarim Basin are welcome to join in an extended excursion (Urumqi-Korla-Kashi- Kuqa-Beijing, 10 days).
4. Marine Permian in Guizhou and Guangxi (Guiyang-Anshun-Lodien Liuzhou-Guilin, 10 days)

Excursion fee is estimated at $65.00 per day plus air fares between large cities.

BUSINESS MEETINGS & WORKSHOP:
The following international organizations & working groups are going to have business meetings during the symposium:
-Subcommission on Permian Stratigraphy, IUGS
-International Working Group on P/T Boundary
-International Working Group on C/P Boundary
-IGCP Project 359
-IGCP Project 306
-Chinese Working Group, Pangea Project, GSGP, IUGS
-Workshop on Permian conodonts

LANGUAGE:
The official language of the symposium is Chinese & English.

REGISTRATION FEE:
US $ 200.00. Registration fee for accompanying and student members will be at a reduced rate.

SECRETARIAT:
Further information relating to the symposium may be obtained from the secretariat at the address:

Dr. Wang Xiang-dong
Secretariat, Organizing Committee for ISP, 1994,
Laboratory of Palaeobiology & Stratigraphy
Nanjing Institute of Geology & Palaeontology
Chi'Ming-Ssu, Nanjing, 210008 CHINA

Phone: 86-25-714443 **Fax:** 86-25-712207

Specific questions concerning the working plan of international committees or working groups involved in the symposium should be directed to their chairpersons.

PLEASE RETURN THE REPLY FORM TO Dr. Wang Xiang-dong **BY 1 OCTOBER 1993**

A REPLY FORM IS PROVIDED ON PAGE 44

4th PALEOBOTANICAL-PALYNOLOGICAL CONFERENCE
Heerlen, The Netherlands, 19-23 September 1994

FIRST CIRCULAR

The fourth European meeting of paleobotanists and palynologists will be held in Heerlen, The Netherlands, 19-23 September 1994.

The chosen location is the **Rolduc Congress Centre in** Kerkrade near Heerlen which offers excellent and reasonably priced facilities for lectures and accomodation.

PROVISIONAL PROGRAM:

Monday 19 Sept.
Morning : Arrival/Registration
Afternoon: Opening; key-note lecture on Sequence Stratigraphy; lecture sesslons
Evening : Introductory lecture to regional geology

Tuesday 20 Sept.
Keynote lecture Dr B. Spicer; lecture sessions
Evening :
Reception by the Municipality of Heerlen
Jongmans Memorial Lecture by Dr R.H. Wagner and
Opening of the geology exhibition

Wednesday 21 Sept.
Key-note lecture(s) and lecture sessions
Evening: Guided visit to Maastricht

Thursday 22 Sept. Excursions

Friday 23 Sept. Excursions

Contributions dealing with all aspects of Paleobotany/Palynology are invited. Poster sessions are also envisaged as an alternative to oral presentations.

The Second Circular will be distributed in December 1993 to those who have registered; the last circular will be sent in July / August 1994.

EXCURSIONS

The region Belgium-Germany-The Netherlands offers many excursion sites for various purposes. The following field trips are planned:

1) Devonian-Carboniferous of Belgium and Germany: two days

2) Upper Cretaceous of southern Limburg and Belgium: one day

3) Mioçene brown coal pits in Germany: one day

4) Plio/Pleistocene in the Dutch/German border area: one day

5) Archaeology: one day

PUBLICATION

An abstract volume and excursion guides will be distributed during the conference. The congress volume will be published in the *Mededelingen Rijks Geologische Dienst* (Official publication of the Geological Survey of The Netherlands).

REGISTRATION

Please help the organisers by returning the attached registration form to the Secretary-General before 1 October 1993.

Chairman: H.W.J. VAN AMEROM, Geol. Surv. N.Rhine-Westphalia, PO Box 1080, D-4150 Krefeld l Germany.
(**Phone** 49-2151-897255; **Fax** 49-2151-897505).

Secretary General: G.F.W. HERNGREEN, Geol. Surv. of The Netherlands, PO Box 157, 2000 AD Haarlem, The Netherlands
(Phone 31-23-300359; Fax 31-23-401754).

4th PALEOBOTANICAL-PALYNOLOGICAL CONFERENCE, HEERLEN THE NETHERLANDS, September 1994 -Preliminary Registration Form

Family name: . . . . . .

Given names: . . . . . .

Postal address: . . . . . .

Phone:. . . . . .FAX:. . . . . .

Name of accompanying member(s):

. . . . . .

I intend to give a lecture:yes. . . . . no. . . . . .

