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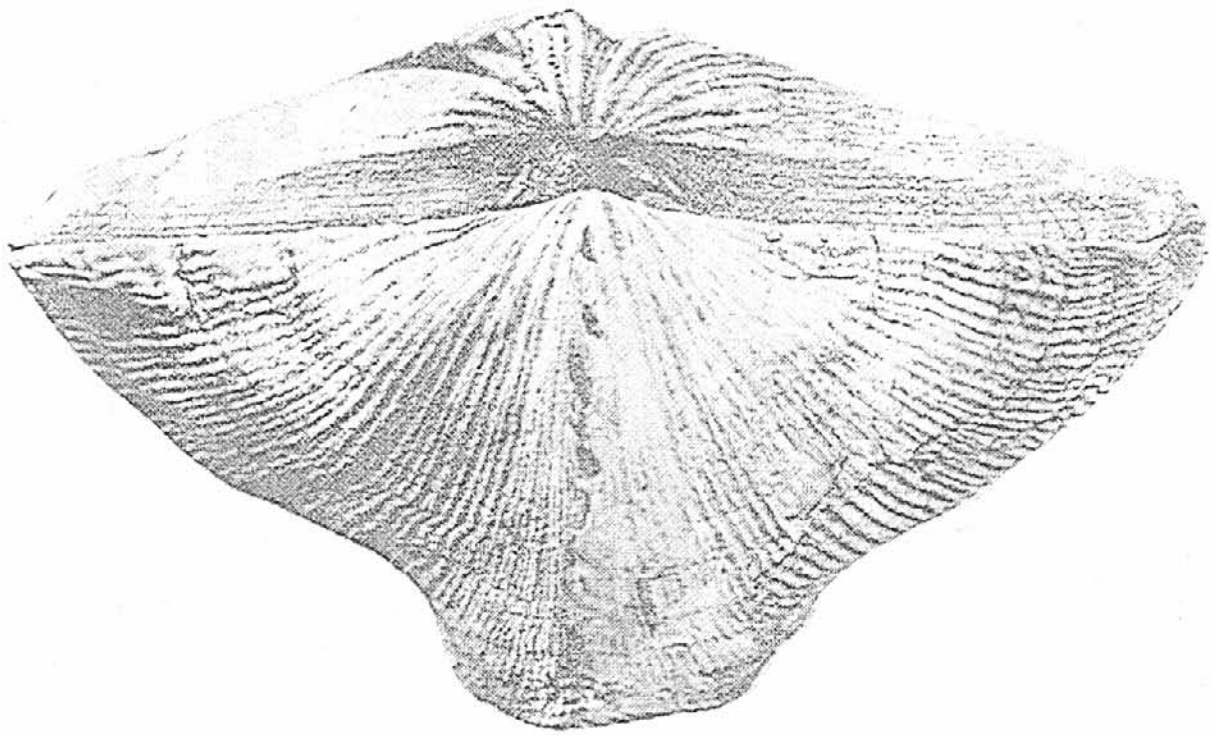

SUBCOMMISSION ON PERMIAN STRATIGRAPHY

INTERNATIONAL COMMISSION ON STRATIGRAPHY

INTERNATIONAL UNION OF GEOLOGICAL SCIENCES (IUGS)

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Neospirifer striato-paradoxus (Toula). From the Assistance Formation, Roadian, Grinnell Peninsula, Devon Island, Canadian Arctic Archipelago (approximately X 2.4). Original photograph in Harker and Thorsteinsson, 1960.

1. CHAIRMAN'S NOTE

A further reminder concerning the "International Symposium on Permian Stratigraphy, Environments and Resources".

This will be held in Guiyang, Guizhou, China, from August 28-31, 1994, in conjunction with meetings of the Pangea Project, GSGP, IGCP Projects:

- 359 (Correlation of Tethyan, Circum-Pacific and Marginal Gondwanan Permo-Triassic), and
- 306 (Stratigraphic correlation of southeastern Asian Paleozoic-Mesozoic).

There will be time allocated for subcommission working groups to meet during this conference. After the conference from September 5-20, there will be a geological excursion along the Silk Road in Xinjiang. This will be organized by the Permian Subcommission on Stratigraphy and the Phanerozoic Climatology Project. Further details are available from Wang Xiang-dong or Jin Yugan at the address given below.

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2. SECRETARY'S NOTE

I should like to thank all those who contributed to the issue of "Permophiles". The next issue will be in June 1994; please submit contributions by May 15.

Contributors may send in reports by FAX to the number given below. "Permophiles" is prepared using WordPerfect 5.1 for those wishing to send in 5¼" or 3½" IBM computer discs (please also send printed hard copy).

