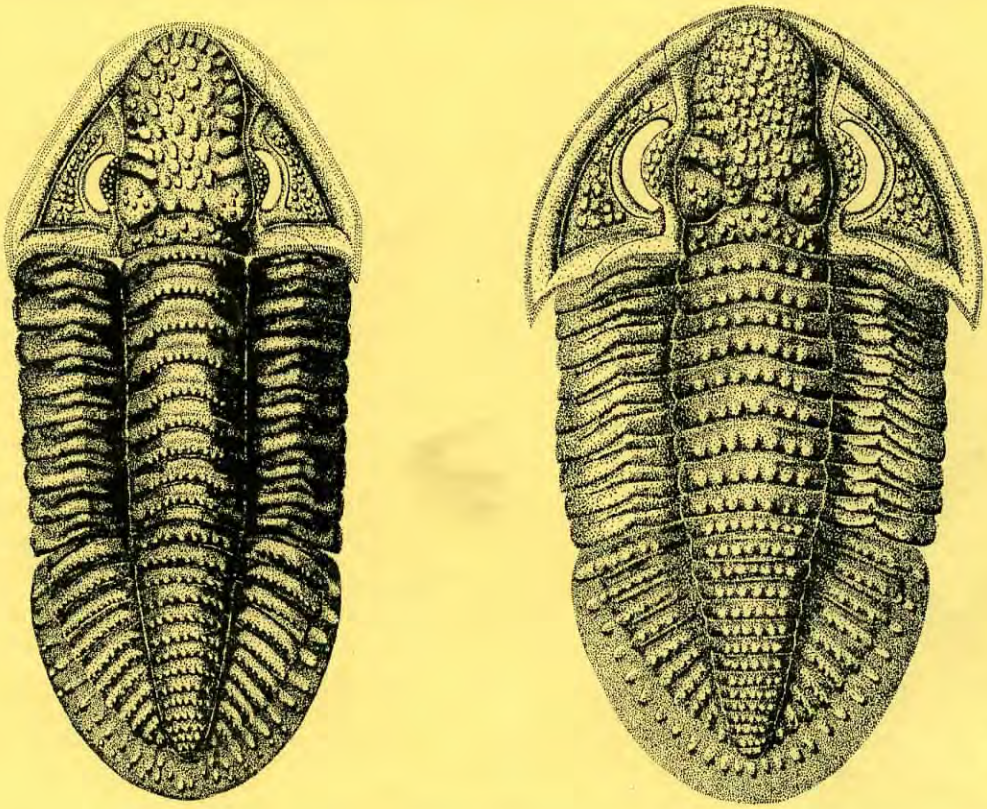
NEWSLETTER ON CARBONIFEROUS STRATIGRAPHY

Volume 12 July 1994



SCCS

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

Table of Contents

CHAIRMAN'S COLUMN . . . 1

SCCS ANNUAL REPORT 1993 . . . 2
Statement of Income and Expenditure 1992-93 . . . 2

MID-CARBONIFEROUS BOUNDARY WORKING GROUP . . . 3

PROJECT GROUP REPORTS . . . 4
Project Group 1: The "mid-Tournaisian" intercontinental boundary: recent activities . . . 4
Project Group 4: Ammonoid biostratigraphy at the base of the Westphalian and the Bloydian 4
Project Group 5: A boundary at the base of the *Protriticites* Zone . . . 6

COMMUNICATIONS FROM ICS . . . 7
Consolidated report about activities of ICS Subcommissions . . . 7
Genetic Stratigraphy . . . 8

CONTRIBUTIONS BY SCCS MEMBERS . . . 9
Research on the Tournaisian-Viséan transitional strata in S. China (Guangxi Autonomous Region) (Luc Hance et al.) . . . 9
Research on the Devonian-Carboniferous transitional strata in South China (Hunan Province) (Luc Hance et al.) . . . 9
On the correlation of radiometric and biostratigraphic data in the Namurian (J. Dvořák) . 10
Correlation between West–East European chronostratigraphic units: revision and corrections on the "Global Correlation Chart" of ICS (R.H. Wagner & C. Winkler Prins) 11
Recent research on Carboniferous black shales of Sinai, Egypt (M.H. Kolief) . . . 12
Rich faunas of Upper Famennian and Dinantian age (E. Thomas) . . . 12
Comments on the Devonian/Carboniferous boundary position throughout the Russian Platform (M.V. Durante & G.A. Rukina) . . . 13
Possible Levels of the Lower Carboniferous Subdivision in Moravia (Czech Republic) (J. Kalvoda) . . . 14
Lower Carboniferous plant assemblages of the Minussinsk Trough (V.T. Zorin) . . . 15
Biostratigraphy of the North Timan Carboniferous conodonts (N. Goreva) . . . 16
Carboniferous deposits of the southern area of Novaya Zemlya (R.A. Schecoldin et al.) . 17
Carboniferous miospores and stratigraphy of the western part of the Tunguska Syneclise (middle Siberia) (L.N. Peterson) . . . 20
Carboniferous of Brazil (A.C. Rocha Campos & L.E. Anelli) . . . 22

NEWS, REVIEWS & NEW PUBLICATIONS . . . 23
Ichthyolith Issues (Ed: Susan Turner) . . . 23
Notes from Argentina (Sergio Archangelsky) . . . 23
Retirements (Robert M. Kosanke and Brian Engel) . . . 23
Abstracts of papers . . . 23
Lower Carboniferous of Moscow syneclise and Voronezh anteclise (Eds: M.N. Solovyova & E.M. Shik) . . . 23
Late Carboniferous & Early Permian algal microflora (Liuzhou, South China) (Chun Li & B. Mamet) . . . 24
The Nanbiancun algal microflora: a study of the Devonian-Carboniferous boundary in China (B. Mamet) . . . 24
Upper Carboniferous fusulinids from Mt Maruyama Mine City, Yamaguchi Prefecture, Japan (Y. Ota) . . . 24
Faunal change of the Upper Carboniferous to Lower Permian fusulinaceans from the Akiyoshi Limestone Group (Y. & M. Ota) . . . 24
Early Carboniferous bivalvia from western Argentina (C.R. González) . . . 24
Field work in Russia (several authors) . . . 25
New contacts in Kazakhstan (several authors) . . . 25

CONFERENCE NOTICES . . . 26
XIII International Congress on Carboniferous-Permian (Kraków, Aug.-Sept.1995) . . 26, 30
Państwowy Instytut Geologiczny . . . 29
30th International Geological Congress, (Beijing, China, August 1996) . . . 29
First Circular - European Coal Conference '95 (Prague, June-July 1995) . . . 31, 32

CONTRIBUTIONS TO THE NEWSLETTER . . . 32

APPENDIX 1: SCCS Membership mailing list . . . 1-1 to 1-4

APPENDIX 2: SCCS Voting Members list 1992-96 . . . Back Cover

Newsletter on Carboniferous Stratigraphy

IUGS SUBCOMMISSION ON CARBONIFEROUS STRATIGRAPHY / VOL. 12 - 1994

Chairman's column

SCCS continues to seek progress with its two closely related, major objectives:

- the definition of international chronostratigraphic boundaries in the Carboniferous; and

- the "Global Correlation Program", commenced in 1989 at the SCCS meeting held in Provo, Utah.

The definition of the mid Carboniferous boundary is very close to a final recommendation from the responsible Working Group. After its receipt, it is expected that the Subcommission will conduct a postal ballot of its Voting Members asking them to endorse the proposition that the Arrow Canyon Section in Nevada, USA should be designated as the stratotype section. The procedure has taken much longer than is desirable but we will profit by this experience as we move forward to the definition of further boundaries.

The Global Correlation Program for the definition of other boundaries has benefited from the continuing cooperation of the relevant specialists. To date there are two possible definitions for the base of the Viséan (by foraminifers or by conodonts) which are being studied and, in the younger Carboniferous, fusulinid studies have provided encouraging stratigraphic evidence.

The necessity for globally accepted chronostratigraphic subdivision of the Carboniferous is evident. Palaeontology and radiometry appear to provide two of the most helpful tools but, within the limitations of each technique, it is essential that all methods/tools be tested and used with care and precision. Different techniques will act as a check on each other but even the most careful study can not guarantee that a chosen stratotype and point (GSSP) is the right choice.

May I repeat that chronostratigraphic subdivision of the Carboniferous is not a "purely scientific aim" but a pre-condition for all related scientific work. The choice of a GSSP is a scientific effort with the very practical aim of providing, by definition, a generally acknowledged scale which enables the process of global communication. It has been proved before that the definition of a GSSP (e.g. Devonian-Carboniferous boundary) is not the end but the beginning of successful, scientific studies which have been facilitated by the process of a GSSP definition.

Everybody interested in the Carboniferous is invited to cooperate within the framework of SCCS. Biostratigraphic studies from a local to a regional scale are important tools which we need in order to refine our data. Only by this means can the Carboniferous subdivisions become universally acceptable. The organisation welcomes suggestions or proposals from individuals which will further our objectives. Please contact me at any time to discuss ways and means by which such cooperation can be encouraged.

Finally, please try to attend the 1995 ICC-P Congress in Poland. Please return your enrolment form to the Congress Secretariat as soon as possible. The Subcommission will be organising special sessions including one with reports from the five Project Groups. With good progress in some groups, it may be time to consider the establishment of one or more formal Working Groups, each with a specific charter for boundary designation.

Eva Paproth

THE COVER ILLUSTRATION

Restoration of the complete dorsal shields of the Early Carboniferous trilobites *Palaeophillipsia robertsi* (ENGEL & MORRIS)(x5) (on left) and *Palaeophillipsia girvanensis* (ENGEL & MORRIS)(x3.7) (on right).

Both species belong to a suite of five trilobite taxa found in the Late Tournaisian - Early Viséan strata of eastern New South Wales, Australia. All species share the cephalic features of a long, gently-waisted glabella reaching or partly overhanging the anterior border, isolated pre-occipital lobes, long crescentic eyes, and dense nodose ornament. Evolution of the pygidia is marked by the ring count remaining near constant at 14(13) but with the number of rib pairs dropping progressively from 12 to 7 over their stratigraphic range. In combination with pygidial border changes, the group constitutes an excellent set of guide fossils.

ENGEL, B.A. & MORRIS, L.N. 1983. *Phillipsia - Weberiphillipsia* in the Early Carboniferous of eastern New South Wales – *Alcheringa* **7(3-4)**, 223-251, Figs 1-16, Tabs 1-4; Sydney.

SCCS ANNUAL REPORT 1993

Membership:

The Subcommission has 22 *Voting Members*, including the 2 Bureau Officers. In addition, there are 239 *Corresponding Members* and 6 *Libraries* on the mailing list (see Appendix 1). SCCS holds biennial meetings, one in conjunction with the International Congress on Carboniferous-Permian Stratigraphy and Geology (four yearly intervals) and the other at a Field and General Meeting of the Subcommission held midway between Congresses.

Bureau Officers:

Chairman: Dr Eva PAPROTH, Schwanenburgstr. 14, D-47804 Krefeld, GERMANY

Secretary/Vice Chairman: Dr B.A. ENGEL, Department of Geology, University of Newcastle, NSW 2308 AUSTRALIA

Activities in 1993:

1. Field and General Meeting held in Liège, June 1993.

Details of this very successful meeting were presented in *Newsletter 11* (July 1993).

2. Mid-Carboniferous Boundary Working Group

The Working Group met at the meeting in Liège in June 1993. As reported in the last Newsletter, the outcome of a review of all candidate sections at the Liège meeting was to limit the final choice of the potential stratotype to three sections, namely:

a) Stonehead Beck, UK;

b) Arrow Canyon, Nevada,USA;

c) Aksu-I section, Uzbekistan.

The Working Group was invited to recommend a final candidate section from these three, preferably by 15 January 1994. The outcome of that ballot was to recommend the nomination of the Arrow Canyon Section in Nevada, USA. Full details of the voting are presented in the Working Group Chairman's final report which appears on the following page.

SCCS Work Plans for 1994

These include:

- A decision on the Mid Carboniferous boundary stratotype.
- Preparation of documentation to support the above decision and its transmission with voting results to ICS/IUGS.
- Continuation of the Project Groups with a view to the improvement of global stratigraphical correlation.
- Radiometric dating of volcanic ash layers from biostratigraphically dated sections located on the Russian Platform.
- Preparation for the next meeting of SCCS at the XIII ICC-P Meeting in Poland in August-September 1995.

B.A. Engel, Secretary

STATEMENT OF INCOME AND EXPENDITURE 1992-93

INCOME	AUS$ Definitive	US$ Estimated
IUGS Grant for 1993	0.00	0.00
Donations from members	430.60	279.89
Bank interest	33.88	22.02
TOTAL INCOME	464.48	301.91
EXPENDITURE		
Newsletter 11 publication	543.00	352.95
Newsletter 11 postage	599.50	389.67
Liège Conference notices	131.30	85.35
Bureau postage & stationery	249.92	162.45
Bank charges	1.58	1.03
TOTAL EXPENDITURE	1525.30	991.45

Explanatory Note: Definitive income and expenditure are quoted in Australian Dollars. All income and expenditure have been converted at an exchange rate of AUS$1.00=US$0.65

BALANCE SHEET (1993)	AUS$ Definitive	US$ Estimated
Funds carried forward from 1992	1328.97	930.28
Exchange rate loss (0.70 to 0.65 US)		(66.45)
PLUS Income 1993	464.48	301.91
LESS Expenditure 1993	(1525.30)	(991.45)
CREDIT balance forward to 1994	268.15	174.29

BUDGET REQUEST FOR 1994	AUS$ Definitive	US$ Estimated
Newsletter 12 preparation/publication	575.00	374.00
Newsletter 12 postage	600.00	390.00
Bureau expenses	250.00	163.00
Drafting support for "CARBONIFEROUS OF THE WORLD", Volume 3	154.00	100.00
PROJECTED EXPENDITURE	1579.00	1027.00

The Subcommission has been advised by ICS that it has been allocated US$ 485.00 in IUGS funding for 1994.

Mid-Carboniferous Boundary Working Group Decision

H.Richard LANE, Paul BRENCKLE, Amoco Production Co., PO Box 3092, Houston, Texas USA and Alan HIGGINS, Strata-Data Ltd, 9 Treglos Court, Oatlands Drive, Weybridge, Surrey, UK, KT13 9JG.

Following the meeting of the Mid-Carboniferous Working Group in Liège (8 June 1993) at which three candidate sections (Arrow Canyon, Nevada; Stonehead Beck, UK; and Aksu-1, Gissar Ridge, Uzbekistan) were selected for a decision on which section was to be recommended as a stratotype section for the boundary, two postal votes have been held. At the meeting, the SCCS asked the Mid-Carboniferous Boundary Working Group to have a final recommendation for a boundary stratotype to the Chairman of SCCS, Eva Paproth by 15 January 1994.

Extensive documents, describing the current state of knowledge of each of the three sections, were circulated to all 19 voting members of the working group together with a ballot paper. It was recommended that the votes be placed in order, 1, 2 and 3, with 1 having the highest priority, and that the candidate section with the lowest total should be recommended to the SCCS. All 19 members voted in the ballot (table 1, first ballot) by 15 January 1994, and the result indicated a preference for the Arrow Canyon Section. However, both Arrow Canyon and Stonehead Beck received the same number of first choice votes and, after extensive consultation between the officers of the Working Group and the officers of the SCCS, it was thought that at least one more ballot should be held, on a first past the post system, between Arrow Canyon and Stonehead Beck.

ICS rules on stratotype voting are clear on the methodology to be used by the Subcommission but are less clear on Working Group procedures. We are of the opinion that the rules indicate that the favoured candidate section should receive a 50%+1 vote before being forwarded to the SCCS. The second ballot (table 1, second ballot) which closed on 15 February showed a clear preference for the Arrow Canyon Section with a greater than 50%+1 vote and accordingly this result has been forwarded to the SCCS with a recommendation that the Arrow Canyon Section be selected as the stratotype for the Mid-Carboniferous Boundary.

(**Editorial Note**: Very recent field work has necessitated small, late stage modifications to the exact boundary level in Arrow Canyon resulting in a delay until the Working Group members are advised of the changes and asked to approve this modification to their earlier decision.

Once the decision has been confirmed, the SCCS Voting Members will then be asked to approve/disapprove the selected candidate stratotype section. This vote requires a 60% majority of the Voting Membership).

FIRST BALLOT RESULTS				SECOND BALLOT RESULTS		
Name	A.C.	Aksu	S.B	Name	A.C.	S.B.
Brenckle, P.	1	2	3	Brenckle, P.	x	
Dvorak, J.	2	3	1	Dvorak, J.		x
Engel, B.	2	3	1	Engel, B.		x
Gastaldo, R.A.	1	3	2	Gastaldo, R.A.	x	
Gibshman, N.	1	3	2	Gibshman, N.	x	
Higgins, A.C.	3	2	1	Higgins, A.C.		x
Igo, H.	1	3	2	Igo, H.	x	
Jing-zhi, Y.	2	1	3	Jing-zhi, Y.	x	
Lane, H.R.	1	2	3	Lane, H.R.	x	
Manger, W.	2	3	1	Manger, W.		x
Nemirovskaya, T.	2	1	3	Nemirovskaya, T.	x	
Owens, B.	2	3	1	Owens, B.		x
Paproth, E.	2	3	1	Paproth, E.		x
Perret, M.F.	2	3	1	Perret, M.F.		x
Ramsbottom, W.H.C.	3	2	1	Ramsbottom, W.H.C.		x
Rocha-Campos, A.	1	3	2	Rocha-Campos, A.	x	
Skipp, B.	1	2	3	Skipp, B.	x	
Yi-ping, R.	2	1	3	Yi-ping, R.	x	
Zhi-hao, W.	1	2	3	Zhi-hao, W.	x	
Total Scores	32	45	37			
No. of First Votes	8	3	8	No. of First Votes	11	8

Table 1: Results of the two postal ballots held by the Mid-Carboniferous Working Group in order to decide the nomination for the Mid-Carboniferous Boundary Stratotype (A.C. = Arrow Canyon section, Nevada, USA; Aksu = Aksu-1 section, Uzbekistan; and S.B. = Stonehead Beck section, UK). The first, preferential ballot added the raw scores (1, 2, 3) together to give a total score from which the section with the lowest total was to be designated as the successful candidate section. As this ballot also recorded a tie for the number of primary votes (8 each) for two of the sections, a second ballot requiring the choice of only one candidate was conducted, after the elimination of the least favoured third candidate in the first ballot. This resulted in the Arrow Canyon Section, Nevada being chosen as the preferred stratotype section by the Working Group.

PROJECT GROUP REPORTS

PROJECT GROUP 1: The "mid-Tournaisian" intercontinental boundary: recent activities

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

Vladislav POLETAEV (Institute of Geology, Ukrainian Academy of Sciences, Kiev) visited the Project Leader in mid-May during which there was some discussion on how to reactivate mid-Tournaisian boundary studies in the former Soviet Union. Previous arrangements for cooperative studies ended with the downfall of the Soviet Union and the breakup of the All-Union Stratigraphical Committee into regional groups supported by the individual republics. Vlad will investigate the possibility of obtaining funds from the International Science Foundation (Soros) or other agencies to assemble a multidisciplinary team of FSU palaeontologists who will study mid-Tournaisian successions in the Donets Basin (Volnovakha River region), Ukraine; South Urals (Zilim River, Bashkiria), Russia; South Kazakhstan (Bolshoi and Malyi Karatau); and Uzbekistan-Kyrgyzstan (Fergana Valley). Even if Vlad is successful in obtaining funds, it probably will not be until next year that the group could start generating information, and most likely little will be available at the time of the next Carboniferous Congress.

Details of the collaborative activities of Luc HANCE (Belgian Geological Survey) in China are presented separately in this Newsletter (p.9).

Uwe BRAND (Brock University, St Catherines, Ontario) is in the process of establishing world-wide collaboration for the study of geochemical changes across the Mid-Carboniferous Boundary.

Recent publication:

BRENCKLE, P.L. and WAHLMAN, G.P. - *Conilia*, a new Upper Paleozoic pseudovidalinid foraminifer – *Mem. Inst. Geol. Univ. Louvain* **35** (Conil Memorial Volume).

PROJECT GROUP 4: Ammonoid biostratigraphy at the base of the Westphalian and the Bloydian

Jürgen KULLMANN and Svetlana V. NIKOLAEVA, Institut für Geologie und Paläontologie, Universität Tübingen, Sigwartstr.10, D-72076 Tübingen, Germany.

Although this boundary seems to be well marked lithologically in several successions and shows notable changes in the evolution of ammonoids, its correlation in different regions is problematic. Following the Carboniferous Congress in Buenos Aires (1991), the senior author was asked to organise an international research group to investigate the possibilities of defining this boundary

Donations

The Bureau is most grateful for the generous donations received from the membership during 1993-94. With an IUGS subsidy of US$485.00 in 1994, we will now have in hand sufficient funds to produce and distribute this edition of the Newsletter.