I intend to present a poster: yes. . . . .no . . . .

I intend to participate in excursion(s), number (s)

. . . . . .

I prefer accommodation in the Congress Centre:
. . .single room (f.100-120 p.p./day full board)
. . .double room (f.87.50-100 p.p./day full board)

I prefer accomodation in a hotel:
Single room . . . . . double room . . . . . .

Method of travelling: car . . .train. . . .air. . . .

Date: . . . . . .

Signature . . . . . .

RETURN TO: Secretary-General 4th. European Paleobot. & Palynol. Conference, Dr G.F.W. Herngreen c/o Geological Survey of The Netherland,s PO Box 157, 2000 AD Haarlem, The Netherlands

FIRST FRENCH CONGRESS ON STRATIGRAPHY, TOULOUSE (France) 12-14 September 1994

This Meeting is organised by the French Stratigraphy Committee, University Paul Sabatier, Earth Sciences,Institute of Toulouse and the participation of Société Géologique de France.

SUBJECT OF CONGRESS:
The stratigraphy, foundation of all the research in sedimentary and historical geology was submitted to fundamental changes of its technologies, methods, concepts and global approach during the last two decades. This branch of the Earth Sciences, more and more diversified by its tools, progressively become more synthetic by its processes and finality. The French Committee on Stratigraphy deems it necessary to organize a Congress, in order to weigh its advances and to guide its evolution. Two topics will be emphasised: The methods and tendencies in sedimentary stratigraphy; the stratigraphic synthesis.

SCIENTIFIC PROGRAM:
12-13 September: Stratigraphic methods and tendencies, with participation of guest lecturers. Conferences and posters.

14 September : Stratigraphic synthesis: Conferences and posters organised by working group.

FIELD TRIPS:
Pre-congress field trip -11 September 1994: Jurassic Sequential Stratigraphy (Qercy, North Aquitanian Basin)

Post-congress field trip - 15 September 1994: Meso and Cenozoic Sequential Stratigraphy (North Central Pyrenees) and/or Palaeozoic succession (pre-tectonic, syn-tectonic and post-tectonic Variscan deposits in Central Pyrenees axial Zone)

OFFICIAL LANGUAGES:
French, English, Spanish.

SCHEDULE:
Early registration before: . . . . . 1 June 1993

2nd Circular distribution . . . . . 1 Oct. 1993

Return of registration form and payment of reduced registration fees . . . . . 1 Feb. 1994

Abstracts due . . . . . 1 May 1994

Publication of the abstracts in a special issue of *STRATA* (Toulouse) and of the proceedings in special issues of the Société Géologique de France after submission to 2 reviewers.

ACCOMMODATION:
Accommodation will not be organised by the Congress but a list of hotels will be sent.

INFORMATION: - Please contact:
BERNARC PEYBERNES, Laboratoire de Géologie sedimentaire, et Paléontologie-Université Paul Sabatier, 39, allées Jules Guesde
31062 TOULOUSE Cedex

Tél.(33) 61 53 02 35 (350)
Fax (33) 62 26 71 40

or: MARIE-FRANCE PERRET, Laboratoire de Géologie Structurale, et Tectonophysique- Université Paul Sabatier, 38 rue des 36 ponts
31400 TOULOUSE

Tél. (33) 61 55 6517 **Fax** (33) 61 55 82 5O

Permian Stratigraphy, China - Preliminary Registration Form

Family name: . . . . . .

First names . . . . . .

Degree . . . . . .

Female/male: . . . . . .

Institution : . . . . . .

Address: . . . . . .

. . . . . .

. . . . . .

Phone, fax, telex: . . . . . .

Student: yes . . . . . , no . . . . . .

Accompanying persons: . . . . . .

Please write in capitals. One person per form.

I plan to offer a contribution:
yes. . . . . no. . . . . oral . . . . . poster . . . . . .

Provisional title / authors/; underline the co-author who will present the lecture, if more than one author:

. . . . . .

. . . . . .

. . . . . .

will participate in excursion/s/: yes. . . no . . . . .

will pay in cash, or other . . . . . .

will participate in exhibition; yes . . . .no. . . . .

Please return this preliminary questionnaire by **1 October 1993** to Dr Wang Xiang-dong. (See notice on page 41 for address).

SCCS VOTING AND CORRESPONDING MEMBERSHIP LIST, 1993

Please check your entry and report any changes to the Secretary

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D-42103 Wuppertal, GERMANY

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Drs G. & R. Hahn
Inst.für Geologie und Paläontol.
Philipps-Universität Marburg
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D-35043 Marburg, GERMANY

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