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3. MINUTES OF THE SUBCOMMISSION ON PERMIAN STRATIGRAPHY AND CARBONIFEROUS/PERMIAN BOUNDARY WORKING GROUP MEETING, 16 AUGUST 1993, 17.30 19.00, PANGEA CONFERENCE, CALGARY, ALBERTA, CANADA

Jin Yugan, Chairman
J. Utting, Secretary
B. Glenister, Chairman of Carboniferous/Permian boundary working group

A. Attendance

E. Leven, Russia
H. Kozur, Hungary
P. Belasky, U.S.A.
Y.D. Zacharov, Russia
A. Baud, Switzerland
M. Menning, Germany
M. Dickins, Australia
Y. Ezaki, Japan
Lee, C-Z., Korea
D. Baghbani, Iran
M. Gaetani, Italy
E. Heydari, U.S.A.
T. Kawamura, Japan
H. Machiyama, Japan
I. Metcalfe, Australia
V. Lozovsky, Moscow
C. Henderson, Canada
D. Erwin, U.S.A.
M. Nestell, U.S.A.
G.L. Wilde, U.S.A.
W.S. Snyder, U.S.A.
S.M. Ritter, U.S.A.
C. Spinosa, U.S.A.
V. Davydov, Russia
Rui Lin, Canada
J.R.P. Ross, U.S.A.
C.A. Ross, U.S.A.
W.W. Nassichuk, Canada

B. Agenda

The following agenda was proposed and accepted.

Introduction and Welcome (Jin, Chair, SPS)
Joint session SPS and C/P BWG

Report Secretary SPS (Utting)

Report Secretary C/P BWG (Glenister for Wardlaw)

Introduction to meeting agenda (Glenister)
Notable developments since Perm Conference
Reorganization of C/P and P/T BWG
Publications
Outstanding issues of Permophiles
International Geological Review selection of papers
Occasional Papers S. Carolina ESRI
Revised Urals field guides
Remaining Perm papers
Russian/US collaboration in S. Urals

Reports of Working Groups organized in Perm 1991

1) C/P Boundary (Davydov, Chair)
2) Base of Sakmarian and Artinskian (Chuvashov, Chair)
3) Post Artinskian/pre Roadian stage (Glenister for Wardlaw)
4) Guadalupian (Glenister, Chair)
5) Upper Permian
   South China (Jin, Chair)
   Transcaucasia, (Kotlyar)

New Business (Jin, Chair)

C. The chairman thanked the conference organising committee for planning the conference, and welcomed members to the meeting. He summarised the agenda to be followed. He pointed out that considerable progress was being made in the various working groups and invited the respective chairs to summarize progress.

D. Secretary of Permian Subcommission report:
The secretary gave a summary of recent history of the Permian subcommission. He pointed out that the last two years have been very active.

Important meetings held include the:

- Guadalupian symposium in Texas, U.S.A. (1991);
- Perm meeting, Russia (1991);
- Carboniferous/Permian Congress Buenos Aires, Argentina (1991);
- International Geological Congress in Kyoto, Japan (1992);
- Carboniferous to Jurassic Pangea Conference, Calgary, Alberta, Canada (1993); and
- Seminar on Upper Permian palynomorphs, Kazan University, Kazan, Russia (1993). Future meetings include:
- an International Meeting at Guiyang, China (August 28-31, 1994) - a highlight of this meeting will be a field trip to Xinjiang (organisers Jin Yugan, Chen Xu and Chen Pei-ji);
- a meeting on Upper Permian deposits of the Volga-Ural region of Russia (3-10 July, 1994);
- Carboniferous-Permian Congress in Cracow, Poland (August 28-September 2, 1995).

There are a number of active working groups including:

a. Carboniferous/Permian boundary (Chair, Dr. B. Glenister)
b. Permian/Triassic boundary (Chair, Dr. Yin Hongfu)
c. Guadalupian (Chair, Dr. Glenister)
d. N. American/Russian post-Artinskian working group (Chair, Dr. Wardlaw)
e. Major subdivisions of tethyan Permian (Chair, Dr. Leven)
f. Lower Permian stages-Sakmarian and Artinskian (Chair, Dr. Chuvashov)
g. Sub-Roadian Stage (Chair, Dr. Wardlaw)
h. Permian of Turkey and Transcaucasian-central Asia (Chair, Dr. Guvenc)
i. Continental beds at the Permian/Triassic boundary (Chair, Dr. Lozovsky)
j. Upper Permian correlation (Chair, Drs. Kotlyar, Leven, Baghbani and Jin Yugan)

Also members are involved in IGCP project:

- 272 Late Paleozoic and Early Mesozoic circum-Pacific events (Dr. Dickins), and
- 359 Tethyan, Circum Pacific and Marginal Gondwanan Late Palaeozoic and Early Mesozoic correlation (Dr. Yin Hongfu)

The secretary pointed out that a considerable volume of work by our 13 titular members and 120 corresponding members, has and is being carried out, but that few actual decisions have been made. The International Commission on Stratigraphy recently reviewed the Subcommission and according the secretary general (Dr. Gohrbandt) was "concerned about the progress by the Subcommission on Permian stratigraphy in regard to ICS's goal of making advances on the Global Chronostratigraphic Scale".