Members are invited to continue their support into 1994-95 by forwarding small donations, billing their **MasterCard** or **Visa** credit card using the form enclosed with this *Newsletter*. Because of currency fluctuations, it would be preferred if you could nominate an amount in **Australian Dollars** - the credit card company will do the conversion and we will not run the risk of overcharging you. Approximate current conversion rates for the Australian dollar at the time of publication are indicated on the form. Please note however that these rates are unstable and probably will have changed by the time the *Newsletter* is delivered.

European members can send their donation direct to the SCCS Chairman, EVA PAPROTH. Funds should be sent to DEUTSCHE BANK, KREFELD for deposit in ACCOUNT No. 598367. Please do not send personal cheques to the Secretary since the bank charges (~AUS$8) can minimise the value of the donation.

DONATIONS IN 1993-94

Dr P. Brenckle, USA
Dr J.L. Carter, USA
Dr C.J. Cleal, UK
Dr R.M.C. Eagar, UK
Dr F.R. Ettensohn, USA
Dr W.H. Gillespie, USA
Dr C.R. Gonzalez, Argentina
Dr Hisayoshi Igo, Japan
Dr Kunihiro Ishizaki, Japan
Dr F. Kahler, Germany
Dr M.F. Perret, France
Dr G. Playford, Australia
Dr S. Rodríguez, Spain
Drs C.& J. Ross, USA
Dr C.A. Sandberg, USA
Dr W.J. Sando, USA
Dr Sumio Sakagami, Japan
Dr S. Stojanovic, Australia
Dr Kozo Watanabe, Japan
Dr R.R. West, USA
Anonymous France (x1), Germany (x1)
Anonymous Japan (x2), USA (x1)

in Upper Carboniferous sequences.

The boundary between Namurian and Westphalian is drawn in Western Europe by the bed with *Gastrioceras subcrenatum*. *Gastrioceras* was preceded by *Cancelloceras* which became extinct at the end of the Namurian. According to RUZHENTSEV & BOGOSLOVSKAIA (1978), NASSICHUK (1975) and NIKOLAEVA & KULLMANN (in press) these genera can be readily differentiated, mainly on the basis of their ornamentation. Species of *Cancelloceras* possess a reticulate ornamentation, whereas in *Gastrioceras* the spirals are almost absent or considerably reduced, and the test lacks a reticulate pattern. Several species indicate this change in the gastrioceratid lineage.

The uppermost Namurian

The upper Namurian *Gastrioceras*-1 (G_1) Zone is well documented by ammonoids: it contains 27 genera, 12 of which appeared for the first time in this interval with most of them being described from the Southern Urals. The family Gastrioceratidae is represented by the genera *Cancelloceras* and *Agastrioceras*. The first species of this family appeared earlier in the R_2 Zone (*C. lineatum, C. karpinskii*), but, beginning with the G_1 Zone, gastrioceratids form the most significant part of the ammonoid assemblage.

Western Europe: The G_1 Zone in Great Britain is subdivided into two subzones: *C. cancellatum* and *C. cumbriense* (RAMSBOTTOM & CALVER 1962). The first subzone consists of three successive assemblages typified by different species of *Cancelloceras*. The base of the G_1 Zone is marked by the entry of the first assemblage containing *C. branneroides*. In Germany and Belgium this boundary is not specified, because *C. branneroides* and *C. cancellatum* seem to be absent. The second assemblage of the *C. cancellatum* Subzone contains the old species *B. superbilinguis* and occurs in the British succession a few feet above the layers with *C. branneroides*. The third assemblage includes *Agastrioceras carinatum*, *C. crencellatum* and *C. rurae*. RAMSBOTTOM & CALVER (1962) and PATTEISKY (1965) correlated this part of the *cancellatum* Subzone to the "Hauptflöz Horizont" in the Ruhr Basin in Germany where both *C. crencellatum* and *A. carinatum* are abundant. This level apparently corresponds to the second marine band below the Fraxhisse horizon in Belgium. In Germany, these species are known from the "Schieferbank Horizont" (PATTEISKY 1965), and in Belgium from the first marine band below the Fraxhisse horizon.

USA: The equivalent of the lower boundary of the G_1 Zone in the Arkansas sequence lies within the *Arkanites relictus* Zone which is subdivided into two subzones (MANGER & SAUNDERS 1980). The lower boundary of the upper *Cancelloceras huntsvillense* Subzone contains the association of *Arkanites relictus* and *C. huntsvillense*. The entry of the latter species marks the base of the *C. huntsvillense* Subzone, which is correlated with the lower boundary of the G_1 Zone. *C. huntsvillense* ranges to the top of the *Verneuilites pygmaeus* Zone (uppermost Halian).

Southern Urals and Central Asia: In this region, sediments equivalent to the G_1 Zone are referred to the upper *B. superbilinguis* Subzone of the *Bilinguites -Cancelloceras* Genozone (RUZHENTSEV & BOGOSLOVSKAIA 1978; NIKOLAEVA, in press). This subzone is defined by the stratigraphic range of *B. superbilinguis*.

The lowermost Westphalian

With the beginning of the Westphalian (and Bloydian) a remarkable changeover took place: about 50 species, 14 genera, 5 families and 2 superfamilies appeared for the first time (Database GONIAT, KORN & KULLMANN 1994). One of the initial species of the Schistocerataceae, *Branneroceras branneri*, is regarded as an index form for the lower Bloydian and is mainly known from North America. Reticuloceratidae and Surenitidae became almost extinct by the end of the Namurian being represented only by species with a dwarfed conch and simplified suture.

Western Europe: The base of the Westphalian is marked by the entry of *Gastrioceras subcrenatum*, the first gastrioceratid species lacking a reticulate ornament on the entire surface. In Britain, this level corresponds to the boundary between the lower and upper Galifaxian beds, drawn at the base of the marine band overlying the Pot Clay Coal. Occurrences of *G. subcrenatum* are widely distributed through England; in Germany *G. subcrenatum* occurs in the marine horizon above the "Sarnsbank Horizont", and the boundary is drawn at the base of this horizon. RAMSBOTTOM & CALVER (1962) reported that *G. subcrenatum* in Belgium occurs in the Fraxhisse horizon to be correlated with the boundary under consideration.

USA: In Arkansas the upper boundary of the G_1 Zone corresponds to the top of the *Verneuilites pygmaeus* Zone of uppermost Halian age. The beginning of the Bloydian is defined by the first occurrence of *Branneroceras branneri* (McCALEB 1968 and others). In most sections the upper boundary of the *Verneuilites pygmaeus* Zone coincides with the Halian-Bloydian boundary, except for locality 115 of the Kessler Mountains where among other ammonoids *Cancelloceras huntsvillense* occurs in the basal Bloydian (MANGER & SAUNDERS 1980). In Eastern Kentucky the possible equivalent of the basal Westphalian lies within the Pottsvillian Coal Measures (Breathitt Formation) where *Gastrioceras occidentale* was found (FURNISH & KNAPP 1966). These authors reported the resemblance of the latter species to *G. subcrenatum*.

Canada: The equivalent of the Namurian-Westphalian boundary in Arctic Canada is drawn within the Otto Fyord Formation (NASSICHUK 1975). The ammonoid faunas contain the typical elements of Bloydian (or Westphalian) *Branneroceras, Bisatoceras, Gastrioceras* spp. The precise stratigraphic position of these occurrences, especially the entry of *G. subcrenatum* is not yet clear because *B. branneri* is not known from precise sections of Western Europe. Two *Gastrioceras* species

described by NASSICHUK (1975) from the Otto Fyord Formation differ in conch ornamentation from all known forms in Western Europe and cannot be used to correlate Canadian and European sequences.

Central Asia: The G_1-G_2 boundary is usually correlated with the boundary between the lower and upper Bashkirian. Early Bashkirian ammonoids are common in this region, and localities of G_1 ammonoids were reported from the Middle and South Tian-Shan (ZAKHAROV 1969, RUZHENTSEV & BOGOSLOVSKAIA 1978, NIKOLAEVA in press). Occurrences of late Bashkirian ammonoids are frequent, but not sufficiently studied. One single section containing ammonoids of both G_1 and G_2 zones was described by NIKOLAEVA (in press). Situated in South Fergana (north part of the Katrantau Ridge, dried stream Shuran-sai), it exposes limestones of the Shuran Series ranging from R_2 to G_1 and containing *Cancelloceras* at the top; they are overlain by sandstones, conglomerates, limestones and shales of the Yangak Series containing *Branneroceras*. The interval of 50m between the last occurrence of G_1 and the first occurrence of G_2 is unexposed.

Donets Basin: The Namurian-Westphalian boundary is drawn at the base of the "Limestone G1" (POPOV 1979) and corresponds to the lower-upper Bashkirian boundary. The Kayalian Stage proposed by RAUZER-CHERNOUSOVA (1949), although very convenient to the ammonoid-based correlation, is not used in accepted stratigraphic schemes for the Donets Basin. The uppermost occurrence of *Cancelloceras* is confined to the "Limestone F2" with *C. infans*. The first *Gastrioceras* occurs in the "Limestone G1" and is represented by *G. listeri*. Certainly, this level does not necessarily coincide with the base in Western Europe where *G. listeri* appears later than *G. subcrenatum*.

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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.

Dr Villa reports the following items detailing the activities of her group:

1. Dr Vladimir DAVYDOV (St Petersburg) and Dr Kozo WATANABE (Tokyo) visited the University of Oviedo and the Cantabrian Mountains in November 1993. The opportunity was taken to inspect several outcrops belonging to the Moscovian/Kasimovian transition. Discussion took place on the fusulinid assemblages, not only from the Cantabrian Mountains, but also from many other sections that have been studied by Dr DAVYDOV in different areas of Russia and Middle Asia.

2. Dr Alexandra DZHENCHURAEVA from Bishkek (Kyrghyzstan) has recently agreed to join the Project Group. Dr DZHENCHURAEVA expects to be able to present the results of new research on the fusulinids of the Moscovian/Kasimovian transition in Kyrghyzstan in the coming months.

3. Dr VILLA would like to make a request to all members of the group to forward progress reports of their investigations by the end of this year. In 1995, it will be six years since the group was created, a term which should be long enough to present a proposal to SCCS. Dr Villa would like to compile all local reports into an overall report for presentation at the Carboniferous Congress in Poland. Therefore, in order to leave enough time for discussion, all reports should reach her **NO LATER THAN DECEMBER 1994**.

Consolidated report about activities of ICS Subcommissions

Jürgen REMANE, Chairman of ICS, Neuchatel, December 1993.

1. Introduction

Prof. REMANE prepared the following summary notes for presentation to IUGS based upon reports from ICS constituent bodies. These notes are reproduced here for the information of the SCCS membership. The notes have been circulated to Voting Members of ICS for comment and correction.

Summary of Subcommission annual reports

2.1. Precambrian SC

According to the new administrative structure of ICS, the **Working Group on the Terminal Proterozoic System** is incorporated in the Precambrian SC, but for 1993 we received separate reports.

As to the Precambrian SC (s. str.), it should be stressed that a new subdivision of the Archean is being proposed. It follows the same scheme as the subdivision of the Proterozoic (ratified by IUGS in 1990), i.e. chronostratigraphic boundaries defined in terms of absolute ages and not by GSSPs. Interestingly the notion of a Hadean era corresponding to the period from which no rocks are preserved, has not been retained by the SC, which is certainly a good thing.

The work program of the SC shows that a very extensive discussion of the proposed new Archean subdivision is planned. The submission of a final project to ICS can be expected for 1995, after the South Africa meeting.

Terminal Proterozoic System WG

The base of this system (which has still to be named) was fixed at 650 Ma B.P. together with the Proterozoic subdivision adopted by IUGS in 1990. But this system offers better possibilities for correlation than the rest of the Precambrian, thanks to acritarchs, Ediacara type assemblages and trace fossils. Research in this field seems to have made good progress, and the definition of the system's lower boundary through a GSSP is envisaged.

Very active group cooperating closely with relevant IGCP projects, especially Project 320, with a very informative common newsletter.

2.2. Cambrian SC

For the Cambrian, the subdivision on stage level is not as well settled as e.g. in the Devonian. The SC now concentrates its work on this task, focusing on the lowermost stage: This is a new problem, because the newly defined base of the Cambrian lies deeper than the classical boundary at the base of the Tommotian. Discussion about the lower boundary of the Cambrian seems still to go on, but it has to be stressed that the GSSP defining the boundary at Fortune Head, Newfoundland, has been voted in due form and ratified by IUGS.

2.3. Ordovician SC

The reorganisation of the Cambrian-Ordovician Boundary Working Group (COBWG) is now completed and a new chairman has been elected.The COBWG will re-examine the failed GSSP candidate at Dayangcha (China) in the light of new data and hopefully come to a conclusion in 1994.The first vote on Dayangcha had been between 50% and 60% in favour.

The classical European subdivisions of the Ordovician as Tremadoc Arenig etc., are often difficult to correlate around the world due to strong paleogeographic provincialism. The SC has therefore chosen a different approach, searching for correlatable biohorizons which may provide a base for solid boundary definitions. This research has obviously made good progress and should now lead to the establishment of formal units on series/stage level.

The completion of the Ordovician correlation charts, the last of which are now ready for publication should be highlighted here.

2.4. Silurian SC

All Silurian stage boundaries have been defined by GSSPs already in 1985, resulting in a very detailed subdivision with 8 stages for only 28Ma. The SC now concentrates on the mutual calibration of zonal schemes based on different fossil groups in order to obtain a common denominator for correlation charts. This seems to be problematic and will certainly also provide an interesting test for the worldwide practicability of Silurian stages.

2.5. Devonian SC

Very active SC, only two of the six internal stage boundaries are not yet formally defined by a GSSP. But one of them (base of the Givetian) has already been voted by ICS and awaits ratification through IUGS, and the last one will soon be submitted to ICS.

2.6. Carboniferous SC

After the decision to have only one system, the Carboniferous, in the global standard scale and not two (as Mississippian and Pennsylvanian or Dinantian and Silesian) the Mid Carboniferous boundary was the first problem to be solved, in order to arrive at a globally applicable subdivision of the Carboniferous into two subsystems. Good progress has been made in this direction.

Another problem is that the classical W-European subdivision of the Upper Carboniferous was derived from the coal measures. This has to be replaced by a marine standard, but so far no clear image of the subdivision to be used has emerged.

2.7. Gondwana SC

The interregional correlation of terrestrial Gondwana successions and their correlation with the marine standard is a most important and interesting task. It would be fine to have more detailed information about the existing (or envisaged) terrestrial scheme(s) and the possibilities of correlation with marine series (which ones? and where?)

The reorganisation, viz. thorough discussion of the SGS strategy was already mentioned in the 1992 report and seems to continue.

2.8. Permian SC

Very active SC, has obviously made good progress towards defining the Carboniferous-Permian boundary, cooperates closely with the Triassic SC on the Permian-Triassic boundary. It should perhaps be mentioned that during the Permian, global correlations are difficult.

2.9. Triassic SC

The long dispute over the subdivision of the Scythian at the base and whether the Rhaetian stage should be maintained at the top of the Triassic has been ended in 1992, so that the SC now turns to a precise definition of stage boundaries.

With the election of a new Chairman the Permian-Triassic Boundary Working Group has been reactivated.

A precise definition of this boundary has so far been difficult although it falls into a period of major faunal turnover. This is mainly due to a strong biogeographic provincialism with separate Tethyan and Boreal ammonite faunas. It appears that conodonts will bring a solution.

2.10. Jurassic SC

The subdivision of the Jurassic system into series and stages has been agreed upon for many years. Most of the traditional boundaries, as expressed in ammonite zones, allow far reaching correlations.

But none of the boundaries has so far been defined by a GSSP and there seems to be no hope for 1994. Hopefully, the International Symposium in Argentina 1994 will accelerate procedures.

2.11. Cretaceous SC

No formal report received, only accounts for 1993 and budget for 1994. According to Newsl. 1993/1 from Aug. 30, 1993 and personal discussions of the Chairman of ICS with the Secretary of the Cretaceous SC the reorganisation of the SC in Working Groups for individual stages makes further progress.The renewed activity of the SC merits to be supported.

2.12. Paleogene SC

Working Groups for nearly all open stage boundaries within the Paleogene have been established (the Eocene/Oligocene boundary has already a GSSP).

The open-endedness of this kind of WG, criticised in the report, is indeed a problem and may unduly delay agreement on a GSSP. On the other hand, the comparison

with IGCP projects is not quite correct: the latter can be terminated even when they have not attained the anticipated goal, boundary WGs not, they can only be reorganised (as in the case of the Cambrian-Ordovician BWG). And some boundary problems are more difficult than others, this can best be judged by the respective SC. So the question is, if SCs shall be encouraged or obliged to set deadlines for their BWGs.

2.13. Neogene SC

No formal report. According to documents forwarded to the Chairman of ICS, the Pliocene Symposium at Baton Rouge (USA) was one of the main activities. There a new magneto-chrono-biocyclostratigraphic scheme was developed.

2.14. Quaternary SC

The sudden retirement of the Chairman caused some organisational problems. The Vice-Chairman was therefore obliged to provide the annual report within a very brief period.

The base of the Quaternary was defined in 1985 by a GSSP at Vrica (Italy). There seems to be a strong tendency among Quaternary stratigraphers to move the boundary farther down to a more "natural" level. Therefore the Pliocene-Pleistocene BWG, with T. Partridge as Chairman was established at the Kyoto IGC, in order to decide if a new boundary level has a higher correlation potential. In such a case, a formal BWG would have to be elected with the task to propose a new GSSP. It should, however, be remembered that the Vrica boundary remains valid until a new boundary + GSSP has been voted by ICS and ratified by IUGS.

2.15. ISSC

As other SCs, ISSC is going to discuss sequence stratigraphy. The project to produce an abridged version of the International Stratigraphic Guide is maintained.

2.16. Subcommission on Geochronology

Very active and successful SC, the report is very informative in this respect and there is nothing to add here. The calibration of chronostratigraphic boundaries by radiometric dating is indeed a very important task.

Genetic Stratigraphy

Notice from K.H. GOHRBANDT, Secretary General ICS, Chevron Overseas Petroleum Inc., 6001 Bollinger Canyon Road, San Ramon, CA 94583-0946.

The Secretary General of ICS advised all Chairpersons of ICS Subcommissions that, effective of 1 March 1994, ICS had approved the establishment of a Committee on Genetic Stratigraphy. The following circulated documentation sets out the terms of reference and mission statement for this new body:

Genetic Stratigraphy is the branch of stratigraphy which analyses, defines and describes the generating processes and resultant relationships of deposits in time and space. As such, Genetic Stratigraphy integrates high-resolution chronostratigraphy with sedimentology and produces models of distribution of deposits. Genetic Stratigraphy entails Sequence Stratigraphy as the division dealing with rock successions between global unconformities and their conformable equivalents, Event Stratigraphy as the division concerned with the correlation of global maxima of transgression and regression, and Cyclostratigraphy as the division dealing with thin-bedded rhythmic deposits.

Eustasies produce geometries of sequences of stratification which are definable on high-quality reflection seismic (CDP) data (Seismic Stratigraphy). The analysis of these sequences is useful in Applied Geology for forward-modelling and, therefore, as a predictive tool for reservoir rock distribution.

Mission Statement

The purpose of the ICS Committee on Genetic Stratigraphy shall be to investigate the time/space relationships of sedimentary sequences and their members. For this reason, the Committee shall study in particular:

1) the significance of biostratigraphy, radiometry, chemostratigraphy, and magnetostratigraphy as high resolution chronostratigraphic tools for the determination of the time of transgressions and regressions and the establishment of their global synchronism or magnitude of diachronism.
2) the causes of eustasy other than glaciation, i.e., orbital and plate-tectonic forces.
3) the different effects of eustasy on detrital (siliciclastic) and on biogenetic (carbonate) depositional environments.
4) the sets of stratal geometries produced by eustasy and identifiable on reflection seismic data for enhancing the search for hydrocarbon resources.
5) the causes of and principles of deposition and erosion by global maxima of transgression and regression.
6) the causes and principles of deposition of thin-bedded rhythmic deposits.
7) the differences in the stratigraphic relationship and distribution of sediments between active and passive continental margins and on interior platforms.
8) the validity of the application of late Phanerozoic depositional models to the deposition of late Proterozoic to early Phanerozoic sediments.
9) the definition of the newly created terminology.
10) the difference between the concepts of modern Genetic Stratigraphy and the concepts advanced by E.O. Ulrich in 1911 for the early Phanerozoic section of North America.
11) the effects of sedimentation on biostratigraphy.
12) the genetic-stratigraphic criteria to be applied to the selection of locations for chronostratigraphic boundary-stratotypes (GSSPs).

In addition, the Committee shall promote and coordinate meetings to disseminate advances and standards in this field of multidisciplinary stratigraphy.

The Committee shall cooperate with other international organisations dealing with this subject, especially with other commissions of IUGS, and the subcommissions of ICS.

Research on the Tournaisian-Viséan transitional strata in S. China (Guangxi Autonomous Region)

Luc HANCE, Belgian Geological Survey, Jennerstraat. 13, B-1040 Bruxelles and HOU HONG FEI and XIANG LIWEN, Chinese Academy of Geological Sciences.