Thus the "call to action" by Dr. Glenister in "Permophiles" 22, Item 3, where members are urged to come to some final conclusions is very timely, and is endorsed strongly by the executive.

E. Introduction to meeting agenda (Dr. Glenister).

- A summary was given of the reorganisation that had taken place amongst the executive of the Carboniferous/Permian working Group (Dr. B. Glenister being voted chair replacing Dr. Wu Wang-shi) and the Permian/Triassic boundary working Group (Dr. Jin Hongfu voted chair replacing Dr. E.T. Tozer).
- Collaborative field research in the Southern Urals was initiated by a Russian/American team in 1993, and will continue next summer.

- "Permophiles" has included a number of outstanding issues recently. The newsletter is an asset to the Subcommission. The fact that it appears regularly twice a year makes it an ideal vehicle to publicise current research and solicit ideas. Members were encouraged to submit contributions concerning their work.

Dr. Glenister brought to the attention of members a number of recent publications. These include:

- A number of papers from the Perm Symposium in the International Geology Review (Volume 34, No. 9, 1992).
- Publication of the field guides of the Perm meeting jointly by Uralian Branch, Russian Academy of Sciences, Ekaterinburg, Russia and the Earth Sciences and Resources Institute, University of South Carolina, Columbia, SC, U.S.A., (Occasional Publications ESRI, New Series No. 10 "Permian System: Guides to Geological Excursions in the Uralian type localities").
- 32 Additional papers presented at the International Congress on the Permian System of the World have also been published as Occasional Papers, ESRI, New Series 8B and 9B.
- Permo-Triassic Events in the Eastern Tethys, 1992, Cambridge University Press.
- To be published in the near future by the Smithsonian Institute are the proceedings of the Guadalupian Symposium.

F. Reports of Working Groups

i) C/P Boundary (Davydov)

A general progress report was given for the last three years. The zonations of ammonoids, fusulinaceans and conodonts at the Carboniferous/Permian boundary were summarized. The group is now working towards a general consensus that the boundary should be placed near the top of Bed 19 (12 m below the base of Bed 20) in the Aidaralash section at the base of the *Sphaeroschwagerina fusiformis-S. vulgaris* Zone of fusulinaceans. The conodont data at the boundary are still not clear and are the subject of a joint Russian/American group studying the Aidaralash section. In addition, detailed work is being carried out on the sedimentology.

Work of the group was summarised by Davydov *et al.*, 1992, International Geology Review, Vol. 34, No. 9, p. 889-906.

Dr. Kozur commented that in his view the Aidaralesh section left much to be desired because of the alleged extensive reworking of the conodonts.

ii) Post Artinskian/pre-Roadian stage (Glenister for Wardlaw)

Conodonts and other data indicate a time interval younger than Artinskian, but older than Roadian (i.e. Kungurian?) is represented by the Cathedral Mountain Formation of West Texas. The formation is very fossiliferous containing ammonoids, fusulinaceans and conodonts. Thus the "Cathedralean" possibly represents a stage that is poorly developed in most other areas. Stressed was the fact that conodont clines need to be studied from the Baigendzhinian up, and that it is possible to recognize such clines in the "Cathedralean".

iii) Guadalupian (Glenister)

The Guadalupian was first proposed by Girty (1902). The type area is in West Texas. It is a complex facies, with abundant fossils (ammonoids, fusulinaceans, conodonts, and radiolarians), and has been studied intensively. The component stages in ascending order are Roadian, Wordian and Capitanian). The base of the Roadian will be defined within an arbitrary point in a conodont cline. Similar clines also occur in the Wordian and Capitanian. Both Wardlaw and Kozur have recovered conodonts above the type Capitanian, suggesting both Dzhulfian and Changhsingian representation. Perhaps the time is approaching to find out informally what members think of the Guadalupian proposal. The 1994 meeting in China would be a possibility to have an informal vote of all members present, followed by a formal mail ballot of Titular Members.

iv) Major subdivisions of the Tethyan Perm (Jin Yugan and Leven)

A summary was given of work in progress between the joint China and Russian correlation group. Although separate work by members is in progress, the planned joint meetings have not materialized due to political and economic difficulties in Russia. Dr. Baud brought to members attention the late Murgabian map and paleoenvironments of Tethys (see Permophiles 22, item 12).

v) Upper Permian correlation (Kotlyar)

A summary was given of work in progress on three stratotypes in Transcaucasia (Midian, Dzhulfian and Dorashamian). The area contains significant sections for this part of the Permian which have been studied for over 10 years. One of the main problems to be solved is the Lower Dzhulfian as it is not defined in terms of ammonoids. A restudy of the conodonts has helped partly resolve this problem. Correlations can be made with the slope facies in south China, but there is lack of agreement. Correlation of the Dzhulfian/Midian boundary is possible between South China and Transcaucasia. The area contains sections suitable for the stratotypes of the Dzhulfian and Dorashamian. Correlation of the Permian/ Triassic boundary is problematical and yet to be resolved.