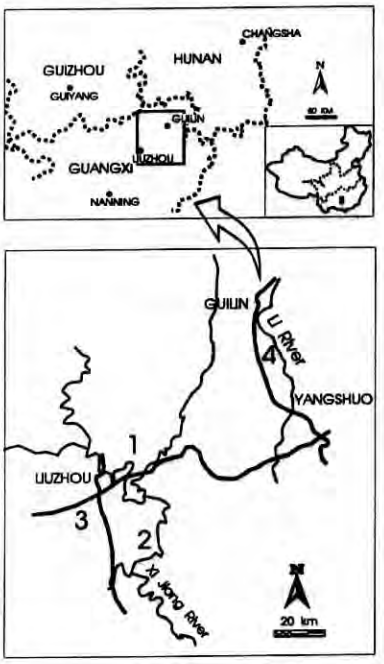

Figure 1: Investigated sections : 1. Penchiong; 2. Yajiao; 3. Longdiangshan; 4. Huaquio.

In order to better document the Tournaisian-Viséan (Tn/V) transitional strata in South China and to improve intercontinental correlations at this level, joint research has been supported by the Chinese Academy of Geological Sciences and the Belgian Geological Survey.

A first field mission in Autumn 1993, in the Guangxi Autonomous Region, has permitted the investigation of four well exposed sections representative of platform carbonate, slope and culm facies (Fig. 1). Based on lithostratigraphic regional correlations, macrofaunal content and some conodont data, these sections were thought to straddle the Tn/V boundary.

The sections have been described in detail for integrated sedimentological and biostratigraphical studies with sampling for foraminifers, conodonts and ostracods. Preliminary results on foraminifera are encouraging. Assemblages are rich and diversified and clearly indicate that the Tn/V boundary, as defined by the appearance of *Eoparastaffella*, must be placed lower than previously supposed in three of the four investigated sections. Moreover, the entry of primitive archaediscids has been recognised in the Penchiong (culm-slope facies) and Yajiao (slope facies) sections which are the most promising ones for improving correspondence of foraminiferal and conodont zonations. The Huaquio section (platform facies) is extremely interesting for the study of Lower Viséan rugose and tabulate corals and foraminifera but further field investigations are required to collect information on the uppermost Tournaisian.

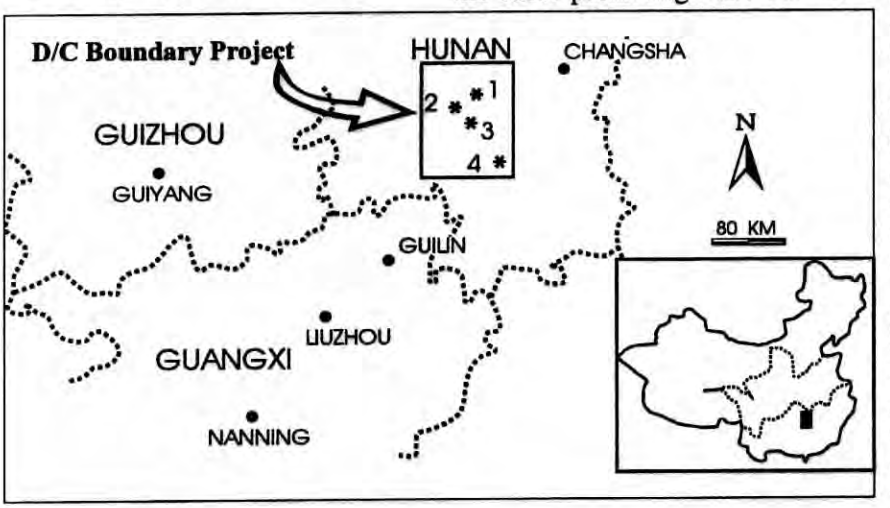

Figure 2: Investigated sections: 1. Oujiachong; 2. Laojiachong; 3. Malanbian; 4. Sujiaping.

Research on the Devonian-Carboniferous transitional strata in South China (Hunan Province)

Luc HANCE, Belgian Geological Survey, Rue Jenner 13 (Pare Léopold), 1040 Bruxelles.

The results of scientific cooperation between the Chinese Academy of Geological Sciences and the Belgian Geological Survey on the Devonian-Carboniferous transitional strata in Hunan (see localities on Figure 2) will be published in the next issue of the Mémoires de l'Institut Géologique de l'Université de Louvain with the following content (Eds: GROESSENS, E. & HOU, H.F.).

Contents of Volume

XIANG, L. - Geological setting.

MUCHEZ, Ph., HOU, H.F., GROESSENS, E., HANCE, L. & TAN, Z. - Sedimentology and paleogeography of the Famennian-Tournaisian and Lower Viséan in Southern China.

MUCHEZ, Ph. - Sequence stratigraphy at the Devonian-Carboniferous transition in Southern China.

MUCHEZ, Ph., PEETERS, C. & VIAENE, W. - Lithogeochemistry of the Devonian-Carboniferous boundary at Malanbian and Oujiachong sections (Southern China).

GROESSENS, E. & COEN, M. - Conodont stratigraphy at the Devonian-Carboniferous boundary and Tournaisian strata in central Hunan Province, South China.

HANCE, L. - Foraminiferal biostratigraphy of the Devonian-Carboniferous boundary and Tournaisian strata in central Hunan Province, South China.

COEN, M. - Ostracod faunas from the Devonian-Carboniferous boundary in Southern China.

STEEMANS, Ph., FANG, X. & STREEL, M. - Miospore stratigraphy around the Devonian-Carboniferous boundary, Hunan Province, China.

POTY, E. & XU, S.C. - Rugosa from the Devonian-Carboniferous transition in Hunan (Southern China).

TOURNEUR, F. - Tabulata from the Devonian-Carboniferous transition in Hunan, Southern China.

MISTIAEN, B. - Stromatopora from the Devonian-Carboniferous transition in Hunan, Southern China.

BIGEY, F. - Bryozoa from the Devonian-Carboniferous transition in Hunan, Southern China.

MEHL, D. - "Lithostida", Porifera from the Nitangli Formation at Laojianchang, Hunan Province.

LELIEVRE, H. - Fish remains around the Devonian-Carboniferous boundary in Southern China.

HOU, H.F., MUCHEZ, Ph., SWENNEN, R., HERTOGEN, J., YAN, Z. & ZHOU, H.L. - The Frasnian-Famennian events in Hunan, Southern China: biostratigraphical, sedimentological and geochemical evidences.

HOU, H.F., BRICE, D. & TAN, Z. - Revision on Famennian Spiriferid Brachiopoda of Hunan, China.

HOU, H.F. & HANCE, L. - Correlation elements of Famennian and Tournaisian deposits in central Hunan (South China) and Dinant area (South Belgium).

On the correlation of radiometric and biostratigraphic data in the Namurian

JAROSLAV DVOŘÁK, Český geologický ústav, Leitnerova 22., CS-65869 Brno, Czech Republic.

In the *Newsletter on Carboniferous Stratigraphy* 1993 (11: p.10), WINKLER PRINS & WAGNER published a chart with "a correlation scheme for the main chronostratigraphic subdivisions ...". The age of 325my is indicated for the Viséan-Namurian boundary and 315my for the Namurian-Westphalian boundary.

LIPPOLT & HESS (1985) studied sanidines by the $^{40}Ar/^{39}Ar$ method in two pairs of tonstein samples from the Ostrava Formation/Upper Silesian Coal Basin, Czech Republic (see Fig. 3). The younger pair came from the Poruba Member and indicated an age of 319.5±1.2my. The older samples, from the underlying Jaklovec Member, gave an age of 324.6±1.1my. LIPPOLT & HESS deduced a sedimentation gap of 5my duration in a middle part of the Ostrava Formation.

VAŠÍČEK (1983A/B) has demonstrated that the 3000 m thick Ostrava Formation belongs to the time of goniatite E1b and E2 zones; the E1a subzone is still represented by an uppermost part of the Hradec - Kyjovice (flysch) Formation (DVOŘÁK 1993, Fig. 6). The goniatite subzone E2a is present in the Barbora marine horizon of the youngest part of the Jaklovec Member (ŘEHOŘ 1970), between the tonstein levels of 319.5my and of 324.7my age. The goniatite subzone E2b is represented in the Gaebler marine horizon which occurs shortly below the Prokop coal seam, in the youngest part of the Poruba Member (VAŠÍČEK 1983B).

In western Europe, the Namurian consists of 7 goniatite zones. When the Namurian is about 10 my long, an average goniatite zone should be of about 1.4my duration. Argued in this way, all of the Ostrava Formation (about E1b+E2a+E2b subzones) should have been deposited in about 3my. This would exclude the possibility of a 5my gap - half of the Namurian! - in a middle part of the Ostrava Formation.

In the greywacke quarry Krásné Loucky, west of Krnov (Silesia, Czech Republik), two tuffite beds bearing biotite, quartz and zircon have been studied by A. PŘICHYSTAL in the laboratory of the Geological Survey of Finland (O. KOUVO); they gave a zircon age of 319±2my. No goniatites have yet been found in the quarry; its lithostratigraphic position, however, is correlated with the oldest part of the Moravice Formation which belongs to the lower part of the Upper Viséan Go α zone (*Goniatites crenistria*).

Correlation of biostratigraphic and radiometric age determinations should still be handled with great prudence. One of the more promising methods seems to be the microprobe SHRIMP method that has been used with evident success on zircons out of tuffite layers near the Devonian-Carboniferous boundary (CLAOUÉ-LONG et al. 1993).

Karviná Formation				Namurian B
	Prokop Coal Seam (5 m)			Namurian A
Ostrava Formation	Poruba Member (680 m)	Gaebler M.H.	E2b	
		Tonstein Tonstein	319.5 Ma	
	Jaklovec Member (460 m)	Barbora M.H	E2a	
		Tonstein Tonstein	324.7 Ma	
	Hrusov Member (960 m)			
	Petrkovice Member (700 m)			
Hradec - Kyjovice Formation (~ 1599 m)			E1a Go γ	Upper Viséan (partim)
Moravice Formation (~ 2000 m)			Go α / Go β	

Figure 3: Biostratigraphic subdivision of Upper Viséan and Namurian sedimentary formations in Moravia - Silesia.

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Correlation between West–East European Chronostratigraphic Units (Revision and corrections on the "Global Correlation Chart" of ICS)

R.H. WAGNER, Jardín Botánico de Córdoba, Avenida de Linneo s/n, 14004 Córdoba, Spain and C.F. WINKLER PRINS, Nationaal Natuurhistorisch Museum, Postbus 9517, 2300 RA Leiden, The Netherlands.

At the SCCS Meeting in Buenos Aires (1991), it was observed that the Carboniferous part of the **Global Correlation Chart**, produced by the International Commission on Stratigraphy (COWIE & BASSETT 1989), contained a number of errors which needed correction. The present writers were asked at the SCCS Executive Meeting to prepare a first draft for circulation and updating by all members (*Newsletter* **10**, p.4, July 1992). A revised chart was presented during the SCCS General Meeting at Liège, 1993, and this draft was subsequently circulated for comment and further correction by SCCS members (*Newsletter* **11**, p.10, 1993). No corrections were received, and the authors have assumed that the membership at large agreed with the substance of the chart as reproduced in *Newsletter* **11**.

The present writers have made a few adjustments to the correlations proposed, and have prepared a report for publication in which they discussed the background to their chart, explained the various corrections to the **Global Chart** of COWIE & BASSETT (1989), and briefly summarised the salient features of the regional chronostratigraphic classifications in Western Europe and in Russia. The report also expanded on the original brief and presentation at Liège with a discussion on the wider problems of Carboniferous stratigraphy in the Gondwana and Angará areas of higher palaeolatitude, and concluded that the climatic differentiation in later Carboniferous times made a purely biostratigraphic approach to Carboniferous chronostratigraphy a non-viable proposition. They proposed combining event stratigraphy with biostratigraphy for a worldwide Carboniferous chronostratigraphy (WAGNER & WINKLER PRINS 1994). This wider report was submitted for publication with other SCCS reports read at the General Meeting in Liège but was deemed editorially to be outside the scope of the proposed volume of the *Société*

	WESTERN EUROPE		ex USSR (mainly Russian Platform)		Approximate absolute ages
L.P.	Autunian		Sokoljegorsky	L. Permian	(Ma)
- -?- -					290
			Noginsky	Gzhelian	
	Stephanian	Stephanian C	Pavlovo-Posadsky		
		Stephanian B	Amerevsky		
U			Rechitsky		
P		- - - - - - - - -	Yauzsky	Kasimovian	
P		Barruelian	Dorogomilovsky		
E		- - - - - - - - -	Khamovnichesky		
R			Krevyakinsk		
S		Cantabrian			
U			Myachkovsky	Moscovian	305
B	Westphalian	Westphalian D			
S			Podolsky		
Y		Bolsovian			
S			Kashirsky		
T		Duckmantian			
E					
M		Langsettian	Vereisky		
					315
			Asatausky*	Bashkirian	
	Namurian	Yeadonian	Tashastinsky*		
			Askynbashsky*		
		Marsdenian	Akavassky*		
		Kinderscoutian	Syuransky*		
		Alportian	Voznesensky**	Serpukhovian	
		Chokierian			
.....		.....	.....	M.C.B.	320
			Zapaltyubinsky**		
L		Arnsbergian	Protvinsky		
O		Pendleian	Steshevsky		
W			Tarussky		
E					325
R	Viséan	Brigantian***	Venevsky	Viséan	
		Asbian***	Mikhailovsky		
S			Aleksinsky		
U		Holkerian***	Tulsky		
B		Arundian***	Bobrikovsky		
S		Chadian***	Radaevsky		
Y			Kosvinsky		
S					345
T	Tournaisian	Courceyan***	Kizelovsky*	Tournaisian	
E			Cherepetsky		
M			Karakubsky**		
			Upinsky		
			Malevsky		
			Kalinovsky		355
U.D.	Famennian		Zavolzhsky	Famennian	

* = type section in the Urals. ** = type section in the Donbass;
*** = British local stages. M.C.B. = Mid-Carboniferous Boundary.

Figure 4: Final draft of a document presenting a correlation scheme for the main chronostratigraphic subdivisions of the Carboniferous in the ex-USSR and western Europe. This chart incorporates minor adjustments made since the first draft was printed in *Newsletter* **11**, p.10 (1993).

géologique de Belgique which is to have the title **Early Carboniferous Stratigraphy - Liège 1993**. After review and amendment, the editors agreed to place the paper in the current issue of the journal, thus providing for its appearance before the issue which will contain papers relevant to the Lower Carboniferous theme.

The report appeared in May 1994 under the title **General overview of Carboniferous Stratigraphy** in *Annales de la Société géologique de Belgique*, **116** (for 1993). Unfortunately the rapid process of publication resulted in a number of typesetting errors which detract from the intended impact of the publication. The authors have requested an official corrigenda which corrects the problems. In particular, the report proclaims four conclusions of which the last one failed to appear in the Annales. The conclusions were:

1. The unauthorised, unacknowledged use of discussion documents in grey publications, such as the *Newsletter on Carboniferous Stratigraphy*, should be discouraged. (Ed: In the full context of the published paper, this conclusion alludes to the repetition of material from unpublished field guides, etc. and not to the editorial practice of this *Newsletter*).

2. The publication of a poorly constrained Carboniferous chronostratigraphy in the IUGS journal *Episodes* by officers of the Commission on Stratigraphy has done a disservice to the Subcommission on Carboniferous Stratigraphy, which is likely to be blamed for the inaccuracies.

3. The historical process of regional Carboniferous chronostratigraphic classifications having been erected in the different parts of the world may be explained, at least in part, by the biostratigraphic differences induced by climatic diversity. A correct appraisal of the climatic effects (temperature, sea-level changes) will be necessary for a general framework to be established for Carboniferous chronostratigraphy worldwide.

4. There is still no globally valid set of major chronostratigraphic units which can be recognised in the high palaeolatitude Gondwana and Angará areas, as well as in the palaeoequatorial belt.

The writers will forward copies of the printed report to any interested members of SCCS.

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Recent research on Carboniferous black shales of Sinai, Egypt

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Following detailed sedimentological study of pre-Cenomanian clastic sections in west-central Sinai, efforts were directed to the mineralogical and geochemical study of the Carboniferous black shales which constitute well-defined horizons extending widely throughout the study area. Based on palaeontological records and biostratigraphic zonation, these black shales which are overlain and underlain by the Nubia sandstone facies are considered to be of mid Carboniferous age. Dr A. Abu Ezz (Petroleum Research Institute) carried out mineralogical and geochemical analyses of representative samples of three surface sections of this formation. Using XRD and DTA methods, the clay minerals encountered in the black shales were shown to be dominated by kaolinite. Illite was present in relatively few samples and smectite was rarely recorded. The kaolinite is mainly detrital, sometimes partially recrystallised, and authigenic in origin.

Chemical analysis of the black shale samples revealed a wide variation in the concentration of both major and trace elements. The most abnormal feature of this analysis was the discovery of high concentrations of vanadium and nickel of up to 2376 and 4366 ppm respectively in some shale samples. The unusual concentration of these two elements raises the question of the economic significance of the occurrence. Further field and laboratory studies on additional surface sections is planned in order to gather more information on the areas of distribution, concentration and origin. Exchange of information with any interested members of SCCS would be most appreciated.

Rich faunas of Upper Famennian and Dinantian age

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In NW Germany, the Velbert antiform and its southerly continuation into the Herzkamp synform are located at the NW edge of the Rhenish Massif (east of the Rhine River). Devonian and Dinantian rocks crop out in an area of about 30km East-West and 15km North-South. Oldest rocks in the antiform are Frasnian limestones which are overlain by Famennian psammites (Velberter Schichten) and Dinantian-Namurian sediments.

The youngest Devonian ("Etroeungt-Schichten") strata consist of sandy, marly rocks with a few limestone beds, all of which contain a rich marine fauna. The Dinantian is represented by limestones more than 200m thick in the west (Ratingen) which grade laterally into a thin (50m) succession of shales, carbonate beds and cherts in the east (Wuppertal). This change in lithology is accompanied by a simultaneous change from Kohlenkalk to Kulm facies marine faunas. The rapid facies change in a small area over a short time interval permits an insight into, and reconstruction of, the changing conditions of the sea floor.

Geologists have been attracted to this area for a long time but there is still a great deal of work to be done. A recent publication (THOMAS (ed.)1992) presents the

results of several recent contributions. Amongst many other fossils, it includes the description of numerous species of echinoderms of near complete preservation. A further volume, dedicated to the memory of Henry PAUL, will be published in 1994.

The fossil material which includes many older type specimens (e.g. of PAECKELMANN and PAUL) published before and during World War II, is housed in the collections of the former Preussische Geologische Landesanstalt (now Bundesanstalt für Geowissenschaften und Rohstoffe, Invalidenstr. 44, D-10115 Berlin). A more recent collection of mostly (but not exclusively) echinoderms is now in the Naturmuseum Senckenberg (Senckenberg-Anlage 25, D-60325 Frankfurt a.M; collections of THOMAS).

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Comments on the Devonian/Carboniferous boundary position throughout the Russian Platform

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Until the end of the 1980s the Devonian/Carboniferous boundary had been placed on different levels in Western Europe (the base of the *Gattendorfia* ammonoid zone) and Russia (the base of the *Wocklumeria* zone).

Joint studies by the SCCS D/C boundary Working Group came to the conclusion that it was necessary to replace the ammonoid standard with a conodont one. According to the official SCCS decision the first appearance of *Siphonodella sulcata* is taken as the Carboniferous base (COWIE et al. 1989). This decision has been supported by many Russian researchers and applied to regional stratigraphic schemes including that of the Russian Platform which was established by the Stratigraphical Committee of Russia in 1988.

The level of the Devonian/Carboniferous boundary was taken as the base of the Gumerovsky horizon which has been established by KOTCHETKOVA et al. (1988) in the South Ural (Zigan River near Gumerovo village). The horizon (section Sikasa) consists of three layers of which the uppermost one contains *Siphonodella sulcata*. In spite of the presence of this important taxon we have hesitated to agree that the base of this horizon coincides with the Carboniferous base.

The top of the Gumerovsky horizon may be preferable as the D/C boundary

Certainly, the palynological assemblages of the horizon contain *"Retispora" lepidophyta* - a very characteristic uppermost Devonian species. The disappearance of this species (the boundary of the LN and VI palynological zones) at Haselbuchtal and some other important West European sections is very near the base of the *Siphonodella sulcata* zone.

Because of Byvsheva's correlation of the LN/VI palynological zonal boundary with the top of the Gumerovsky horizon (Granitza.... 1988), it is possible to suggest that this level and not the base of the Gumerovsky horizon better coincides with the position of the D/C boundary in the West European stratotype area.

In contrast with the Gumerovsky horizon base, the top of the same horizon (the base of the Russian platform Malevsky zone) is an easily traceable level because of a strong change in the marine faunal community structures and a decrease in population density. These prominent changes caused some researchers to propose this level as the D/C boundary (Birina, 1948). In the 1960s, this level was rejected because the marine faunal changes were "facial" or "ecological" and not "evolutionary". It was not observed that a wide distribution of this "facial" change indicated more about deep environmental change than about facies variation.

Because of the coincidence of the Malevsky horizon base with the disappearance of the characteristic spore species *"Retispora" lepidophyta*, it is possible to follow this level not only throughout Europe but all over Angaraland as well. According to PETERSON & ZORIN (1983) the top of the *"Retispora" lepidophyta* zone coincides with a strong floristic change between the rather cosmopolitan *Cyclostigma* flora and younger endemic lepidophytean assemblages. It is possible to say that a disappearance of *"Retispora" lepidophyta* marked the beginning of Angaran endemism.

Therefore the level coinciding with the top of the Gumerovsky (= the base of Malevsky) horizon can be traced in marine and continental facies all over Eurasia. It is located just near the base of the *Siphonodella sulcata* zone and therefore may be preferable as the level of the D/C boundary compared with the base of the Gumerovsky horizon.

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Possible Levels of the Lower Carboniferous Subdivision in Moravia (Czech Republic)

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In a search for possible levels of Lower Carboniferous subdivision, the Subcommission on Carboniferous Stratigraphy has recently started three projects studying the Middle/Upper Tournaisian (Kinderhookian/Osagean) boundary interval, the latest Tournaisian - earliest Viséan (Tn3c-V1a) interval and a Mid-Viséan interval. The immediate objective is to intensify an international effort to identify evolutionary changes in the various groups of biota that may provide suitable horizons for long distance correlation, the objective being to establish global Lower Carboniferous subdivision.

Two faunal groups with the best potential for the identification of these levels seem to be conodonts and calcareous foraminifers which enable the finest stratigraphical subdivision of the Tournaisian and Viséan. In Moravia, conodont and foraminiferal faunas have been studied from the same samples both at the Middle/Upper Tournaisian (Kinderhookian-Osagean) boundary, at the base of the *Scaliognathus anchoralis* Zone and at the Tournaisian-Viséan boundary. Several important events (see Figure 5), not necessarily restricted to Moravia, are discussed below.

Middle/Upper Tournaisian

The first possible level of the Lower Carboniferous subdivision correlates approximately with the Kinderhookian-Osagean (Middle/Upper Tournaisian) boundary interval. The following sequence of events can be recognised:

1. The occurrence of calcareous foraminifers with basal deposits - *Spinobrunsiina, Tuberendothyra* together with conodonts of the *Siphonodella isosticha* - Upper *Siphonodella crenulata* Zone (*Gnathodus delicatus* BRANSON & MEHL, *Gnathodus punctatus* (COOPER), *Gnathodus typicus* COOPER (Morphotype 1), *Siphonodella obsoleta* HASS).

2. Higher, the boundary is marked by the occurrence of unfavourable facies (time-specific facies of Calcaire de Maurenne) with rare foraminifers and sedimentary breaks recognised worldwide at the Kinderhookian/ Osagean boundary.

3. The entry of *Paraendothyra* is recorded not only in Moravia but also in Tian-Shan, Urals, Dinant Basin, and Eastern Siberia at a similar stratigraphical level (KALVODA 1989). In conodonts, *Pseudopolygnathus multistriatus* MEHL and THOMAS (M2), *Gnathodus cuneiformis* MEHL & THOMAS and *Mestognathus praebeckmanni* BITTER, SANDBERG & ORCHARD suggest Upper *Gnathodus typicus* rather than Lower *Gnathodus typicus* Zone. Interestingly, *Mestognathus praebeckmanni* seems to be widespread at this level being recorded in Cordilleran North America and Western Europe (BITTER et al. 1986), Moravia Donets Basin (KOZITSKAYA et al. 1978) and Altai (BUSHMINA et al. 1984).

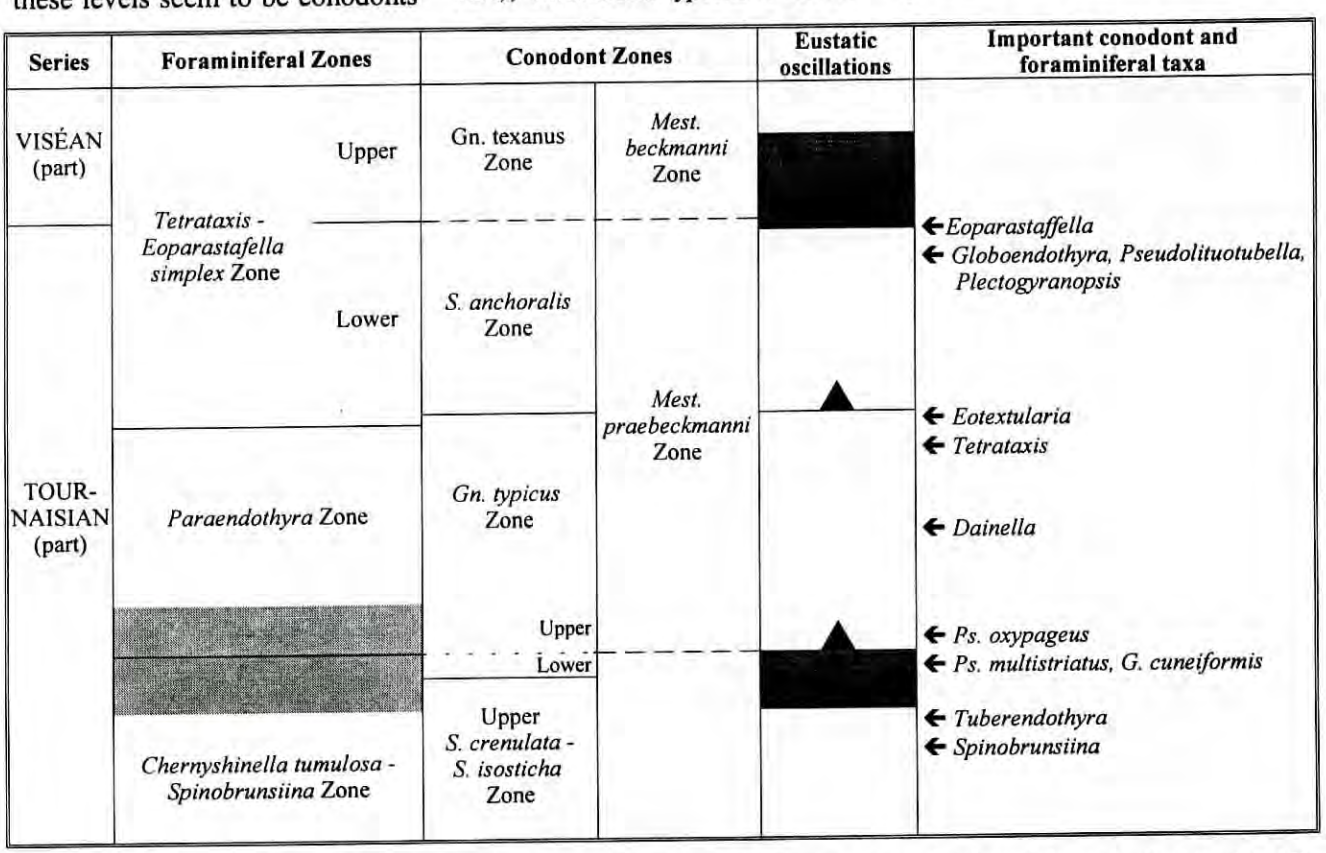

Figure 5: A correlation chart of conodont and foraminiferal zones recognised in Moravia in late Middle Tournaisian to early Viséan. (Legend for Eustatic Oscillations column: Regressions are shown as dark shaded areas and Transgressions as arrow heads.

4. Within the Upper *Gnathodus typicus* Zone the appearance of *Dainella* and *Pseudoammodiscus* and *Brunsia* at the level of *Eotaphrus bultyncki* Subzone (FRIÁKOVÁ & KALVODA 1982; KALVODA 1982) represents a further important marker horizon.

Late Tournaisian - Early Viséan

In the second interval of interest in the latest Tournaisian and early Viséan the following events have been traced:

1. The emergence of *Eotextularia* and *Tetrataxis* seem to coincide with the diversification of mesopelagic *Scaliognathus* as well as *Doliognathus*. From the point of view of conodont stratigraphy, the lineage from *Scaliognathus praeanchoralis* LANE, SANDBERG & ZIEGLER to *Scaliognathus fairchildi* LANE & ZIEGLER appears to be preferable.

2. Within the *Scaliognathus anchoralis* Zone, there is a further important increase of taxa characteristic of the Viséan, represented by *Globoendothyra, Plectogyranopsis, Pseudolituotuba*, and *Pseudolituotubella*.

3. The Tournaisian/Viséan boundary in Moravia, similar to many places in the world, is accompanied by a regression. *Eoparastaffella simplex* (VDOVENKO) occurs at this level, however, its first occurrence is facially controlled and in many profiles has not been recorded. *Gnathodus texanus* ROUNDY is hard to find and distinguish, *Mestognathus praebeckmanni* BITTER, SANDBERG & ORCHARD has been recorded already in the Upper Tournaisian and thus the most important taxon occurring at this level seems to be *Mestognathus beckmanni* BISCHOFF. As already pointed out by KALVODA (1983, 1989), the appearance of most "Viséan" foraminiferal markers in the stratotype profiles of the Dinant Basin was substantially delayed because of unfavourable facies development (see Figure 5).

4. The entry of the first Archaediscidae in Moravia is not very well recorded and was probably facially controlled.

From the point of view of precise global correlation, the lineage of the worldwide distributed mesopelagic conodont genus *Scaliognathus* supplemented by the *Doliognathus* lineage would best meet the generally preferred demands. It would enable also the adoption of a strategy similar to that used to define the lower boundary of the Carboniferous System. Nevertheless the levels of the first occurrence of *Scaliognathus* species represented a time of Tournaisian evolutionary acme both of conodont and foraminiferal faunas and it is not common to draw a stage boundary at such a level.

The level that would correspond best to the concept that a global stage boundary should be connected in some way with an interval of a faunistic and lithological change seems to be the Kinderhookian-Osagean (Middle-Upper Tournaisian) boundary. However, the complete decline of the mesopelagic Middle Tournaisian *Siphonodella* fauna created vacant mesopelagic niches up to the Upper *Gnathodus* Zone (KALVODA 1991) complicating the stratigraphical correlation. The first isochronous occurrences of possible global boundary index forms such as *Tuberendothyra tuberculata* (LIPINA), *Gnathodus cuneiformis* MEHL & THOMAS, *Gnathodus typicus* COOPER and other gnathodids with supposed nectobenthic mode of life remain doubtful.

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Lower Carboniferous Plant Assemblages of the Minussinsk Trough

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The Minussinsk trough is situated in the south of Middle Siberia. During the early Carboniferous, a sequence of terrestrial deposits of up to 1200-1300m thickness was accumulated. The Minussinsk trough is the sole region in Angaraland, where the whole sequence of plant assemblages of the Angaran Lower Carboniferous was preserved. Its section can be considered as a stratotype for the whole continental Lower Carboniferous of Angaraland.

The Minussinsk Trough can be considered as a Lower Carboniferous continental stratotype for Angaraland

Investigations during 1993 supplemented with new data, established the structure of the Lower Carboniferous sequence and the composition and extent of previously proposed assemblages of macroflora (ANANIEV 1979; MEYEN 1982). Miospore studies by L.N. PETERSON have provided greater precision in the age of some of these assemblages. Further treatment of fossil collections remains to be done but sufficient is known to enable the following preliminary summary of the characteristic plant assemblages to be made.

Seven plant assemblages for the flora of the Minussinskian Lower Carboniferous are proposed.

The first assemblage belongs to the deposits of the Bystryanskaya

suite. It corresponds to the plant assemblage L-1 of MEYEN (1982). It is characterised by the domination of two European lepidophytes: *Cyclostigma kiltorkense* HAUGHT. and *Pseudolepidodendropsis carneggianum* (HEER) SCHW., which are often accompanied by the remains of articulates *Sphenophyllum* cf. *subtenerrimum* NATH. and seldom by the ferns: *Archaeopteris* sp., *Rhacopteris* sp., *Aneimites* cf. *acadica* DAWS., *Rhacophyton* (?) sp., and *Sphenocyclopteridium* cf. *belgicum* STOCKM. In connection with *Cyclostigma kiltorkense*, remains of the rhizophore *Stigmaria* sp. have been discovered. The Lower Carboniferous age of this assemblage is supported by the palynological data (ZORIN & PETERSON 1989) and the occurrence of Carboniferous fish remains from the Bystryanskaya suite.

In the second assemblage an endemic lepidophyte *Pseudolepidodendron igrishense* (A. AN.) V. AN. is dominant and also ferns which are referred to the Euramerian genera *Adiantites, Tripyllopteris* and *Aneimites* (ANANIEV 1979). It also contains *Cyclostigma kiltorkense, Sphenophyllum* sp. and *Rhacophyton(?)* sp. (single records). According to the palynological data (ZORIN & PETERSON 1989) the age of this assemblage is supported as being transitional from early to late Tournaisian.

The third and the fourth assemblages have a late Tournaisian age according to the palynological data. For them, and also younger assemblages, a strictly endemic habit is typical.

The third assemblage is represented by lepidophytes *Tomiodendron(?) varium* (RADCH.) MEYEN, *Ursodendron chacassicum* RADCH. emend MEYEN, *Pseudolepidodendron concinnum* (RADCH.) ZORIN comb. nov. and a problematic fern *Caulopteris ogurensis* (SCHM.) A. AN. & MIKH. This assemblage together with the second assemblage corresponds to the plant assemblage L-2 of MEYEN (1982).

For the fourth assemblage, which is proposed for the first time, lepidophytes *Eskdalia elliptica* (RADCH.) ZORIN comb.nov., *E.* sp., *Pseudolepidodendron* sp., *P.(?)* cf. *concinnum* (RADCH.), and *Ursodendron* cf. *chacassicum* are typical.

The fifth assemblage corresponds to the plant assemblage L-3 of MEYEN (1982). It is early Viséan age according to the palynological data (ZORIN & PETERSON 1989). It is characterised by the lepidophytes *Angarophloios alternans* (SCHM.) MEYEN, *Ursodendron distans* (CHACHL.) MEYEN, *Eskdalia neuburgae* (A.AN.) ZORIN comb. nov., *Tomiodendron chachlovii* (CHACHL.) ZORIN nom. nov. and two new species of the fern genus *Caulopteris ogurensis*.

The sixth assemblage is probably of late Viséan age. It is characterised by lepidophytes *Tomiodendron* sp. nov. (=*Demetria(?) asiatica* ZAL. by ANANIEV 1979), *Ursodendron* aff. *distans* (*Ursodendron* sp. nov.), *Eskdalia* sp. and the ferns *Caulopteris ogurensis* and *Rhodea(?)* sp.

The seventh assemblage corresponds to the plant assemblage L-4 of MEYEN (1982). Its age is Viséan(?)-Serpuchovian (= Namurian A). In the Minussinsk trough, it is represented by the lepidophytes *Tomiodendron kemeroviense* (CHACHL.)RADCH., *T. ostrogianum* (ZAL.) Radch., *Ursodendron* aff. *distans* (*Ursodendron* sp. nov.), *Lophiodendron(?)* sp., ferns *Caulopteris ogurensis, Angaropteridium(?)* sp.,algae(?) *Martjanovskia angarica* RADCH., articulates *Paracalamites* cf. *mrassiensis* RADCH., *Mesocalamites* sp. and single seeds.

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Biostratigraphy of the North Timan Carboniferous Conodonts

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Very little is currently known about the Carboniferous conodonts in the North Timan and only one occurrence of that age has been previously reported from the west slope of the Timan Mountains. The North Timan is a transitional region for intercontinental correlation of Upper Palaeozoic deposits of the Russian Platform and North America and therefore the problem of stratigraphic subdivision of the deposits is of real significance.

The best Middle through Upper Carboniferous section is located at the western slope of North Timan and is exposed along the Volonga River for more than 3km. It is more than 230m thick, was deposited in mostly shallow water, and contains different benthic fossils. This section is subdivided into local horizons on the basis of the brachiopod and foraminiferal data. These horizons partly correspond to those of the Carboniferous Standard Scale as adopted for the Central part of the Russian Platform. Our studies commence with the Moscovian Stage. In ascending order this stage includes: the Volongsky, Ilsky and Sulsky horizons. The Upper Carboniferous is subdivided into the Burkemsky and Odesky Horizons of the Kasimovian Stage and Auvinsky Horizon of the Gzhelian Stage.

These horizons have been the subject of comprehensive studies (biostratigraphic, lithologic and cyclostratigraphic). The boundaries of the horizons were determined by macrofaunal, foraminiferal and conodont data.

In the Moscovian deposits, six conodont assemblages were recovered: the first, with numerous and diverse *Idiognathoides*, is characteristic of the lower part of the Volongsky Horizon. Such conodont associations are well known

from the Vereysky Horizon of the central part of the Russian Platform. The second and third complexes include different species of the *Neognathodus* genus. It is widespread in the Russian Platform, Western Urals and North America having been reported from the Kashirsky Horizon (*Neognathodus bothrops* and *Neognathodus medadultimus* Zones). Thus the lower part of the Volongsky Horizon of the Timan area seems to correspond to the Vereisky Horizon and the upper part of the Volongsky Horizon can be correlated with the Kashirsky Horizon of the Russian Platform.

Two conodont associations were recognised within the Ilsky Horizon. They belong to the *Neognathodus medexultimus* Zone of the Podolsky Horizon of the Russian platform. The sixth assemblage (the Sulsky Horizon) was established in the upper part of the Moscovian Stage. Late Moscovian was characterised by the appearance and development of the terminal species of *Neognathodus* (the *Neognathodus roundyi* Zone). Conodonts of the Sulsky Horizon of the Timan area can be correlated with the Myachcovsky Horizon of the type Moscovian. Only non-platform conodonts are currently known from deposits of the Burkemsky Horizon.

Three conodont assemblages with (ascending order) *Idiognathodus sagittalis*, *Id. toretzianus* and *Id. lobulatus* of the Odesky Horizon are similar to those described previously from the Moscow Syneclise. The conodonts from the Ajuvinsky Horizon belong to the lower part of the *Streptognathodus alekseevi* zone, thus *Streptognathodus simulatur* subzone and therefore the Ajuvinsky Horizon can be correlated with the Dobryatinsky (former Rusavkisky) Horizon of the Moscovian Syneclise.

Thus, Middle and Late Carboniferous conodont sequences of the North Timan are similar to those of the Appalachians and Midcontinent of North America and the central part of the Russian Platform but stratigraphic ranges of some species are closer to those of the Canadian Arctic Island and Western Urals.

Carboniferous deposits of the southern area of Novaya Zemlya

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Carboniferous deposits have relatively limited distribution in the south of Novaya Zemlya (Figure 6). They form narrow strips (from several hundred metres to several kilometres) between larger outcrops of the Devonian and Permian deposits. They are well exposed and accessible but until the middle of the 1970s they were poorly investigated. A few publications [1,4] have described mostly carbonate deposits distributed on the southern and western coasts of Novaya Zemlya.

Mid-scale and large-scale geological mapping and special stratigraphical research were carried out in the 1970s and 1980s in Novaya Zemlya. New information on Carboniferous stratigraphy obtained during these investigations was partially published in three short papers [2,3,4]. The aim of this paper is to provide a summary of the Carboniferous stratigraphy of the south of Novaya Zemlya.

Due to pronounced lithological differences, Carboniferous deposits of the South Island of Novaya Zemlya are divided into two sedimentary areas (I. South area and II. Kara area). Each is further divided into two subareas (eastern and western) on the basis of other less distinctive features (figure 6).

In the South area, Lower and Middle Carboniferous series are composed of shallow-water carbonate deposits of major thickness (up to 1000-1200m). The Upper Carboniferous series contains basinal cherts, marls and shales and is up to 50m thick. In the Kara area, the whole Carboniferous section is composed of basinal cherts, shales and limestones of limited (400-500m) thickness.

An abrupt change in thickness and composition of Carboniferous deposits occurs in a well exposed, narrow transition zone (up to 10 km) which has been designated as the boundary between the two areas. Changes from western to eastern subareas of the South area are hidden under the Kostin Shar Strait. In the Kara area, the transition is covered with Permian deposits, and in the northern Kara area, the contact has been shown to be very gradual.

A short lithological description of the Carboniferous Formations of the southern area of Novaya Zemlya and some speculation on depositional environments is presented below. Palaeontological data are given in the stratigraphic table (see table 2).

I. South area

In the South area, the deposits of the Carboniferous system are divided into the Lazarevskaya and Glazovskaya Formations.

Lazarevskaya Formation

The Lazarevskaya Formation is composed in general of diverse types of limestones interbedded with dolomites, shales and cherts. It conformably overlies early Famennian deposits. The lower part of the formation belongs to the Upper Famennian and is composed of biogenic wackestones and packstones, and stromatoporoidal boundstones. There is a distinct lithological boundary between the Famennian and the Carboniferous parts of the formation. The lower boundary of the Carboniferous system is established at the base of the first appearance of Early Tournaisian foraminifera and conodonts.