In reply to a question from Dr. Glenister as to whether the Midian could be an international stratotype Dr. Kotlyar replied that it was premature to say. Further work was necessary. The Midian is defined using different faunal groups. However, a major problem is that the base lacks conodonts and ammonoids. Dr. Glenister also asked which sections were most suitable for international standard sections, those from the Dzhulfian and Dorashamian of the Transcaucasus or from south China? Dr. Kotlyar replied that both areas contain good sections, but at present there are political problems in Transcaucasia limiting their accessibility. Good sections also occur in Iran. Dr. Baghbani supported this statement and gave examples of a number of good localities that also contain fusulinaceans.

Dr. Dickins pointed out that the original aims of this working group had been to propose correlation charts for the Upper Permian and this had been done. In general a two fold subdivision (Midian and Dzhulfian) of the Upper Permian was proposed. Possibly the working group had performed its function. Dr. Kotlyar did not agree with this and felt much more work needed to be done.

vi) Continental sequence of Permian and Permian/Triassic boundary working group (Lozovsky)

An explanation was given as to why this working group was established. Correlation between the continental and marine facies of the Permian is extremely problematical and uncertain. Also the Permian/Triassic boundary in continental sediments needs much more study. In the continental sequence palynology and paleomagnetism are very important. A meeting of the working group will be held in Albuquerque in October.

vii) General questions and comments:

- Dr. Baud asked Dr. Glenister to comment on the accessibility of Cathedralean and Roadian sections in Texas. Dr. Glenister stated that professionally qualified American scientists could have access to the park areas, but this could be a problem at present for non-nationals. However this was being discussed with park authorities.

- Dr. Leven asked how we were going to divide the Permian. For example are we going to have 2, 3 or 4 divisions. He also suggested that it was inappropriate at this time to use Middle Permian in any formal sense until this problem had been resolved. Yin Yugan replied that we must first find appropriate stratigraphic levels for establishing stages, and then we could correlate them. But there were still insufficient data to do this. Thus at present 2, 3 or 4 divisions were informal and for the convenience of workers. Once continuous sections were established as international standards we could then informally sub-divided the Permian.

- Dr. Menning stressed that we needed continuous sections for the whole of the Permian in more than two localities in the world. Also we should be addressing questions that are important to IUGS.

- Dr. Kotlyar brought to members attention a special meeting to be held in Kazan 3-10 July 1994 on the Upper Permian deposits of the Volga-Ural region of Russia. This meeting will be sponsored by the Kazan State University and VSEGEI (Geological Institute, St. Petersburg), and will be organised by Dr. Kotlyar and Esaulova (for details see this issue of "Permophiles" item entitled UPPER PERMIAN DEPOSITS OF THE VOLGA-URAL REGION).

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4. THE CARBONIFEROUS/PERMIAN BOUNDARY IN RUSSIA AND ITS POSITION IN THE AIDARALASH TYPE-SECTION OF THE URALS (A REPLY TO THE ARTICLE BY B.I. CHUVASHOV *ET AL.* IN "PERMOPHILES", NO. 22, JUNE 1993)

The article by Dr. Chuvashov *et al.* (1993) renews the discussion, which I thought was concluded in 1991 at the Permian Geological Congress. To begin with, some words on the history of the problem of the C/P boundary, which is given by Chuvashov *et al.* (1993) somewhat in the wrong light. When establishing Asselian, V.E. Ruzhentsev placed its lower boundary at the basis of the beds with the definite Asselian ammonoid assemblage and first *Sphaeroschwagerina* (Ruzhentsev 1954). He adhered to this position of the boundary in all his papers. The lower boundary of Asselian in the Urals, or the boundary between pseudofusuline and schwagerine horizons, was placed by specialists on fusulinids (Rauser-Chernousova 1940, 1949; Rosovskaya 1952) at the same level. D.F. Shamov, when recognizing fusulinid zones in the Asselian, has also drawn the lower boundary of the schwagerine horizon according to the first occurrence of *Sphaeroschwagerina* (Shamov 1940). However, there existed some practical difficulties in establishing the boundary between pseudofusuline and schwagerine horizons in the Russian Platform and Cis-Urals, where intensive oil prospecting was carried out. In connection with this at the end of the sixties a Working Group of specialists on fusulinids was organized. Having reviewed all the material on the Russian Platform, they clarified the characteristics of *Daixina sokensis* Carboniferous zone and placed the C/P boundary at the top of this zone, and referred the overlying deposits to the Asselian (Kireeva *et al.* 1971). As a matter of fact the boundary was replaced. Deposits of the upper half of pseudofusuline horizon, later recorded as *Ultradaixina bosbytauensis-Schwagerina robusta* zone, were assigned to the Asselian. The boundary was considerably lowered (in some sections up to 500 m in thickness), however it was not accepted and formally the boundary remained at the same level between *Daixina sokensis* and *Sphaeroschwagerina vulgaris-S. fusiformis* zones. After these new criteria were applied to the South Uralian sections, the opinion was widely accepted, that the Orenburgian corresponded to the lower zone of Asselian (Pnev *et al.* 1975) and that V.E. Ruzhentsev placed the Asselian upper boundary at the level of its middle zone. To clarify the real correlation of the ammonoid and fusulinid units, a detailed restudy of Orenburgian and Asselian sections of the South Urals, including the type sections, was needed.