In the eastern South subarea (Ia), the Lazarevskaya Formation generally consists of biogenic wackestones and packstones with a few interbeds of mudstones, shales, and black cherts in its lower (Tournaisian-Viséan) part. The upper part (Serpukhovian, Bashkirian and Moscovian) consists mostly of packstones and grainstones, partly dolomitised, probably reflecting gradual shelf shallowing. Carbonate deposits of the eastern South subarea are well documented [1-5].

Last year new data on Carboniferous deposits from the western South subarea (Ia) have been obtained by the authors of this paper. The basal part of the Lazarevskaya Formation consists here of black shales, cherty shales and radiolarite cherts with large nodules and interbeds of fine crystalline limestone, in which early Tournaisian conodonts have been found. The thickest middle part (2nd member) of the formation is composed of biogenic, mostly crinoidal calcarenites, from fine to coarse-grained, with calcirudite interbeds and slidesheets. In the lower part of this member there are algal buildups and an anhydrite bed up to 110m thick. The geological age, based on foraminifera and conodonts, is considered to be Serpukhovian-Early Bashkirian. The depositional environment for this member is assumed to be an enclosed outer shelf.

The upper part of the formation (3rd and 4th members) is composed of black radiolarite cherts, limey and dolomitic marls, black shales and siltstones, considered to be deep-water deposits reflecting the supposed shelf degradation. This part of the formation contains Bashkirian, Late Moscovian and Kasimovian conodonts.

Glazovskaya Formation

The Glazovskaya Formation conformably overlies the Lazarevskaya Formation. Its lower part is composed of black and silty shales, rhythmically interbedded with each other. No fossils have been found here. The Carboniferous/Permian boundary is supposed to lie within this interval. The upper part of the Glazovskaya Formation, consisting of silty shales, contains Early Permian foraminifers and ammonoids. The depositional environment appears to be a deep-water basin.

II. Kara area

The Lower Carboniferous over the entire Kara area is divided into the Rogachevskaya and Milinskaya Formations. The Milinskaya Formation is overlain by the Kazarkinskaya Formation in the western subarea (IIa) and by the Esipovskaya and Stepovskaya Formations in the eastern subarea (IIb), corresponding to the Upper Serpukhovian - Lower Permian interval.

Rogachevskaya Formation

The Rogachevskaya Formation conformably overlies Famennian calcilutites, calcarenites and calcirudites. The boundary is lithologically sharp with a light-coloured carbonate being abruptly replaced by black cherts.

In the western Kara subarea, the Rogachevskaya Formation is subdivided into two subformations. The lower subformation is composed of black radiolarite cherts rhythmically interbedded with black cherty shales. The upper subformation consists generally of black shales with some interbeds of fine crystalline limestone (probably recrystallised calcilutite) and limestone nodules.

In the eastern subarea of the Kara area, in the section of the Rogachevskaya Formation, black radiolarite cherts with horizons of phosphate nodules and interbeds of graded calcarenites-calcisiltites, interpreted as carbonate turbidites, prevail. Conodonts of Tournaisian-Early Viséan age have been found in rocks of the Rogachevskaya Formation. The depositional environment appears to be a deep water basin with anoxic conditions in its bottom zone. The low oxygen content enabled the preservation of organic matter in sediments.

Milinskaya Formation

The Milinskaya Formation conformably overlies the Rogachevskaya Formation and has a sharp, distinct boundary at which black cherts are replaced by light-grey limestones. Carbonate breccias (debrites), graded calcarenites (carbonate turbidites), slides and slumps, interbedded with fine crystalline limestones, are widespread in the Milinskaya Formation near the South area.

In the north-eastern part of the western Kara subarea, the Milinskaya Formation consists in general of fine crystalline limestones, which are interpreted as recrystal-

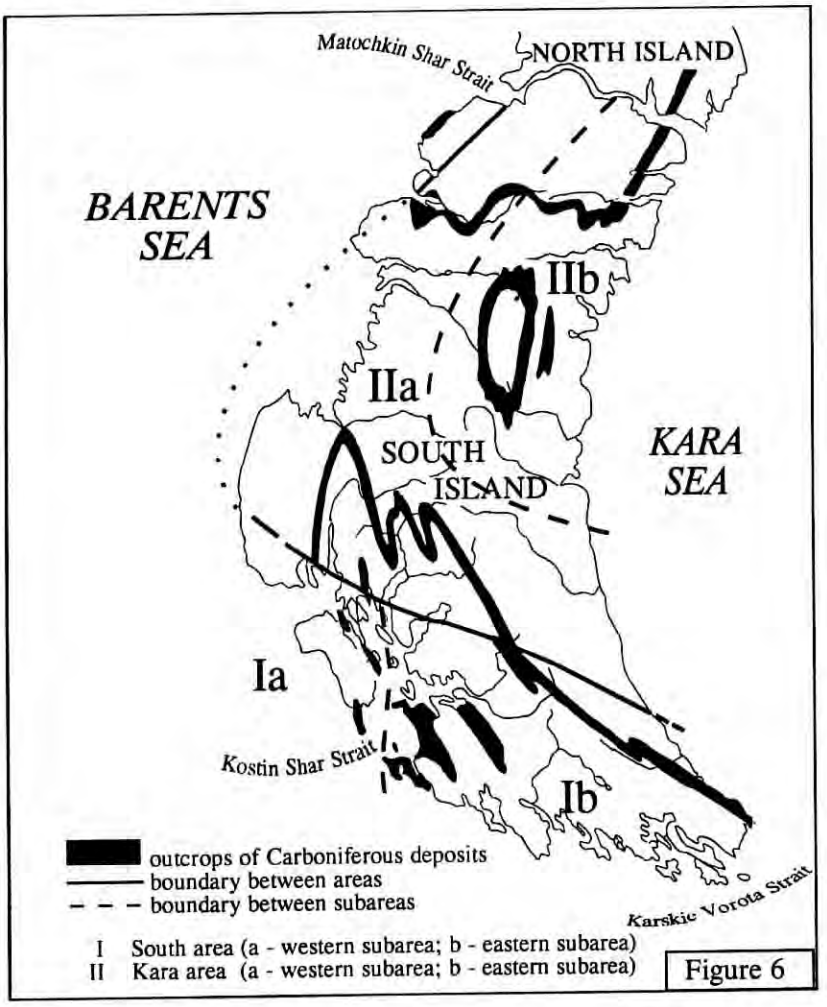

Figure 6

SYSTEM	SERIES	STAGE	SOUTH AREA		KARA AREA	
			WESTERN SUBAREA	EASTERN SUBAREA	WESTERN SUBAREA	EASTERN SUBAREA
PERMIAN	LOWER	ASSELIAN	GLAZOVSCAYA FORMATION Shales, silty shales, silty limestones with Protonodosaria cf. proceraformis, P. cf. rauserae, P cf. cornutoapercionis, Nodosaria cf. krotovi, Geinitzina cf. minuta, Glahyrites sp., Agathiceras sp	Shales, silty shales, cherty shales sparse graded calcarenite beds	KAZARKINSKAYA FORMATION UPPER: manganese carbonates interbedded with radiolarite cherts and calcarenites with Streptognathodus constrictus, S. barskovi in base - shales with Streptognathodus wabaunsensis, S. flangulatus	TOLBEYAKHSKAYA FORMATION silty shales, rhytmically interbedded with graded calcarenites with Streptognathodus constrictus, S. barskovi in base with Streptognathodus cristellaris MEMBER III black shales with sparse manganese carbonate beds and nodules 100 - 200 m
CARBONIFEROUS	UPPER	GZHELIAN	180 m		MEMBER III black shales, upper part with sparse manganese carbonate beds with Streptognathodus elongatus, S. alekseevi	MEMBER II shales, rhytmically interbedded with manganese carbonates and gradded biocalcarenites upper part with Streptognathodus elongatus, S. alekseevi, S. eccentricus,
	PERMIAN	KASIMOVIAN	MEMBER IV Shales, silstones with Protonodosaria praecursor, P. cf. rauserae, P. cf. cornutoapercionis, Streptognathodus oppletus		middle part with Parashumardites sp.,	middle part with Strptognathodus excelsus
		MOSCOVIAN	lime and dolomite marls with Streptognathodus aff. excelsus Idiognathoides sulcatus MEMBER III Black cherts rhythmically interbedded with cherty shales, with Idiognathoides sinuatus	MEMEBER V Limestones, with Taitzehoella cf. librovitchi perseverata, Ozawainella sp., Tetrataxis paraconica, Choristites ex gr. priscus, Spirifer attenuatiformis, Brachythyrina cf. kleini more than 50 m	lower part with Neognathodus roundyi, N. medexultimus, Idiognathodus delicatus, Idiognathoides tuberculatus, I. fossatus, I. sinuatus	lower part with Neognathodus roundyi 45 - 50 m
		BASHKIRIAN	MEMBER II Upper part - crinoidal biocalcarenites, shales, cherts with Pseudastaffella ex gr. antiqua Globovalvulina pulchra, Asteroarchaediscus subbaschkiricus, Semicostella cf. uklukaensis, Declinognathodus noduliferus japonicus, Idoignathoides corrugatus, I. sinuatus, Streptognathodus cf. parvus	MEMEBER IV Limistones, dolomitic limestones with Eostaffella acutissima, Neoarchaediscus gregorii, Asteroarchaediscus baschkiricus, Krotovia rarituberculata Plicatifera plicatilis, Ovatia tenuistriata, Syngastrioceras aff. dronovi, Idiognathoides aff. corrugatus 100 - 200 m	MEMBER II black radiolarite cherts and cherty shales with phosphate nodules, with Declinognathodus noduliferus japonicus, Idiognathoides pacificus in base Declinognathodus noduliferus inaequalis	MEMBER I black radiolarite cherts with phosphate nodules and gradded calcarenite beds upper part with Streptognathodus expansus middle part with Declinognathodus lateralis, D. noduliferus noduliferus, D. noduliferus japonicus, Idiognathoides sinuatus, I. sulcatus in base - Declinognathodus noduliferus inaequalis, Gnathodus ex gr. bilineatus 40 - 55m
		SERPUKHOVIAN	Lower part - crinoidal biocalcarenites, anhydrites, limestone breccias, algal boundstones with Mediocris brevicula, Archaediscus krestovnicovi compressa, A. pussilla, Goniatites aff. crenulatus, Gnathodus bilineatus bilineatus, Lochriea commutata	MEMEBER III Upper part - limestones with Endothyranopsis sphaerica, Eostaffellina protvae, Eostaffella pseudostruvei, Neoarchaediscus timanicus, Asteroarchaediscus subbaschkiricus, Gigantoproductus protvensis, Latiproductus edelburgensis Lower part - limestones, dolomitic limestones with Asteroarchaediscus ovoides, Striticfera striata, Gigantoproductus striatosulcatus, Latiproductus latissimus 200-250 m	MEMBER I laminated black shales, radiolarite cherts and silty dolomitic limestones with Gnathodus bilineatus bollandensis The whole thickness of subformation 10 - 150m	ESIPOVSKAYA FORMATION micaceous sandstones, siltstones, shales, limestones with Eostaffella aff. micrica, Tetraxis planiocula, Archaediscus ex gr. itenerarus, Rugosoarchaediscus agapovensis, Lochriea commutata, Gnathodus bilineatus bollandensis 30-140m
		VISEAN	MEMBER I Shales, cherty shales, cherts, micrite limestones	MEMEBER II Upper part - limestones with Endothyranopsis crassa, Brady na rotula, Archaediscus gigas Striatifera striata, Semiplanus semiplanus, Gigantoproductus aff. maximus, Productus concinnus, Eomarginifera longispina, Davidsonina septosa Lower part - limestones, shales, cherts with Eogloboendothyra orelica, Palaeospiroplectammina diversa, Avonia youngiana, Paulonia ranovensis	MILINSKAYA FORMATION fine crystalline cherty limestones, limestone breccias, graded calcarenites with Endothyranopsis sphaerica, Eostaffellina paraprotvae, Eostaffella ikensis, Mediocris breviscula, Gnathodus bilineatus bilineatus, Lochriea commutata 60 - 100 m	
		TOURNAISIAN	Lower part - with Siphonodella obsoleta, S. lobata, S. crenulata The whole thickness of the formation 150-1100 m	MEMBER I Upper part - limestones with Chernyshinella kinensis, Tournayella molleri, Grameliferella crassitheca, Endothyra tuberculata, Uralinia multiplex Chonetes chardrensis, Brachythyris suborbicularis, Eudoxina media Lower part - limestones, dolomitic limestones, dolomites with Bisphaera irregularis, Septatournayella rauserae, Quasiendothyra communis, Chernyshinella glomiformis 250 - 300 m	ROGACHEVSKAYA FORMATION UPPER SUBFORMATION laminated bkack shales, radiolarite cherts, sparse fine crystalline limestone beds and nodules with Palaeospiroplectammina tschernyschinensis globata, Endothyra paracosvensis, Endothyranopsis compressa, Gnathodus cf. texnus, Mestognathus sp. Scaliognathus ex gr. anchoralis 50 - 100 m LOWER SUBFORMATION black radiolarite cherts, rhytmically interbedded with black cherry shales, in the eastern subarea - with sparse graded calcarenite - calcisilicite beds. Eudoxina media, Siphonodella sp., Patrognathus crassus, Clydognathus cf. cavusiformis 110 - 120 m	

Table 2: A stratigraphic correlation chart for Carboniferous deposits located in the southern portion of Novaya Zemlya, Russia. The region is divided into the South (I) and Kara (II) areas, each of which is further divided into two subareas (Ia and Ib; IIa and IIb) (see Figure 6).

lised calcilutites (possible fine-grained turbidites). In the eastern Kara subarea, the Milinskaya Formation consists of the same limestones together with fine-grained sandstones and siltstones, also regarded as possible turbidites. The geological age of the Milinskaya Formation, based on foraminifers, ammonoids and conodonts, is considered to be Late Viséan - Early Serpukhovian.

Lithological features of the Milinskaya Formation, especially the abundance of gravity flow deposits, suggest that the depositional environments correspond to the slope, base of the slope and the basin floor.

Kazarkinskaya Formation

The Kazarkinskaya Formation is distributed in the western Kara subarea. It conformably overlies the Milinskaya Formation with a distinct boundary at which light grey limestones are sharply replaced by black, or dark-grey siliceous and argillaceous rocks. The Kazarkinskaya Formation is subdivided into two subformations. The lower subformation is composed of black shales with phosphate nodules and radiolarite cherts interbedded with graded calcarenites (supposedly carbonate turbidites). The upper subformation consists of shales rhythmically interbedded with silty shales, containing beds of manganese carbonate ores, which are complex isomorphic mixtures of manganese, calcium, magnesium, and iron carbonates with some addition of silica.

The lower Kazarkinskaya subformation contains Serpukhovian conodonts at its base, middle Carboniferous Kasimovian foraminifers and conodonts in its middle part, and conodonts of the *elongatus* Zone have been found at its top. The upper Kazarkinskaya subformation contains Early Asselian conodonts at its base.

The depositional environments are presumed to be the base of a slope - basin floor with anoxic (euxinic) conditions in the lower part of the water column. The lower Kazarkinskaya subformation provides a typical example of starved sedimentation (sedimentation rates vary from 0.05 to 1.0m per million years).

Esipovskaya Formation

The Esipovskaya Formation conformably overlies the Milinskaya Formation in the eastern Kara subarea. Micaceous sandstones prevail in its section. In the upper part of the formation they are interbedded with siltstones and shales. Late Serpukhovian conodonts have been found in limestone interbeds in the middle part of the formation. The rocks of the Esipovskaya Formation are interpreted as low-density and high-density turbidity current deposits and the depositional environment is assumed to be a submarine fan.

Stepovskaya Formation

The Stepovskaya Formation conformably overlies the Esipovskaya Formation. The boundary between them is lithologically distinct and established by the appearance of black radiolarites with phosphate nodules and interbeds of graded calcarenites, containing Bashkirian conodonts (lower member). The middle and the upper parts of the formation are composed of shales with sparse interbeds, lenses and nodules of cherty manganese carbonate rocks. The middle member contains calcarenite interbeds with Late Moscovian, Kasimovian and Gzhelian conodonts. The upper member contains no fossils.

The Stepovskaya Formation is conformably overlain by the Tolbeyakhskaya Formation, which contains Middle Asselian conodonts at its base. Thus, the Carboniferous/Permian boundary is not established exactly and is located somewhere inside the upper member of the Stepovskaya Formation. The depositional environments for the Stepovskaya Formation are close to those for the Kazarkinskaya Formation - a deep water euxinic basin. The calcarenites are interpreted as carbonate turbidites.

Summary

Carboniferous deposits of the southern area of Novaya Zemlya occur in two types of sequences distributed in two environmental areas namely the South area and the Kara area. In both areas, the Carboniferous system is fully represented and the earlier postulated Carboniferous/Permian unconformity [1, 3] does not exist.

The palaeogeographical situation in the Early, Middle and earliest Late Carboniferous seems to be a shelf - slope - basin transition with gravity driven mass flows being widespread on the slope. The destruction of the carbonate shelf and the formation of an euxinic deep-water basin took place during Kasimovian time. As the solute manganese concentration rose, manganese-bearing sediments were deposited in the stagnant zone of this basin.

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Carboniferous Miospores and Stratigraphy of the western part of the Tunguska Syneclise (middle Siberia)

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Carboniferous deposits of this region are rich in coal and are prospective for diamonds and bauxite. They can be subdivided into Middle-Upper Carboniferous continental coal measures and a Lower Carboniferous marine sequence.

During the period 1959-1994, the author has investigated a large

number of palynological samples from which it has been possible to define six separate complexes:

1. The first complex with *Acanthotriletes rarisetosus* - *Spelaeotriletes baculus* has been collected from the lowest part of the Carboniferous in the Tychan diamond region. It is usual for it to contain a large number of the spores *Retusotriletes simplex* NAUMOVA, *R. setosus* KEDO, *R. granulatus* PASHKEVITCH, and *R. rugulosus* PETERSON. Also commonly present are the spores *Acanthotriletes rarisetosus* KEDO, *Reticulatisporites reticulatus* IBRAHIM, *Hymenozonotriletes luteolus* NAUM., *Spelaeotriletes baculus* PET., *Lycospora subtila* LUBER, *Lophotriletes mesogrumosus* KEDO. The age of this complex is Upper Tournaisian-Lower Viséan.

2. The second complex with *Lycospora* spp. - *Retusotriletes coniferus* is collected from the Tuschama suite and the Schuschuk suite of the central part of the Tunguska syneclise. It is characterised by an abundance of the spores *Lycospora* and *Densosporites*. A greater part of the complex consists of spores of the genus *Retusotriletes* (*R. coniferus* KEDO, *R. setosus* KEDO, *R.granulatus* PASHK., *R. communis* NAUM.). Also found are appreciable quantities of the spores *Trachytriletes punctulatus* (WALTZ) ISCHENKO, *Granisporites testiculatus* KEDO, *Acanthotriletes dominans* KEDO, *Spelaeotriletes baculus* PET., *Hymenozonotriletes submirabilis* JUSHKO, *H. flavus* KEDO. The complex is dated as Upper Viséan.

3. The third complex with *Remisporites mirabilis* - *Apiculiretusispora ciliaris* is found in the lowest part of the Upper Palaeozoic coal measures. It is typical for the complex to be dominated by the spores *Remysporites mirabilis* Luber, *Cyclobaculisporites trichacanthus* LUB., *C. pallens* LUB., *Granulatisporites microgranifer* IBR., *G. spinotuberosus* LUB., *Foveolatisporites perforatus* LUB., *Apiculiretispora ciliaris* PET., *Cyclogranisporites larvatus* (LUB.) PET., *Turrisporites rigidispinosus* LUB., *Lycospora breviapiculata* (LUB.) POT. et KR. and pollen *Cordaitina rotata* (LUB.) SAMOILOVITSCH, *Plicatipollenites* sp., *Florinites macropterus* LUB., *Vittatina striata* LUB. Archaic Devonian and Lower Carboniferous spores can also be found. The complex occurs in the Bashkirian stage of the Middle Carboniferous and it characterises the lower part of the Yangotoy biostratigraphic horizon.

4. The fourth complex with *Remysporites psilopterus* - *Florinites grandis* is found in strata associated with coal located at the Upper Yangotoi biostratigraphic horizon. In this complex the spores *Remysporites psylopterus* LUB. and *Cyclobaculisporites trichacanthus* LUB. are dominant. The amount of older spores *Retusotriletes* and lepidophytes has been reduced and the quantity and variety of cordait pollen have increased. Typical are miospores such as *Turrisporites resistens* LUB., *Florinites grandis* LUB., *F. macropterus* LUB., *Granulatisporites grossepunctatus* (WALTZ) LUB., *Planisporites mollis* LUB.