In the former USSR, and now in Russia, official decisions are often preceded by wide discussions. Such was the case with the decision on the C/P boundary made at the Joint Plenum of commission on the Carboniferous and Permian systems of Interdepartmental Stratigraphical Commission (ISC) of Russia in 1991 and approved by ISC in 1992. (Resolutions of ISC ... 1992). In 1979-1987 VSEGEI workers thoroughly restudied the key Upper Carboniferous and Lower Permian sections in the South Urals. Big collections of fusulinids and ammonoids, numbering dozens of thousands orientated thin sections and ammonoid shells were made (Popov *et al.* 1985; Davydov, Popov 1986). Fusulinids and ammonoids were described monographically (Davydov 1986; Bogoslovskaya, Popov 1986). This work enabled us to rehabilitate V.E. Ruzhentsev views on the definition and the boundaries of the Asselian and Orenburgian and on the C/P boundary in particular. We showed that the correlation of Orenburgian with the lower fusulinid *Sphaeroschwagerina vulgaris-S. fusiformis* zone, made by Pnev *et al.* (1975) was based on the erroneous correlation of the sections of the Russian Platform and Urals, and that on the Russian Platform deposits older than beds with first *Sphaeroschwagerina* were referred to Asselian (Popov *et al.* 1985; Davydov, Popov 1986; Leven 1986). In the special book dedicated to substantiating the C/P boundary (Chuvashov, Leven, Davydov *et al.* 1986) grounds were given for placing the C/P boundary at the base of *Sphaeroschwagerina vulgaris-S. fusiformis* zone, coinciding with the boundary between the genozones of ammonoids *Shumardites-Vidrioceras* and *Svetlanoceras-Juresanites*.

The proposals, made by the authors (Chuvashov, Leven, Davydov *et al.* 1986) were thoroughly discussed at two special colloquia dedicated to this problem and held in 1989 in St. Petersburg (Chairman - E. Ya. Leven) and in Ekaterinburg (Chairman - B.I. Chuvashov). Many leading specialists on fusulinids participated. At both colloquia material from the Aidaralash section were discussed in great detail. As a result, all the specialists agreed to the following subdivision of the Aidaralash section by fusulinids (Davydov 1990) (Pict. 1). Beds 1-8 are assigned to the *Daixina sokensis* Zone. The interval of Beds 9-19/5 is officially established as the stratotype of the *Ultradaixina bosbytauensis-S. robusta* Zone (decisions of MSK ... 1985).

According to fusulinids it is divided into three subzones:

a) subzone of *Ultradaixina* aff. *postsokensis*, *Schwagerina* aff. *gracilis* (first *Occidentoschwagerina*, *Schwagerina*, *Ocellina*) (Beds 9-11);

b) subzone of *Ultradaixina bosbytauensis*, *Schwagerina* aff. *pseudokrotowi* (first *Likharevites*, *Rugosochusenella*) (Beds 13-16);

c) subzone of *Ultradaixina dashtidzhumica*, *Schwagerina robusta*, *Likharevites sartauensis* (Beds 17-19/5).

The stratotype of the lower boundary of *Sphaeroschwagerina vulgaris-S. fusiformis* Zone was officially placed at the base of Bed 19/6 of the Aidaralash section (Resolutions ISC ... 1985, 1992). The stratotype of the lower boundary of the middle zone of the Asselian (*Sphaeroschwagerina moelleri-Schwagerina fecunda* Zone) is established in the "Holodny Log" section (outcrop 22, the base of Bed 8), parastratotype - in the Aidaralash section at the base of Bed 26.