5. The fifth complex with *Cyclobaculisporites* spp. - *Vallatisporites radiatus* has been investigated from beds in the lower part of the Kata suite of the Moskovian(?) stage. In this complex, the following spores are dominant - *Cuclobaculisporites trichacanthus* LUB., *C. gibberulus* LUB. and *C. pallens* LUB., *Vallatisporites radiatus* (LUB.) PET. Most typical are the following miospores - *Turrisporites sinuasus* LUB., *Verrucosisporites phaleratus* LUB., *V. ermacovianus* (KOVALENKO) LUB., *Reticulatisporites reticulatus* IBR., *Granulatisporites piroformis* LOOSE. The quantity and variety of cordait pollen and archaic needles have increased - *Florinites katskiensis* MEDVEDEVA, *Protopinites recturatus* (LUB.) VARJUCHINA.

6. The sixth complex with *Remysporites* - *Calamospora* has been recovered from coal seams in the upper part of the Kata suite. In this complex, spores *Remisporites psilopterus* LUB., *R. mirabilis* LUB., *Calamospora microrugosa* (IBR.) S.W. et B., *Nigrisporites nigritellus* (LUB.) Oschurkova, *N. nigrotuberculatus* LUB., *Leiotriletes inermis* (WALTZ) NAUM. are dominant. The amount of spores of *Cyclobaculisporites* has been strongly reduced and many Carboniferous types have disappeared. Small spores of Permian type, *Cyclogranisporites polypyrenus* (LUB.) *Siverceva*, *Granulatisporites pulvigerus* (LUB.) ISCH., *Acanthotriletes parvispinus* (LUB.) ISCH., *A. rectispinus* (LUB.) ISCH. have appeared. The quantity and variety of the pollen *Cordaitina* have increased and the pollen *Cycadales* has appeared. This complex is dated as Upper Carboniferous.

Six Carboniferous palynocomplexes in the Tungusca syneclise that were investigated by the author have been accurately observed in other regions of Siberia in the same stratigraphic sequence and on the same stratigraphic levels.

As a result of the investigation of Carboniferous miospores of Middle Siberia, two major stages in their development have been determined: Lower Carboniferous with complexes 1 and 2, and Middle-Upper Carboniferous with complexes 3, 4, 5 and 6. The boundary between them is clear and correlates with the changes of lepidophyte flora formation to cordait formation.

Spores in the complexes of the Siberian Lower Carboniferous sequences are widely represented in similarly aged complexes of the Westphalian palaeofloristic area. Spores in the complexes of Middle-Upper Carboniferous are endemic and typical for Angaraland. Because of the author's investigation, it can be shown that the time of appearance of the pollens *Florinites* and *Potoniesporites* in Angaraland and Westphalia is identical, being located at the Viséan-Namurian boundary, with the genus *Cordaitina* in Middle Carboniferous and Westphalian and the Cycadales (genus *Marsupipollenites*) in Upper Carboniferous Stephanian C.

The timing of the basic reconstruction in palynofloras of Siberia correlates with the boundary of Namurian A and B, Dinantian-Silesian in Western Europe and Mississippian-Pennsylvanian in the USA.

Carboniferous of Brazil

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Palynology of the Paraná Basin

Palynological analyses of thin paralic coal beds intercalated in the glacial-bearing sequence of the Itararé Subgroup, late Palaeozoic of the Paraná Basin, yielded assemblages indicative of a Carboniferous age.

The assemblage from Buri (SOUSA et al. 1993) in the northern Paraná Basin, southeastern Brazil, contains typical continental spore elements dominated by lycophytes (*Densosporites, Ancistropora, Cristatisporites, Vallatisporites* and *Lundbladispora*), sphenophytes (*Laevigatosporites*) and phyllicophytes (*Punctatisporites, Raistrickia, Granulatisporites* and *Apiculatisporites*, associated with rare *Michrystridium*). The microflora is correlated with the *Ancistrospora* palynozone in the Paganzo Basin of Argentina (AZCUY & JELIN 1980) of probable Westphalian age. Palaeoecologically the assemblage indicates a low, humid, deltaic environment.

Another assemblage from the coal beds at Monte Mór (SOUSA et al. 1993) and also from the Itararé beds in northern Paraná Basin, seems to be slightly younger (Late Carboniferous), as indicated by the presence of *Plicatipollenites* and *Potoniesporites*. Rare acritarchs are evidence of a paralic setting.

From the Lagoa Azul Formation (Itararé Subgroup) in the subsurface of the northern Paraná Basin, DAEMON & FRANCA (1993) reported the finding of spores which they assigned to the Westphalian associated with reworked Early Carboniferous and Devonian forms.

These age determinations suggest an earlier initiation of deposition for the glacial sediments of the Itararé Subgroup in the Paraná Basin than usually accepted.

Marine Invertebrates from the Piauí Formation, Parnaíba Basin

ANELLI (1993; and unpub. Masters thesis 1994) described 22 bivalve taxa from three shallow marine carbonate facies from the upper part of the Piauí Formation (Middle Pennsylvanian) Parnaíba Basin, nothern Brazil. The fauna is typically "tethyan" and includes late Palaeozoic cosmopolitan genera such as *Wilkingia, Permophorus, Astartella, Pteronites*, and *Schizodus*, together with species of *Oriocrassatella* and *Vacunella*-like shells. Other invertebrates in the fauna are brachiopods, trilobites, cephalopods, bryozoans, conodonts, echinoderms, ostracods and foraminifers that are now being described.

The assemblage shows affinities with other Carboniferous assemblages from northern South America (e.g. Itaituba Formation, Amazon Basin; Caño Indio Formation, Venezuela) and from the US Midcontinent.

Palynology of the Amazon Basin

PICARELLI et al. (1993) reported the presence of *Prototaploxypinus, Complexisporites* and *Striamonosaccites* in conodont and fusulinid bearing Middle Pennsylvanian sediments from the Amazon Basin, northern Brazil. The first taxon is not known in beds older than Late Carboniferous in the Paraná Basin of southeast Brazil.

Palaeobotany of the Parnaíba Basin

IANNUZZI & RÖSLER (1993) and IANNUZZI et al. (1993) are revising the megaplant assemblage from the Poti Formation (Early Carboniferous), Parnaíba Basin, northern Brazil. As a result, the following taxa have been recognised: *Diplothmema gothanica* nov. comb., *Adiantites* sp., *Kegelidium lamegoi*, *Paulophyton sommeri*, *Paulophyton* sp., *Nothorhacopteris* sp., *Triphyllopteris adiantoides* nov. sp., and a lycophyte similar to *Ursodendron*.

The assemblage is a mix of Gondwanan and cosmopolitan genera and shows some endemism both at specific and generic levels. It is comparable with Late Carboniferous floras from Argentina, Peru and Bolivia. The age of the flora is still controversial but palynological determinations indicate a Viséan age.

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ANELLI, L.E. 1994. Pelecípodes da Formacão Piauí (Pensilvaniano médio), Bacia do Parnaíba, Brasil. *São Paulo. Master Dissertation, Instituto de Geociências, USP*, (unpublished), 148 p.

Ichthyolith Issues

News and views on Palaeozoic vertebrate microfossils

Ichthyolith Issues is the communications medium for the highly successful project IGCP 328 Palaeozoic Microvertebrate Biochronology and Global Marine/non-Marine Correlation which is co-chaired by **Dr SUSAN TURNER** (Queensland Museum, PO Box 3300, South Brisbane Qld 4101, Australia) and **Dr ALAN BLIECK** (URA 1365 du CNRS, Univ. des Sciences et Techniques de Lille: Sciences de la Terre, F-59655 Villeneuve d'Ascq Cedex, France). Two issues (11 & 12) were published in 1993 with back issues 1-12 being available from Dr TURNER who is the Editor. Issue 13 (April 1994) arrived during the preparation of this Newsletter.

The Project holds international and national workshops clarifying the taxonomy and uses of Palaeozoic fish remains and aims to educate the geological community about the economic value of their work. In 1993, the UNESCO Scientific Committee assessed the project as having the highest standing for its work which saw the doubling of the publication rate to more than 100 papers in that year. One of its major achievements included the co-sponsoring, with the Subcommission on Devonian Stratigraphy, of the international **Gross Symposium** (70 abstracts) which was held in Göttingen in August 1993. One aim of this symposium was to formulate a Devonian correlation chart based on the project group's work on microvertebrates, an outcome which it is hoped will be achieved for their Final Meeting in Paris in 1995. This meeting will be combined with their next symposium on **Early Vertebrate Studies** and it is expected that the cooperative activities of the members of the working group will continue beyond the end of the formal life of the IGCP project, perhaps as a new project or as a separate Society.

SCCS members wishing to learn more of the activities of the group or to subscribe to *Ichthyolith Issues* (1994 Issues - $20) should contact **DR SUSAN TURNER** at the above address (Fax +61 7 846 1918).

Argentina

SERGIO ARCHANGELSKY advises that the two volumes of the Compte Rendu of the XII ICC-P may now be obtained from Asociación Paleontológica Argentina, Maipú 645, 1st Floor, (1006) Buenos Aires, Argentina. The cost of the set is US$100 plus postage. Members should encourage their libraries to obtain copies of this valuable publication.

Dr ARCHANGELSKY also reports that a *Symposium on Paleobiology of Fossil Plants* was held in Trelew City, Chubut, Argentina from 4 - 8 April 1994. It was organised by R. CÚNEO, T.N. TAYLOR and E.L. TAYLOR. Fourteen lectures were delivered, many relating to Late Paleozoic aspects of fossil plants:

D. EDWARDS, Terrestrial dynamics and biogeography of early land plants.

W.D. MICHELE, Late Paleozoic ecosystems as models for study of the long term dynamic behaviour of communities.

W. REMY, Possible ecological pressures on early gametophytes and sporophytes.

T. TAYLOR, Symbiotic relationships as an early force in the evolution of terrestrial ecosystems.

E. TAYLOR, Enigmatic seed plants.

S. ARCHANGELSKY, Seed plant evolution during the Paleozoic-Mesozoic transition in the Southern Hemisphere.

H. KERP, Seed plant evolution during the Paleozoic-Mesozoic transition in the Northern Hemisphere.

V. MOSBRUGGER, Biomechanical pattern in plant evolution.

G. ROTHWELL, Pteridophytic evolution: a reproductive paradigm.

Other lectures were delivered by W. NIXON, P. CRANE, D. DILCHER, E. ROMERO and W. CREPET.

After the symposium, a field trip to Patagonia plant localities included visits to Carboniferous and Permian localities at Chubut and Santa Cruz provinces.

Retirements

ROBERT M. KOSANKE, a longtime Voting Member of the Subcommission has advised that after working for some 50 years, he has decided to retire. Bob will however continue his research as a volunteer on several manuscripts and can still be contacted at his old address.

While on the subject of retirement, **BRIAN ENGEL**, SCCS Secretary & Editor of this *Newsletter* has elected to take early voluntary retirement from the Geology Department of The University of Newcastle. Like Bob KOSANKE, he is unable to leave the workplace and will continue on as an Honorary Associate in the Department where there are still many Carboniferous trilobite specimens waiting to be described.

Abstracts of papers

Lower Carboniferous of Moscow syneclise and Voronezh anteclise.

M.Kh. MAKHLINA, A.S. ALEKSEEV, T.V. BYVSHEVA, M.V. VDOVENKO, L.M. DONAKOVA, V.E. ZHULITOVA, L.I. KONONOVA, N.I. UMNOVA, E.M. SHIK.

Editors: M.N. SOLOVYOVA and E.M.SHIK; **Chief editor:** S.V.TIKHOMIROV; Moscow, Nauka, 1992 - 1993, 25 p., 20 Tabs, 50 Textfigs, 230 References, 32 plates (24 forams; 3 conodonts; 3 spores) (In Russian).

This monograph deals with biorhythmic stratigraphy for all horizons in the Lower Carboniferous Tournaisian, Viséan and Serpukhovian stages of the region and shows the structure of these horizons subdivided into suites and subsuites. Detailed study was undertaken in the type and hypostratotype sections within the type areas and in the region in general. The results of megascopic and microscopic rock description together with bed-by-bed foraminiferal determinations are given

and at a number of sections conodonts, spores and some other groups of fauna were studied as well. Rhythmic sedimentation was demonstrated and critical stratigraphic boundaries were determined using tectonic-eustatic oscillations of sea level.

Natural geological-historical periods correspond to stratigraphic units of different rank. The distribution of palaeontological assemblages (foraminifers, brachiopods, conodonts) relative to these periods is demonstrated and the coincidence of, or differences between biostratigraphical and isochronal boundaries are shown. Lower Carboniferous zonal subdivisions based on foraminifers, brachiopods, conodonts and spores are described. The data was collected from bed-by-bed studies of the stratotype and type section. Monographic description of foraminifers accompanied by their illustration are presented. Stratigraphic columns of stratotype and reference sections, correlation charts and a number of maps showing facies and thickness for different horizons are included in the monograph. Facies distribution within suites and subsuites of all fourteen horizons are illustrated by maps.

Late Carboniferous and Early Permian Algal Microflora (Liuzhou, South China)

CHUN LI, Nanjing Inst. Geol. & Pal., Academia Sinica, Chi-Ming-Ssu, Nanjing China 210008 and BERNARD MAMET, Dépt Géol, Univ. Montréal, BP 6128 Montréal, Québec, Canada H3C 3J7.

Abstract: The role of calcareous algae in sedimentation is studied in a continuous sequence of the Maping Limestone (South China). The beresellid algae are important builders in the Late Carboniferous and the *Tubiphytes-Archaeolithophyllum* community is locally replaced by a *Tubiphytes-Ungdarella* association. Early Permian oncolites were formed by complex *Osagia*, then by *Ellesmerella*. The Asselian *Sphaeroschwagerina* fauna is underlined by the outburst of epimastoporid dasycladales and phylloid Anchicodiaceae. *Microcodium* is observed at the contact of the *Sphaeroschwagerina moellerisphaerica* Zones. The overlying and paraconformable Chihsia Limestone is characterised by a *Gymnocodium - Gyroporella - Mizzia* flora. In most cases, the base of the fusulinid zones, therefore, coincides with an important local floristic change.

Pub: *Bull Canadian Petroleum Geol.* **41** (1), 70-78, 1993.

The Nanbiancun algal microflora: A study of the Devonian-Carboniferous boundary in China

BERNARD MAMET, Dépt Géol, Univ. Montréal, BP 6128 Montréal, Québec, Canada H3C 3J7.

Abstract: The algal microflora at the *praesulcata-sulcata* level in Nanbiancun, China, is undiversified and monotonous. It suggests no major facies change, no important transgression and no temperature variation at the Devonian-Carboniferous boundary.

Pub: *Ann. Soc. géol. de Belgique*, **115** (2), 623-627, 1993.

Upper Carboniferous Fusulinids from Mt Maruyama, Mine City, Yamaguchi Prefecture

YASUHIRO OTA, Mine City Museum, Mine City, Yamaguchi 759-22, Japan.

Abstract: The Middle to Upper Carboniferous Akiyoshi Limestone Group is widely distributed in the Mt Maruyama area, Mine City, Yamaguchi Prefecture. Limestones in this area are variable in their organic composition and include rugose corals, ammonoids, phylloid algae, brachiopods, and fusulinids.

Lithological facies and sedimentary features indicate a palaeoenvironment of the reef flat or by-pass margin between the fore reef part of the Akiyoshi organic reef complex and the open sea.

Locality MA66 is abundant in fusulinid species of primitive type - "*Triticites*". Four species, including three new ones can be discriminated as follows: *Protriticites yanagidai* sp.nov., *Protriticites masamichii* sp. nov., *Protriticites toriyamai* sp. nov., and *Protriticites* aff. *matsumotoi* (KANMERA)

Pub: *Bull Kitakyushu Mus. Nat. Hist.*, **13**, 1-35, Pls 1-3, 1994.

Faunal Change of the Upper Carboniferous to Lower Permian Fusulinaceans from the Akiyoshi Limestone Group, Southwest Japan

YASUHIRO & MASAMICHI OTA, Div. Science, Kyushu Univ. Grad. School, Fukuoka, 812 Japan and Kitakyushu Mus. Nat. Hist., Kitakyushu, 805 Japan.

Abridged abstract: Upper Carboniferous to Lower Permian fusulinacean zonation of the Akiyoshi Limestone Group was reexamined on material successively obtained along a route named AK, adjacent to the Akiyoshi-dai Museum of Natural History .

Six fusulinacean zones were identified in ascending order: *Pseudofusulinella hidaensis* Zone, *Protriticites matsumotoi* Zone, *Montiparus* sp. A Zone, *Triticites simplex* Zone, *Pseudoschwagerina muongthensis* Zone, *Pseudofusulina vulgaris* Zone. Global correlation and facies are discussed. [Text in Japanese]

Pub: *Bull Akiyoshi-dai Mus. Nat. Hist.*, **28**, 1-57, Pls 1-3, 1993

Early Carboniferous Bivalvia from western Argentina

C.R. GONZÁLEZ, Instituto de Paleontología, Fundación Miguel Lillo, Miguel Lillo 251, 4000 Tucumán, Rep. Argentina.

Abstract: Lower Carboniferous deposits of western Argentina yield invertebrates and plant remains. In the Tournaisian epoch, a transgression from the "Pacific" flooded the Rio Blanco Basin, forming a semi-restricted inland sea. Marine invertebrates of this age comprise the Malimanian fauna which is based on the *Protocanites-Rossirhynchus* Assemblage. Eleven species of bivalvia are here described: *Palaeoneilo subquadratum* sp. nov., *Malimania triangularis* gen. et sp. nov., *Phestia* sp., *Volsellina*? sp., *Posi-*

doniella malimanensis sp. nov., *Leptodesma*? sp., *Schizodus* sp., *Cypricardina*? sp., *Edmondia*? sp., *Sanguinolites punillanus* sp. nov., and *Vacunella*? sp. nov. They are accompanied by gastropods, trilobites, conularids and corals. The Malimanian fauna is regarded as a poorly to moderately varied assemblage that was influenced by some basinal restrictions. It was probably connected to faunas of Chile and Peru, and lived during a stage of mild climate preceding the Late Palaeozoic ice age. **Pub:** *Alcheringa,* 18(2), 169-185, 5 Figs, 1994.

Field Work in Russia

In early August 1993, a group of Russian specialists (**A.S. ALEKSEEV & L.I. KONONOVA,** The Moscow State Univ.; **M.K. MAKHLINA,** "Geosynthesis"; **A.V. YAROSHENKO,** Acad. of Oil & Gas; **N.V. GOREVA, T.N. ISAKOVA & T.V. FILIMONOVA,** Geol. Inst., Russian Acad. of Sciences; **O.A. LEBEDEV & A.V. SHKOLIN,** Palaeont. Inst., Russian Acad. of Sciences) carried out ten days field work to study the Carboniferous deposits in the region of the Oka-Tsna bank, near the town of Ryazan in the centre of the Russian plate. In the vicinity of the town of Kasimov, a group described the sequences near the villages of Akishino (Upper Moscovian, Myachkovian) and Sherbatovka (Upper Kasimovian and basal Gzhelian). The stratotype of the Tsnian horizon occurring at the Tsna River in the Yambirno quarry was also investigated in detail. Further studies of fusulinids, conodonts, macrofossils, fish and the lithology of these sequences is planned.

New Contacts in Kazakhstan

Through the efficient activities of Dr Marina DURANTE (Russian Voting Member), contact has been established with a number of Carboniferous workers in the Republic of Kazakhstan. A short precis of their activities is appended:

1. Dr V.Y. KOSHKIN - Chief of the Regional Laboratory of the Kazakhstan Institute of Mineral Products; Chairman of the Kazakhstan Carboniferous and Permian Stratigraphic Committee.

Research: Stratigraphy of continental and marine deposits and the volcanic genesis of the Jungaro-Balkhash region; compiler of regional stratigraphic schemes for the Carboniferous and Permian in Kazakhstan (latest one ratified by the former USSR Stratigraphic Committee in 1989 and published in 1991); co-author of SALMENOVA K.Z. & KOSHKIN V.Y. 1990. Stratigraphy and flora of the Northern Prybalkchash Upper Palaeozoic - Almatry, Nauka.

In the last three years, research on the evolution of Carboniferous and Permian faunas and their lateral variation has been carried out. (At that time Kazakhstan was transitional between Angara and Cathaysia). This work, done in collaboration with K.Z. SALMENOVA and L.V. SERGEEVA, has established an alternation of tropical, boreal and mixed brachiopod faunas in the Mid-Upper Carboniferous marine deposits.

2. Dr S.L. IVANOVNA - is involved with the study of the stratigraphy, volcanism and geochemistry of continental Devonian, Carboniferous and Permian beds exposed in southeast Kazakhstan. Studies have proposed: six formations of Devonian continental deposits for the Dzhungar Alatau and North Tien-Shan regions; compilation of the modern stratigraphic scheme for the Carboniferous of the same area and for the Chu-Ili Mountains area; and stratigraphic subdivision of Devonian, Carboniferous and Permian deposits for the large region of South Balkhash.