The question of the existence of reworked of fusulinids in the Aidaralash section has never arisen at the colloquia, as such fusulinids were never found there. At the colloquia some corrections were made as to the definitions of fusulinids from Beds 20-22, defined by the author in 1980 and published in 1986 (Davydov 1986). In particular, definitions of *Schwagerina exuberata* (Sham.), *Schw. differta* (Sham.), *Schw. nux* (Schellw.), *Schw. portentosa* (Sham.) in Bed 20 and *Schwagerina parafecunda* (Sul.), *Schw. rhomboides* (Sham. et Scherb.) in Bed 22 were considered wrong. *Schwagerina* species in these beds somewhat resemble the enumerated upper species, but are more primitive than *Schwagerina* from the middle zone of Asselian. The typical complex of *Sphaeroschwagerina moelleri-Schwagerina fecunda* Zone in the Aidaralash section was found to occur in Bed 26. Decisions of the colloquia were made on the basis of full consensus and signed by its chairman Dr. Chuvashov. The corrections made at the colloquia were included in the excursion guide-book on the sections of the Upper Carboniferous and Lower Permian of the South Urals (The International congress ... 1991), published before the Congress in Perm. It should be said, that all these corrections did not concern the position of the lower boundary of *Sphaeroschgwagerina vulgaris-S. fusiformis* Zone, first referred by the author (Davydov, Popov 1986) to Bed 20, and then after more comprehensive study placed between Beds 19/5 and 19/6 (Davydov *et al.* 1991). Material on the Aidaralash section numbers more than 12000 oriented thin sections of fusulinid shells. Specimens of fusulinid shells selected for study total hundreds of thousands.

In my opinion, the most interesting part of the article by Chuvashov *et al.* is that concerning conodont data. It is based on the original restudy of Gunnel's collection by conodont specialists (V.V. Chernykh and S. Ritter) and, in connection with it, redefinition of conodont specific assemblages in the C/P boundary deposits in the Aidaralash and Usolka sections. Conodont zonation of the boundary deposits is considerably changed, for example, *Streptognathodus barskovi*, which was considered typical middle Asselian species, is a possible index species of Upper Gzhelian. And it is further evidence, that conodont stratigraphy in the C/P boundary deposits is still being established, but there exist important grounds for drawing precise C/P boundary on conodonts too.

In my view, Dr. Chuvashov's conclusions are based not on new material, but on the reinterpretation of earlier known data, the data distorting reality and being selectively chosen.

In 1993 a joint Russian-American group of specialists:

- Dr. C. Spinosa, Dr. W. Snyder, D. Galegos from Boise State University, Boise, Idaho;
- Dr. S. Ritter from Brigham Young University, Provo, Utah;
- Dr. V. Chernykh from Inst. Geology and Geochemistry, Ekaterinburg;
- Dr. T. Leonova, A. Shkolin from Paleontol. Inst. Moscow;
- Dr. V. Davydov from VSEGEI, St. Petersburg; and also
- Dr. K. Watanabe from Kohnodai High School, Tokyo

carried out additional investigation of all the Aidaralash section. The boundary sections were excavated by bulldozer and described bed by bed as thoroughly as possible centimetre by centimetre. Much additional material on conodonts, fusulinids and ammonoids was collected. I hope, this work will enable us to solve the problem of the C/P boundary.

REFERENCES

CHUVASHOV, B.I., CHERNYKH, V.V., AND MIZENS, G.A., (1993). Zonal divisions of the boundary deposits of the Carboniferous and Permian in the sections of different facies in the South Urals. Permophiles, **22**, June 1993, p. 11-16.

CHUVASHOV, B.I., LEVEN, E. Ya., DAVYDOV, V.I. DAVYDOV *ET AL.*, (1986). Carboniferous-Permian boundary deposits in the Urals, Preurals and Central Asia. M. Nauka, p. 1-152, pl. 1-32.

BOGOSLOVSKAYA, M.F., AND POPOV, A.V., (1986). New species of ammonoids from Carboniferous-Permian boundary deposits of the Southern Urals. In: Carboniferous-Permian boundary deposits of the Urals, Preurals and Central Asia. Chuvashov, B.I., Leven, E. Ya, Davydov, V.I. *et al.* M. Nauka, p. 77-103.

DAVYDOV, V.I., (1986). Upper Carboniferous and Lower Permian Fusulinids of Southern Urals. *Ibid.*, p. 77-103, pl. 11-16.

DAVYDOV, V.I., AND POPOV, A.V., (1986). Upper Carboniferous and Lower Permian sections of the Southern Urals. *Ibid.*, p. 29-33.

LEVEN, E. Ya., (1986). The Daixina bosbytauensis-D. robusta zone and Carboniferous-Permian boundary problem. *Ibid.*, p. 48-56.

DAVYDOV, V.I., (1990). Detail distribution of fusulinids in the Carboniferous/Permian boundary stratotype in the USSR, the Aidaralash section. Abstracts of fourth Internat. symp. on Benthic Foraminifera. Sendai, Japan, p. 52-53.