With M.A. SENKEVICH (Devonian floras), M.I. RADCHENKO (Carboniferous floras), and T.S. GRISHINA (Devonian/Carboniferous palynology) the use of palaeophytological and palynological methods have produced useful results in a region where volcanic and sedimentary horizons (marine and terrestrial) succeed each other in section.

3. Late Palaeozoic Group, Institute of Geological Sciences, National Academy of Sciences, Republic of Kazakhstan.

The above group advises that they have been involved for the last 25 years (1969-1994) with the study of Carboniferous - Permian strata, principally continental deposits, which have widespread occurrence in Kazakhstan.

Collaborators **E.Yu. SEITMURATOVA, G.F. LYAPICHEV, Yu.L. LYALIN, E.N. TIMOPHEEVA and M.R. BORUKAEVA** have been involved principally with study of the Late Palaeozoic sequence of the Balkhash segment of Kazakhstan. Features investigated include: Geological and biostratigraphic data; choice of reference sections; derivation of a new stratigraphic scheme for the Carboniferous and Permian including the Balkhash-Ili volcanic-plutonic belt.

A palaeontological Group (**L.A. GOGANOVA; G.A. AKSCENOVA; S.B. MAMUTOVA and K.Z. BOGOYAVLENSKAYA**) from sister institutions in Kazakhstan collaborated with the following activities: A comparison of Carboniferous deposits from various areas of Kazakhstan; a study of Carboniferous seeds; and the delineation of the palaeontological basis of the Late Palaeozoic sections of North Prebalkhashya.

Drs SEITMURATOVA and GOGANOVA have supplied the Editor with a list of 18 reprints which they are willing to distribute to interested colleagues - they deal with various aspects of the economic geology, volcanic-magmatic studies, stratigraphic studies, and structural geology of Kazakhstan over the period 1974-1994.

XIII International Congress on Carboniferous-Permian, Krakow, Poland - 28 August to 2 September 1995

Carboniferous Congress - Circular 2

The second circular for the Congress was issued in December 1993. It contained registration forms for the XIII ICC-P Conference and Excursions, for which the return deadline was 31 March 1994. Members sending in a late registration should do so now as a matter of urgency. In December 1993, over 400 participants from 30 countries had indicated their intention to attend.The official language of the Congress is English.

Organisers

Państwowy Instytut Geologiczny (Polish Geological Institute)

Polish Organising 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 Program SC: Dr Ryszard WAGNER
Chairman of the Excursion SC: Hubert KIERSNOWSKI, MSc.

Technical Program

1. Global Synthesis: Palaeogeography, Plate Tectonics, Palaeoclimate.
2. Stratigraphy and Palaeontology; Biostratigraphic Global Correlations.
3. Sedimentology, Analysis and Reconstruction of Sedimentary Basins.
4. Tectonics and Magnetism.
5. Post-Depositional Transformations of Organic Substances; Coal Petrology and Geochemistry.
6. Economic Geology (with special reference to coal, coalbed methane and hydrocarbons).
7. Ecological Impact of Coal Mining and Activities of Attached Industries.

EXCURSIONS

The following excursions will operate, depending on the interest shown by the potential participants. These descriptions are an abbreviated version of those appearing in the published congress circular.

Pre-Congress Excursions

A1: Carboniferous-Permian sequences in the Western Carpathians (Slovak Republic)

Duration: 6 days
Begins/ends: Koszyce, Slovak Republic – Kraków
Attendance: min. 15. max. 40
Transportation: Bus
Cost: US$600

The Western Carpathians represent a mountain system with a characteristic Alpine nappe structural style. In this megastructure, fragments of Palaeozoic developments are preserved. The area forms an intensely compressed basinal structure with north-vergent thrusting of the inner units over the outer ones.

The lowermost unit is the Tatraveporic basement on which Permian terrigenous sequences with volcanics are preserved. Higher units are the Southern Veporicum and the multi-nappe unit of the Hronicum which are composed of the terrigenous Stephanian and Permian containing tholeiitic volcanics. The Gemericum belongs to the inner units of the Tethys northern margin. Characteristic are fragments of remnant and peripheral basins of the Carboniferous and Permian formation, established within the consolidated basement.

A2: Development of Variscan Basin and Epivariscan cover at the margin of the East-European Platform (Pomerania, Holy Cross Mts, Cracow Upland)

Duration: 4 days
Begins/ends: Warszawa – Kraków
Attendance: min. 15, max. 40
Transportation: Bus
Cost: US$400

The Holy Cross Mts, a hilly area in Central Poland, expose extensive Devonian to Triassic sequences. The Devonian-Lower Carboniferous succession illustrates the development and decline of a carbonate platform with a complete facies spectrum. Devonian banks and reefs, condensed cephalopod limestones of submarine rise, Carboniferous slope and deep basins as well as the Frasnian/Famennian and D/C boundaries will be presented. Deposits folded during the Late Carboniferous were uplifted and covered with spectacular unconformity by Permian-Triassic complexes which comprise shallow water carbonates and sabkha succession, fanglomerates and fluvial/aeolian Triassic deposits.

A one day visit to the core depository in Leszcze near Warsawa will allow the comparison of Holy Cross sections with platform deposits of the East European Platform margin (Pomerania). The stratigraphy, sedimentology and tectonics of the Carboniferous from the western part of the Polish Lowlands, Lower Silesia and Wielkopolska region (Variscan Zone) will be presented. From the Variscan Zone - folded Culm fluvial deposits and overlying Upper Carboniferous formations will be studied. From the marginal zone (EEP) - cores documenting facies changes, development of a carbonate platform, carbonate clastic transitions and volcanics will be presented.

On the last day, the 600 m thick Tournaisian-Viséan, shallow-water carbonate sequence near Kraków will be examined.

A3: The East-European Rotliegendes Sedimentary Succession

Duration: 3 days
Begins/ends: Poznán – Kraków
Attendance: min. 15, max. 40
Transportation: Bus
Cost: US$300

The Lower Permian (Rotliegendes) volcanic-clastic succession of the eastern extension of the Southern Permian Basin of NW Europe represents the post-Variscan sedimentary cover spread on the Variscides and their northern foreland. The sedimentary cover is divided in two general units: the lower one which succeeds Upper Carboniferous sedimentary basins and the upper one which represents platform sedimentary facies, an early indicator of the Upper Permian (Zechstein) marine transgression to come.

The excursion traverses the Lower Permian Polish Basin to illustrate basin evolution and sedimentary depositional system tracts: beginning from the north- west facies (volcanic/pyroclastic and fluvial/alluvial); through the facies of the central part of the basin (playa lake/ sabkha/dune - visible only in cores); to the south-east marginal part of the basin where the Variscan discontinuity in the Holy Cross Mts facies (fluvial/alluvial) is exposed in outcrop. The Polish Rotliegendes basin is the main area of exploration and hydrocarbon production.

A4: Palaeontology of Carboniferous and Permian of Upper Silesian Coal Basin and Lublin Coal Basin

Duration: 3 days
Begins/ends: Kraków– Ostrava – Kraków
Attendance: min. 15, max. 40
Transportation: Bus
Cost: US$300

Examination of Carboniferous and Permian palaeontological collections kept in Polish and Czech scientific institutions in Kraków, Sosnowiec and Ostrava. In addition, it will be possible to examine and collect palaeontological samples from drill cores, from the Upper Silesian Coal Basin (USCB) as well as from a few outcrops in Poland and the Czech Republic.

Poland - Kraków:

1. Trip to the eastern part of the USCB; Westphalian and Permian sediments.
2. Fossil plant collections of Karniowice Travertine, (Autun).
3. A. Zerndt's megaspore collection.
4. Devonian and Carboniferous spores.
5. Devonian fossil plants.

Sosnowiec: Carboniferous fossil plants and fauna from Polish part of USCB and Lublin Coal Basin (LCB).

1. Macrofauna from marine Viséan-Westphalian and non-marine (Namurian-Westphalian) horizons.
2. Fossil plants (Viséan-Westphalian).
3. Microfaunas (Tournaisian-Westphalian).
4. Megaspores (Viséan-Westphalian).

Czech Republic

Visit to the DPB Company Paskov. Study of the drill cores with faunal horizons in the coal bearing Carboniferous. Collection of marine fossils. Visit to the Ostrava Museum. Exposition of fossils from the Carboniferous of the Ostrava area (based upon the Susta's historical collections). Study of old and new holotypes from Ostrava Carboniferous (flora and fauna), specially exhibited for the occasion of the Congress.

A5: Stratigraphy and Facies of the Middle European Continental Carboniferous and Permian

Duration: 5 days
Begins/ends: Freiberg near Dresden, FRG – Kraków
Attendance: min.25, max. 40.
Transportation: Bus
Cost: US$500

The excursion will present the classical continental deposits of the Carboniferous "Steinkohlenformation", Lower Permian "Rotliegendes" and Upper Permian marine "Zechstein" of the European Variscides in Saxony and Thuringia. It will start in the Erzgebirge basin with Viséan early Molasses (Borna-Hainichen trough, fossil bearing pyroclastics; Chemnitz petrified forest); and soil/lake horizons of the Rotliegendes basin). Drill cores will demonstrate Namurian paralic molasses and Westphalian alluvial fan deposits with coal seams. Outcrops of Stephanian - Midian Upper Rotliegendes in fossiliferous facies, as well as the ingression profile of the marine Zechstein, will be studied in the Thuringian Forest and the Mansfeld-Halle depressions of the Saale basin. At the southern border of the North German basin playa/sabkha/dune associations in the post-Variscan platform development of the topmost Rotliegendes (Midian) will be demonstrated in outcrop and core. Our focus will be on correlations between continental profiles and marine standard sections of the Upper Carboniferous and Permian.

Post-congress Excursions

B1 and B2: Carboniferous and Permian of Sudety Mts, Poland and Czech Republic

The participants can choose excursions B1 (Unit I) or B2 (Unit II/ III and partly Unit I), separately or together.
B1 duration: 4 days; B2 duration: 4 days
B1+B2 duration: 7 days
Begins/ends: Kraków– Wroclaw
Transportation: Bus
Cost: B1: US$400 / B2: US$400
Cost: B1+B2: US$700

The excursion is subdivided into three units:

I. Carboniferous-Permian Evolution of the Intrasudetic Basin, Poland + Czech Republic.

Aspects of the Intrasudetic Basin development (Carboniferous-Permian) with emphasis on the sedimentary response to changing tectonics and climate. The basin was initiated by Late Bretonian tectonic movements as an intermountain depression superimposed on a metamorphic basement, bounded by tectonically active margins. It was filled with siliclastic, continental deposits which now attain several thousands of metres in thickness. Intended localities will also give an overview of the whole P-C lithostratigraphic column of this basin and adjacent regions.

II. Sedimentary Record of Tectonic Activity in the Autochthonous Succession of the Bardo Mts. (Góry Bardzkie).

The Famennian-Lower Carboniferous (Klodzko-Wapnica-Srebrna Góra) autohthonous carbonate platform to foreland succession will be shown in the northern part of the Bardo Mts. (Góry Bardzkie) and in the Sowie Mts. (Góry Sowie). Profiles of the cores Zdanów IG 1 and Dzikowiec IG 1 will be discussed.

III. The Onset of Synorogenic Sedimentation in the Variscan Sudetes (Świebodzice Depression).

Facies development and tectonic controls of the sedimentation of the Upper Devonian-Lower Carboniferous clastic succession of the Świebodzice Basin. The succession, ca.4 km thick, is dominated by petromictic conglomerates of a fan - deltaic/marine affinity which mark the onset of Variscan inversion in the Sudetes. The trip will pass through the spectacular exposures of the Ksiaz Conglomerate in the Pelcznica River gorge.

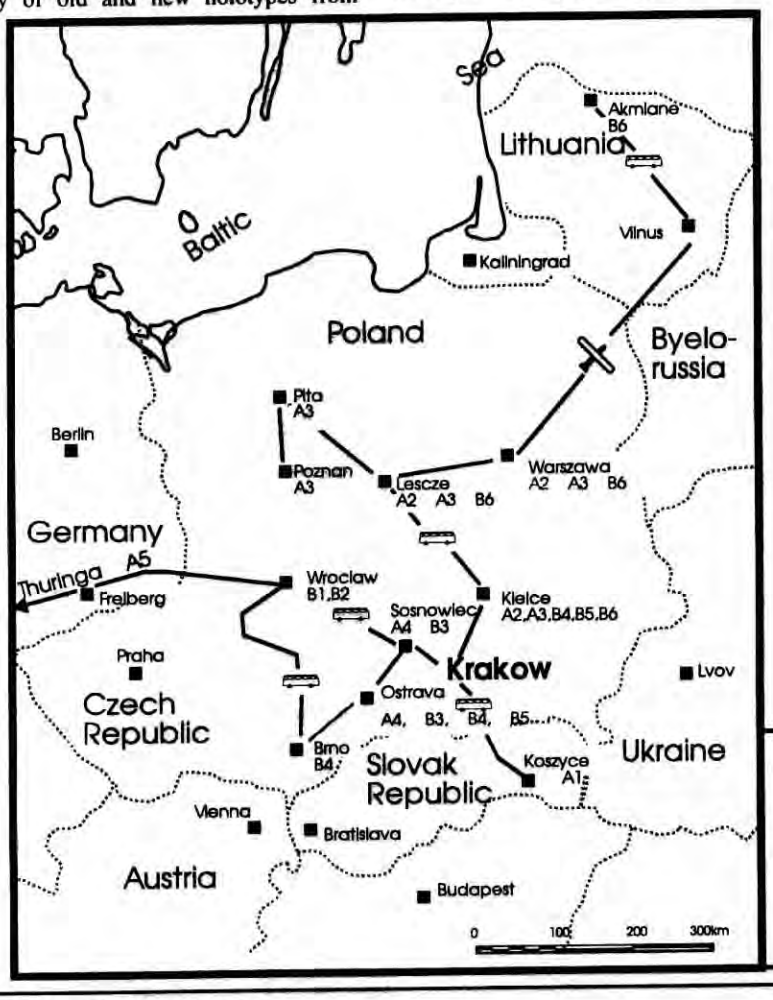

Figure 7: Locality map for the excursions associated with the International Congress on Carboniferous-Permian in Krakow, Poland, 28 August to 2 September 1995.

B3: Coal-bearing Carboniferous Deposits of the Lublin and Upper Silesian Coal Basins

Duration: 5 days
Begins/ends: Kraków– Ostrava (Czech Republic)
Attendance: min. 15, max. 40
Transportation: Bus
Cost: US$500

Coal-bearing deposits from the Lublin Coal Basin (SE Poland) and the Upper Silesian Coal Basin (Southern Poland and Czech Republic).

Lublin Coal Basin: depositional history of coal-bearing deposits in pericratonic conditions; structural framework of the coal basin as a result of Variscan orogenic activity; problems of lithostratigraphic subdivisions of coal-bearing deposits; coal deposits: resources, quality and petrography of coals, coalbed methane reserves.

Drill cores and rock samples, representing all Carboniferous coal-bearing deposits (Upper Viséan-Westphalian C), will be presented.

Upper Silesian Coal Basin: sedimentary environments and changes of palaeogeographic regime in the Moravo-Silesian foreland basin; depositional cycles of coal-bearing deposits of paralic and limnic sedimentary environments; structural framework of the coal basin as a result of Variscan and Alpine orogenies; problems of lithostratigraphic subdivisions and stratigraphic gaps occurring in coal-bearing deposits; coal deposits; resources, quality and petrography of coals, coalbed methane reserves.

Outcrops from limnic and paralic coal-bearing deposits as well as the underlying beds will be viewed. Drilling cores and rock samples, representing the whole Namurian A-Westphalian D coal-bearing sequence and its basement (L/U Carboniferous) will be exhibited.

Czech Republic: (Ostrava — Karvina Coalfield). Paralic and limnic molasse in the Czech part of the Upper Silesian Coal Basin (Namurian, Westphalian A). Outcrops of Namurian A in the Ostrava vicinity with some key lithostratigraphic horizons and structural-tectonic phenomena typical of the western part of the basin. Geological collections of both the Vysoka Skola Bánska (Mining Technical University) and Ostrava Museum, devoted to the Czech part of the Upper Silesian Basin. Participants will obtain representative samples of fossiliferous rocks (both fauna and flora), volcanites (coal tonsteins, whetstones), red beds and coals in various coalification rank, from different mines and boreholes.

B4: Evolution of the Polish-Moravian Carbonate Platform in the Late Devonian and Early Carboniferous: Holy Cross Mts, Kraków Upland, Moravian Karst

Duration: 5 days
Begins/ends: Kraków–Brno (Czech Republic)
Attendance: min. 15, max. 40
Transportation: Bus
Cost: US$500

Overview of the Devonian - Lower Carboniferous succession of southern Poland and northern Moravia. During the Devonian, in the extensive area between Kielce in the North and Brno in the southwest, thick carbonate complexes were deposited, dominated by stromatoporoid-coral bioherms and associated facies. In Late Devonian - Early Carboniferous, this platform was gradually drowned. In the three regions, this process occurred in different ways. It first began in the Holy Cross area which in the Viséan was transformed into a deep basin with typical Culm sedimentation. In the Kraków area, the platform survived up to the end of the Viséan when its margin was finally covered by flysch sediments.

During the excursion the following will be studied:

- platform, slope and basinal Frasnian and Famennian carbonates,

- condensed cephalopod limestones,

- numerous and different examples of F/F and D/C boundaries,

- outer shelf and extremely shallow-water (sabkha facies) Tournaisian carbonates with pyroclastic interlayers,

- broad overview of the Viséan sedimentary environments (e.g. submarine fan conglomerates, outer and inner shelf facies, basinal Culm shales with radiolarians, etc.),

- geotectonic development of the whole basin.

B5: Transition of Early Carboniferous pelagic sedimentation to synorogenic Flysch – Silesian- Moravian Zone & adjacent areas.

Duration: 5 days
Begins and ends: Kraków– Ostrava (Czech Republic)
Attendance: min. 15, max. 40
Transportation: Bus
Cost: US$500

The field trip will present some Lower Carboniferous sequences illustrating palaeogeography and evolution of tectono-sedimentary realms through different facies domains of the deep sea basin. The axis of this basin is located along present Moravo-Silesian orogenic zone (Polish/Czech borderland) which forms an eastern extension of Variscan Rhenohercynian belt. Several outcrops and core sections will be examined, within an extensive area between Kielce (Holy Cross Mts) in the northeast, Sudety Mts in the west and Niski Jasenik Mts (Czech Republic) in the southwest.

Poland: The following will be studied: gradual decline by drowning of Devonian-Dinantian carbonate sedimentation areas; realms of basinal Culm magnafacies sedimentation; siliceous and organic-rich pelagic deposits of radiolarites and pyroclastics *versus* carbonate turbidites (allodapic limestones); anoxic and upwelling events, eustasy and subsidence control of basin palaeogeography during the pre-flysch stage; polarity and diachronism of synorogenic greywacke flysch invasion through the basin; transect from Lower Carboniferous wildflysch in accretionary wedge of Bardo Mts (central Sudety Mts) to undeformed, distal flysch facies on eastern platform domains.

Czech Republic: A continuous section through Lower Carboniferous accretionary wedge with typical flysch megafacies distribution. The transition from pre-flysch to flysch and to marine molasse sediments.

B6: East-European Zechstein Basin

Duration: 4 (7) days
Begins/ends: B6a: Kraków– Warszawa
B6b: Warszawa – Vilnius (Lithuania)
Attendance: min. 15, max. 40
Transportation :Bus, Plane
Cost: US&400 (700) (+cost of airfare Warsaw– Vilnius for B6b participants).

The field trip will be organised in two parts: B6a - Polish Basin, extended to Lithuania; B6b - Lithuania Basin.

Poland: The Holy Cross Mts: visits to outcrops containing the lowermost Zechstein deposits highlighting the problems of the first Zechstein transgression; and the Tumlin quarry with Lower Buntsandstein (Lower Triassic) aeolian sandstones. The core depository in Kielce: presentation of the Zechstein cores from the northern border of the Holy Cross Mts – examination of the facies of marginal (platform) carbonates and evaporites (sulphates and salts). The problem of the Permian-Triassic boundary at the basin margin (facies and stratigraphy) will be discussed. The core depository in Leszcze (Central Poland): core materials from Zechstein deposits (carbonates, evaporites, clastics) of the Polish Lowland. This stop will focus on the problems of the Zechstein facies, differentiation of evaporites, and problems of the Permian-Triassic boundary. Klodawa Salt Mine (near Leszcze): the youngest Zechstein deposits – stratigraphic units of Z2-Z4 cycles in the salt diapir, clayey salts (zubers), salt tectonics and karst features will be examined.

Lithuania: The northern Lithuanian Akmiane quarry: deposits of marginal platform carbonates (Zechstein Limestone Ca 1) located in the northern part of the Baltic Gulf, its contact with the Devonian basement and erosional pockets in the basement, infilled with Rotliegendes clastics. The core depository in the Vievis (near Vilnius): carbonates and evaporites in cores from marginal and central parts of the Zechstein Bay (Peri-Baltic Syneclise).