DAVYDOV, V.I., BOGOSLOVSKAYA, M.F., POPOV, A.V., AKHMETSHINA, L.Z., BARSKOV, I.S., KOZITSKAYA, R.I., KOTLYAR, G.V. AND LEVEN, E. Ya, (1990). The solution to the problem of the Carboniferous/Permian boundary in the USSR. Permophiles, 17, November, p. 9-12.

THE INTERNATIONAL CONGRESS, (1991). The Permian System of the World, In: The Guide-book of the geological excursions. Part 2, Issue 2. The sections of the Permian system of the Urals River's basin (The West slope of the South Urals). Ural. Dep. Ac. Sci. USSR., Sverdlovsk, 94 p.

KIREEVA, G.D., SCHERBOVICH S.F., DOBROKHOTOVA S.V., KETAT O.B., MAL'KOVSKYI F.S., SJOMINA S.A., CHERNOVA I.A., AND YAGOFAROVA F.Z., (1971). The Schwagerina vulgaris and Schwagerina fusiformis zone of the Asselian stage of the Russian Platform and the western slope of the Southern Urals. Questions of Micropal, **14**, p. 70-102, pl. 1-6.

PNEV, V.P., POLOZOVA, A.N., PAVLOV, A.N., AND FADDEEVA, I.Z., (1975). Stratotype section of the Orenburgian stage, Southern Urals (Nikol'skoe village). Izvestiya Akademii Nauk SSSR (News of Ac. Sci. USSR), ser. geol., 6, p. 100-109.

POPOV, A.V., DAVYDOV, V.I., DONAKOVA, L.A., AND KOSSOVAYA, O.L., (1985). On the Gzhelian stratigraphy of Southern Urals. Sov. Geol., **3**, p. 57-67.

RAUSER-CHERNOUSOVA, D.M., (1940). The stratigraphy of Upper Carboniferous and Artinskian of Western slope of the Urals and materials by fusulinid fauna. Trans. Geol. Ins. Ac. Sci. USSR, geol. ser., 7, No. 2, p.

RAUSER-CHERNOUSOVA, D.M., (1949). The stratigraphy Upper Carboniferous and Artinskian deposits of Bashkirian Preurals. Trans. Inst. Geol. Ac. Sci. USSR, geol. ser., **105**, No. 35, p. 3-21.

RESOLUTIONS OF THE INTERDEPARTMENTAL STRATIGRAPHIC COMMITTEE OF THE USSR AND ITS PERMANENT COMMISSIONS, (1985). Decision of plenum of Carboniferous and Permian commissions about position of Carboniferous/Permian boundary. Leningrad, p. 44-48.

RESOLUTIONS OF THE INTERDEPARTMENTAL STRATIGRAPHIC COMMITTEE OF THE RUSSIA AND ITS PERMANENT COMMISSIONS, (1992). Resolution by Carboniferous/Permian boundary. St.-Petersburg, p. 52-56.

ROSOVSKAYA, S.E. The Fusulinids of Upper Carboniferous and Lower Permian of Southern Urals. Trans. Paleontol. Inst. Ac. Sci. USSR, **40**, p. 3-50.

RUZHENZEV, V.E., (1954). Asselian stage of the Permian system. Reports of USSR Ac. Sci., **99**, No. 6, p. 1079-1082.

SHAMOV, D.F., (1940). About geological structure of Ishimbayi oil-bearing region. Sov. Geol., **11**, p. 6-20.

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Zonal subdivisions by fusulinids in the Aidaralash section

Beds No.	Fusulinid zones and subzones	
33 32 31 30 29	*Sphaeroschwagerina sphaerica, Schwagerina firma*	
28	*Sphaeroschwagerina moelleri* *Schwagerina fecunda*	*Pseudoschwagerina robusta* subzone
27 26		*Sphaeroschwagerina moelleria* *Schwagerina* aff. *fecunda* subzone
25 24 23 22	*Sphaeroschwagerina vulgaris aktubensis*	*Sphaeroschwagerina vulgaris aktubensis* *Schwagerina* aff. *subnathorstry* subzone (first *Paraschwagerina?*)
21 20 19/8 19/7 19/6	*S. fusiformis*	*Sphaeroschwagerina salomatiensis* *Schwagerina robusta* subzone (mass *Sphaeroschwagerina*, *Schwagerina*, *Likharevites*, etc.)
19/5 19/4 19/3 19/2 19/1 18 17	*Ultradaixina bosbytauensis*	*Ultradaixina dashtidzhumica* *Schwagerina robusta* subzone (mass *Ultradaixina*, *Likharevites*, *Schwagerina*, *Dutkevitchia*, first *Dutkevichites*, one specimen of primitive *Sphaeroschwagerina*)
16 15 14	*Schwagerina robusta*	*Ultradaixina bosbytauensis* *Schwagerina* aff. *pseudokrotowi* subzone (first *Likharevites*, *Rugosochusenella*)
13 12 11 10 9		*Ultradaixina* aff. *postsokensis* *Schwagerina* aff. *gracilis* subzone (first *Schwagerina*, *Occidentoschwagerina*, *Occelina*)
8 7 6 5 4 3 2 1	*Daixina vasilkovskyi* (upper part of *Daixina sokensis* zone) (*Daixina sokensis* group species, first *Dutkevitchia*, mass *Schellwienia*, *Zigarella*)	