Intra-Congress Excursion

I1: Ecological impact of underground coalmining and activities of attached industries

Duration: 1 day
Begins and ends: Kraków – Kraków
Attendance: min. 15. max 40
Transportation: Bus
Cost: US$60

One day round trip over the Upper Silesian Coal Basin focused on: surface subsidence within the coal mining areas; mining impact on ground and surface water; water pollution caused by coal mine waste dumps; mine waters and their utilisation. In the area of the Bytom syncline, the urban infrastructure is the most vulnerable to mining damage. Earth tremors are a common manifestation of the mining, causing dynamic rock-mass deformation. In the area of Smolnica, the dynamics of soluble solids leached from the coal mines waste dumps will be discussed. The impact of mining subsidence on ground and surface water systems will be discussed in the Szczyglowice mine area. A visit to the Mine-Water Desalination Plant in Debieńsko will focus on the utilisation of mine waters.

Publications and Posters

Abstracts of the presented papers and posters should be received by the Organisers not later than 30 September 1994. All abstracts submitted for review should be typed as follows: a)title (using bold), b) author(s), c) address, d) text of a maximum of 300 words (using Times 10 point regular font, single spaced). The abstracts should be sent on 3.5" IBM compatible disks using common word processing software (WordPerfect or ASCII format) together with a laser printed copy. A volume of Abstracts will be made available at the Congress.

Final Publications: Papers presented at the Congress and accepted by the Polish Organising Committee will be published in the Compte Rendu after the Congress. Manuscripts must be submitted to the Congress Secretariat before or during the Congress. Manuscripts sent after the Congress will not be accepted. The length of the text should not exceed 5,000 words (including illustrations, figures, photos, etc. and bibliography). The text of the final publication should be on floppy disk in WordPerfect or ASCII format.

Posters: Poster sessions are envisaged. Maximum space per poster - $2m^2$.

Other Meetings

During the Congress, general meetings of the IUGS Subcommission on Carboniferous Stratigraphy and IUGS Subcommission on Permian Stratigraphy are planned. Meetings of the Congress Permanent Committee will also be held.

If other international scientific organisation would like to arrange special meetings during the Congress, please notify the Polish Organising Committee as soon as possible.

Registration Fee

US$ 300/subject to change.

Accompanying Persons

Accompanying persons will have an opportunity for short sight-seeing excursions, cultural events, and/or longer tours during the Congress.

Correspondence

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

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

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

Państwowy Instytut Geologiczny - some background notes

Państwowy Instytut Geologiczny, founded in 1919, is one of the oldest scientific institutions in Poland. It is under the general supervision of the Ministry of Environmental Protection, Natural Resources and Forestry and performs the many functions of a state geological survey. It has a staff of about 800 employees, including almost 300 graduates, and, in addition to its Warsaw organisation, maintains seven Regional Branches.

Over its 70 years of activity, Państwowy Instytut Geologiczny has developed geological knowledge of Poland to world standards, and has discovered numerous mineral deposits.

The Institute is involved in studies of the geological structure of Poland, prospecting for and exploration of mineral deposits, evaluation of reserves and quality of ground and thermal waters, as well as an investigation of environmental pollution. For many decades now, it has conducted regional studies connected with the assessment of oil and natural gas potential of the country.

Reports on long term investigations as well as collections of drilling cores are stored in the Institute's archives which have the status of Central Geological Archives of Poland. A modern Data Centre collects information concerning the economic aspects of Polish mineral resources.

The Institute's specialists cooperate closely with the Geological Concessions Office and serve as consultants to Polish and foreign companies interested in exploration or exploitation of mineral deposits in Poland. For this purpose, workshops, discussions, seminars, presentations of drilling cores, etc., are organised by the Institute. Specialist reports are also compiled on request.

Państwowy Instytut Geologiczny operates a very modern chemical laboratory which, besides geological and geochemical samples, is also analysing polluted waters, water sediment, soils, rocks, etc. Results are presented on various maps and atlases.

The results of the Institute's scientific research are published in serial publications such as: Geological Quarterly, the Bulletin of the Polish Geological Institute and Special Papers of the Polish Geological Institute. The Institute is also responsible for geological mapping of the country, publishing various types of maps, the main coverage being on a scale of 1:50,000.

The Institute has developed extensive international contacts including relations with international organisations, foreign geological surveys and universities, consulting services and is also involved with various projects abroad, mainly in the regions of Africa and Asia.

30th International Geological Congress, Beijing, China, 4-14 August 1996

Most members will have received the First Circular for the next IGC meeting. Anyone who still requires a copy should send their request direct to the Congress organisers at the following address:

Secretariat Bureau, 30th International Geological Congress, PO Box 823, Beijing 100037, P.R. China.

Deadlines:

1st Circular response	31 Oct 1994
2nd Circular issued	March 1995
Abstract deadline	1 Nov 1995
Registration Form	1 Dec 1995
Field Trips deposit	1 Dec 1995
Registration payment	1 Feb 1996
3rd Circular issued	Feb 1996
Field Trip payment	1 May 1996

Scientific Program

The program will consist of Colloquia (Congress-wide), Special Symposia (11), Symposia (22), Poster Sessions, Short Courses and Workshops.

Field Trips

The extensive list of field trips is subject to change dependent upon the response to the questionnaire contained in the First Circular. At present there are tentative proposals for Pre-Congress (24), During-Congress (23) and Post-Congress (95) Excursions.

XIII ICC-P REGISTRATION FORM

Family name .....

First names .....

Degree .....

Female/Male

Institution .....

Address .....

.....

Phone, fax, telex .....

Accompanying persons .....

Please write in capitals. Register one person per form. Photo and xerox copies of form are acceptable

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

Title/authors: underline the co-author who will present the lecture. if more than one author

.....

.....

.....

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

will participate in exhibition: yes..... no .....

Please return the questionnaire by 31 March 1994.

XIII ICCP PRELIMINARY EXCURSION REGISTRATION FORM

Family name.....

First names .....

Degree .....

Female/Male.....

Institution .....

Address.....

.....

.....

Phone, fax, telex.....

Accompanying persons .....

Please write in capitals. Register one person per form. Photo and xerox copies of form are acceptable.

I wish to participate in the following excursion(s):

Pre-Congress: 1st choice.....2nd choice .....

Post-Congress: 1st choice .....2nd choice .....

Inter-Congress:.....

Will pay in cash, or other.....

Please return the preliminary questionnaire by 31 March 1994.

Notice 1: The specific excursion will be organised only if the notified attendance reaches the minimum number. i.e. 15 participants. In case of exceptional interest in the specific excursion, when the notified attendance exceeds the maximum number. i.e. 40 persons, the potential participants will be enrolled on a first come first served basis. The remaining persons will be transferred to the excursion of their second choice, providing that free places are still available there.

Notice 2: All excursion costs subject to change.

Coal-Prospecting, Exploration and Evaluation, Utilisation, Coalbed methane and Environmental impacts

Organisers
Faculty of Science, Charles University, Prague
Czech Geological Survey, Prague
Institute of Geonics, Academy of Science of the Czech Republic, Ostrava-Poruba

Chairman: J. Pešek, Faculty of Science
Secretary: V. Skoček, Faculty of Science
Members: V. Holub, Czech Geological Survey
P. Martinec, Institute of Geonics
S. Opluštil, Faculty of Science

GENERAL INFORMATION

Invitation

The European Coal Conference '95 will provide a forum for presentations related to exploration, mining and utilisation of coal and its by-products. The Conference will bring together researchers and prospectors whose interests range from theoretical to practical aspects of coal geology on a global and local scale, from peat to anthracite accumulations, and from the energy policy of individual countries to environmental impacts of coal combustion.

Location and Accommodation

The conference will be held in Prague, the capital of the Czech Republic in the most pleasant climatic period. Prague is easily accessible by air, train or car. Visas are not required from most countries, and restrictions on import and export are very reasonable for tourists. Public transportation in Prague is effective and cheap.

Meetings and other activities will be located in the Faculty of Science building at Charles University. Accommodation will be pre-arranged for those who register in advance, in hotels or less expensive student Halls of Residence.

Circulars and registration

This circular is the first of two. Participants are invited to fill in the attached form and return it before **1 October 1994.** Abstract forms for oral and poster presentations will be mailed to those who respond. The second and final circular will be distributed by the organisers in **December 1994**. It will contain a registration form and final information about accommodation, field trips, cultural program and other events.

Entertainment

Prague is renowned for its historical sites, scenery, low price restaurants, shopping and rich cultural life.The entertainment program will offer sight-seeing tours, museums visits (National Museum, Technical Museum, Jewish Museum) and theatres (National Theatre, Laterna Magica Theatre, Black Theatre).

Abstracts, Poster presentations and demonstrations

Poster displays and demonstrations will run simultaneously with oral presentations. Abstracts are due **28 February 1995.** Information about the physical layout of posters will be sent with the abstract forms.

Publications

Manuscript of an oral or poster presentation should be submitted in English to the organisers during the Conference **(deadline 29 June 1995)**. Guidelines to authors will be mailed with abstract forms.

Field excursions

Planned field trips are listed below. Trips 1 and 2 will be organised before and after the conference and trip 3 as post-conference only. Please indicate on the form those trips in which you may participate. Cost, accommodation and leader details will be provided in the 2nd circular.

1. Tertiary coal basins of NW Bohemia and environmental impacts of open pit mining and coal combustion;
2. Limnic Carboniferous basins of central and western Bohemia;
3. Paralic Carboniferous basins of Upper Silesia.

Accompanying persons program

Daily trips to spectacular castles and chateaux near Prague will be organised for conference participants and their spouses. Early indication of spouse attendance (on attached form) will assist organisers in planning social activities.

Registration fees

The registration fee is expected to be US$150 covering general administration, abstracts, proceedings, tea and coffee. Extra charges will be made for trips, tours and conference dinner, details of which will be provided in the 2nd circular. Students will be eligible for a special rate of US$30 (proceedings not supplied).

Correspondence

European Coal Conference '95 (ECC '95), Faculty of Science, Charles University, Albertov 6, 128 43 Prague 2, Czech Republic

Phone: +2-24915472;
Fax: +2-296084

Specific questions should be directed to:
J. Pesek, Faculty of Science, Charles University

Essential topics include:

- Coal Geology, Coal-Prospecting and Exploration.
- Evaluation, Utilisation and Reserves.
- Energy Policies (coal as a raw material of future)
- Coalbed Methane (exploration, advances in recovery, evaluation); Environmental Impacts (Mining hazards, wastefree technologies, recultivation)

Oral Presentations

English will be the official language of the Conference. Each speaker will be given 30 minutes for presentation and discussion. Two 35 mm slide and overhead projectors will be available in each meeting room. VHS monitors for video presentations will be available for audiences of up to 30 participants.

EUROPEAN COAL CONFERENCE '95

First circular reply form (Please return to organisers before October 1, 1994)

Name and surname: .....

Academic and/or pedagogic title: .....

Mailing address: .....

Employer: .....

Accompanying persons: adults ..... children .....

Accommodation: Hotel: ★★★★❑ ★★★❑ ★★ ❑

Student Hall of Residence: ❑

Oral presentation (title): .....

Poster presentation (title): .....

Demonstration (specify the subject and needed space): .....

Will you submit your paper for publishing in Proceedings? Yes..... No.....

Field excursions:	**1**	**2**	**3**
Pre - conference	❑	❑	❑
Post- conference	❑	❑	❑

(P- *probably*; D - *decided*)

Cultural program:

sight-seeing of Prague ❑

visit to a castle and monastery (Konopiště, Svatá Hora) ❑

dinner ❑

CONTRIBUTIONS TO THE NEWSLETTER

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

- reports on work in progress
- reports on activities in your work place
- news items, conference notices, new publications
- reviews, letters, comments
- graphics suitable for black and white publication.

Contributions for each issue should be timed to reach the Editor before 31 May in the year of publication. Material supplied well before this deadline would be appreciated.

To facilitate setting up the Newsletter and to reduce typing errors, it would be of assistance if copy could be sent BOTH on paper and a computer disk. However, contributions without a disk are still acceptable.

The Newsletter is prepared using WordPerfect but contributions on most other word processing systems can be accommodated. Material should be forwarded on either 5.25 inch IBM compatible or 3.5 inch IBM or Macintosh disks. If you can supply a disk, you should observe the following requirements. Please include a printed copy and the name of the word processing package you have used.

Supply two copies of the file on disk. The first can be the normal output of your software which can include enhancements such as bolding and italics but NO indents or leading TABS please. Avoid unusual formatting features of your package. The second copy of the file should be saved as a plain ASCII textfile (i.e. no enhancements). Please ensure that all typing is done with only ONE space after each full stop at the end of each sentence. Unless specifically requested, the disk will not be returned since the cost of return postage is far greater than the original value of the disk.

AIR MAIL your contribution to the Editor:
Dr B.A. Engel, Department of Geology, University of Newcastle, Newcastle NSW 2308 Australia.

Files can be sent attached to an e-mail message on the Internet. Please follow up your message with an air mailed, formatted, paper copy so that formatting can be restored by the editor. The Editor's e-mail address:
bengel@geology.newcastle.edu.au

Postscript

IGCP 328 - Australian Working Group - Carboniferous Studies

Notes from SUSAN TURNER, Queensland Museum, PO Box 3300, South Brisbane Qld 4101.

FRANCES EDWARDS (MUCEP, Sydney) is investigating Early Carboniferous microvertebrates from a measured section trench cut by TALENT & MAWSON in the north Canning Basin.

JOHN A. LONG (WAM, Perth) is studying Early Carboniferous shark faunas of Western Australia in co-operation with S. TURNER.

SUSAN TURNER (QM, S. Brisbane) is working on a series of Carboniferous microvertebrate assemblages ranging from the D/C boundary to presumed Bashkirian age. Later this year Dr OLEG LEBEDEV (Russian Acad. of Sciences, Palaeont. Institute, Moscow, co-leader of the Carboniferous working group on vertebrate microfossils and Russian National rep. for IGCP 328) hopes to visit Australia. He is completing a major monograph on protacrodont and orodont shark teeth, and will be examining Australian material with S. TURNER and J.A. LONG. Recent references include:

TURNER, S. 1993. Early Carboniferous microvertebrates from the Narrien Range, central Queensland. In P.J. JELL (Ed.) Palaeontological studies in honour of Ken Campbell. *Memoirs Assoc. Australasian Palaeontologists* **15**: 289-304.

TURNER, S. (with contributions from R. JONES, M. LEU, J.A.LONG, V. PALMIERI & I. STEWART) 1994. IGCP 328: Carboniferous shark remains of Australia, *APC-94 Abstracts*, p.58.

TURNER, S. 1994. Devonian and D/C microvertebrate correlation in Australia. IGCP 328: SDS *joint meeting Devonian Eustatic Changes of the World Ocean Level (DEWCOL)*, 9-16 July, Moscow & Timan, 1p.

See also TURNER, S. (Ed.) 1994. *Ichthyolith Issues* No. 13, April, Villeneuve d'Ascq, 40pp. and earlier issues for news of other Carboniferous microvertebrate work.

KEN S.W. CAMPBELL (ANU, Canberra) in co-operation with DICK FOX (U. Edmonton, Canada) is investigating an Early Carboniferous (Viséan) macrofauna from the Raymond Formation of the Narrien Range which includes new osteolepids.

Canadian Paleobotanical & Coal Science Symposium

ERWIN L. ZODROW, University College of Cape Breton, PO Box 5300, Sydney, Nova Scotia, Canada, B1P 6L2

The 1st WALTER A. BELL MEMORIAL SYMPOSIUM ON PALEOBOTANY AND COAL SCIENCE, EURAMERICAN PALEOBOTANY will be held at the University College of Cape Breton, Sydney, Nova Scotia, 28 May 1995 to 1 June 1995. Walter A. Bell was a pioneer in studies of Carboniferous coal-bearing strata of the Maritimes of Canada, and a Director of the Geological Survey of Canada. The Symposium is being sponsored by the University College of Cape Breton, Geological Surveys of Canada and USA, Chemical Society of America (Petroleum Research Fund), and the Cape Breton Miners Foundation.

The meeting will focus on the paleobotany of Carboniferous coal-bearing strata in Euramerica. Fifteen keynote and invited speakers from Canada, the United States, India, and Europe will present talks on significant coal-related research on Carboniferous and related Gondwana paleobotany and palynology. One of the keynote speakers is Canada's foremost coal geologist, Dr Peter A. HACQUEBARD of the Geological Survey of Canada, who will speak on the coal geology of the Maritimes. In addition, there will be about 20 other speakers whose presentations will focus on Euramerican late Paleozoic paleobotany, paleogeography, floral biostratigraphy, and present-day Carboniferous analogues.

The Symposium will include a half-day field trip to the Carboniferous coal-bearing strata of the Maritimes. Also, there will be a half-day workshop on Carboniferous palynology, Carboniferous compressional plant fossils, and newly discovered coal balls from Nova Scotia. There will also be spousal activities. A post-Symposium tour of the historical Fortress Louisbourg is also planned.

The limit of participants is set at about 100 people (including spouses), so early registration is best. The first Circular was mailed in February, 1994. For a copy of it, or for further information, please contact: Dr ERWIN L. ZODROW (Fax: 902 562-0119), or Dr PAUL C. LYONS, US Geological Survey, Mailstop 956, Reston, Virginia, USA 22092 (Fax: 703 648-4227).

The National Science and Engineering Research Council of Canada (NSERC) awarded Dr ZODROW a five year grant for a comparative study of Carboniferous paleobiology of the Sydney Coalfield, Nova Scotia. In particular, this includes the newly discovered coal balls from Stellarton, Nova Scotia, which are being studied in collaboration with Drs M.A. MILLAY, A.C. CROSS, and P.C. LYONS. Also, in full collaboration with Dr P. C. LYONS of the US Geological Survey, of which Dr ZODROW is an Adjunct Research Scientist, the chemotaxonomic potential of Carboniferous pteridosperm cuticles is further explored, after some encouraging experimental results soon to be published. The fruitful collaboration with Dr C.J. CLEAL on pteridosperm cuticles is continued and as a result a revision of alethopterids and lonchopterids of the Sydney Coalfield is in the offing.

Pangea: Global Environments and Resources

B. BEAUCHAMP, Inst. Sed. Pet., Geol. Surv. Canada, 3303-33rd St. NW, Calgary AB, T2L 2A7, Canada.

The proceedings of the Pangea Conference that was held in Calgary, Canada, 15-19 August 1993 will soon be published. The conference, which was a resounding success with its 370 presentations and over 1,400 attendees, was

jointly sponsored by the Canadian Society of Petroleum Geologists (CSPG) and the Global Sedimentary Geology Program (GSGP). The proceedings will be published as CSPG Memoir 17 (Pangea: Global Environments and Resources, edited by B. BEAUCHAMP, A.F. EMBRY, and D. GLASS). The memoir will contain more than 65 contributions over 850 pages, including colour diagrams and plates. The various contributions cover more or less equally the Pangean time span, from the assembly of the supercontinent in Carboniferous time to the commencement of the break-up in the Jurassic. Some of the contributions of direct interest to Carboniferous researchers are listed below. For more information about CSPG Memoir 17, please write to B. BEAUCHAMP, Geological Survey of Canada, 3303-33rd St. NW, Calgary, Alberta, T2L 2A7, Canada (Phone (403) 292-7190; Fax (403) 292-4961).

Contributions

AL-AASM, F.Lu. - Multistage dolomitization of Mississippian Turner Valley Formation, Quirk Creek Field, Alberta: chemical and petrologic evidence.

ALSHARHAN, A.S. & MAGARA, K. - The Jurassic of the Arabian Gulf Basin: their facies, depositional setting and hydrocarbon habitat.

BARDOSSY, G. - Carboniferous to Jurassic bauxite deposits as paleoclimatic and paleogeographic indicators.

BEAUCHAMP, B. & THERIAULT, P. - Late Paleozoic pre-, syn- and post-rift sequences on Grinnell Peninsula, Canadian Arctic (Sverdrup Basin): evidence for basin margin tectonics disturbances associated with sequence boundaries.

BRANDLEY, R.T. & KRAUSE, F.F. - Pseudomorphs after Ikaite from the Mount Mead Formation: indicators of cold water on the subequatorial western margin of the Lower Carboniferous of North America.

CHEN, X., DEREWETZKY, A.N. & WEBSTER, G.D. - Evaluation of the Kinderhookian-Osagean (Lower Mississippian) boundary in the Cordillera, western United States.

CHEN, X. & WEBSTER, G.D. - Carbonate ramp with offshore skeletal-peloidal banks and platform evolution, Lower Mississippian, central Wyoming to eastern Idaho, USA.

COOK, H.E., ZHEMCHUZHNIKOV, S.V., BUVTYSHKIN, V.P., GOLUB, L.Y., GATOVSKY, Y.A. & ZORIN, A.Y. - Devonian-Carboniferous passive margin carbonate platform of southern Kazakhstan: surface analog for understanding the evolution of coeval giant carbonate platform oil and gas fields in the Pre-Caspian Basin, western Kazakhstan.

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