5. A PROGRESS REPORT AIDARALASH AS CANDIDATE STRATOTYPE SECTION FOR THE CARBONIFEROUS-PERMIAN BOUNDARY

INTRODUCTION

A team of Russian-American-Kazakh specialists studied the stratigraphic section at Aidaralash Creek, southern Urals, during June 1993. The Russian team comprised Vladimir I. Davydov, Tatyana B. Leonova and Valery V. Chernykh, the Kazakh specialist was Akmetshina Lemuza and the American group consisted of Walter S. Snyder, Scott M. Ritter, Dora M. Gallegos and Claude Spinosa. The main purposes of the study were to:

a) secure detailed collections of conodonts, fusulinids and ammonoids, that will be deposited at The University of Iowa and at the U. S. National Museum and readily accessible to all specialists;
b) place these collections within the newly re-measured and re-described stratigraphic section and;
c) evaluate objectively the potential for the Aidaralash section to serve as the Carboniferous-Permian boundary stratotype.

The Aidaralash Creek section has been part of classic ammonoid and fusulinacean biostratigraphic studies by V.E. Ruzhencev, Rauser-Chernoussova and others. More recent studies by Davydov, Leven and Chuvachov, and by Bogoslovskaya and Leonova, have placed the biostratigraphy within a modern context. However, sedimentologic studies conducted according to modern sedimentologic practices have not been published for the Aidaralash succession, or are not readily available; the sedimentologic study represented a main focus of the American team.

Beds 17 through 39 were measured and described in detail (at the scale of 1 cm = 1 m) by Gallegos and Snyder and the bed-numbering scheme employed by previous workers was transferred into the newly described and measured section. Additional fusulinid and ammonoid collections were made by Ritter, Chernykh, Spinosa, Leonova and Davydov and detailed conodont samples were taken at 1 to 1.5 m intervals within Bed 19; the conodont collections were precisely correlated to ammonoid and fusulinacean occurrences. A Stratigraphic and structural transect along Aidaralash Creek was prepared by Snyder and Davydov.

SEDIMENTOLOGY AND STRATIGRAPHY

Beds 1 through 39, Gzhelian to Sakmarian, are represented by strata deposited on a shallow marine shelf in a distal prodelta slope or on a sloping outer shelf. A large and persistent delta complex, located to the northeast of Aidaralash Creek periodically transported mass gravity flow deposits in a southwestward directions into the Aidaralash area; these deposits, consisting of hemipelagic silt and clay and abundant wood debris, commonly preserve an unusual association of abundant wood fragments in direct association with ammonoids. Paleocurrent data indicate a S55W (235) direction of transport.

No significant break in sedimentation appears to exist within the strata of Beds 19 and 20, the locus of the proposed C-P boundary. No major sequence boundary can be documented at any interval within Beds 1 through 39. Beds 22, 25 and 29 may be associated with progradation of the delta or with minor relative sea level drops; however, no time-significant unconformity is associated with these beds.

Because published sea level curves (e.g., Ross and Ross, 1987) suggest the presence of sequence boundaries and probable unconformities in close proximity to the C-P boundary, the lack of major sequence boundaries within Beds 1 through 39 was unexpected. A tentative conclusion, therefore, is that tectonic subsidence was greater than the effects of eustatic sea level fluctuations and consequently masked them. In fact, it may be generally true that in areas of significant tectonic activity, the effects of eustacy are difficult to recognize and cannot be employed to the same degree that they can be for deposits of stable shelf settings. Eustatic sea level rises would have had limited effect on the mass gravity flow or on the hemipelagic silt and clay sedimentation. Eustatic lowering of sea level may be reflected by the general coarsening of the section (for example, observed to culminate in Beds 22, 25 and 29). Sedimentation rates varied from 100 to 200 m per million years based on the thickness of the overall section, representing 1 to 2 m per 10,000 years.

CONODONTS

Detailed collections were made in Beds 3 through Bed 36 to establish the first occurrences and phylogenetic relationships of *Streptognathodus*. Samples were collected at 1.5 m intervals within the shales of Bed 19 to attempt to obtain and define precisely phyletic continua across the proposed C-P boundary that can serve for boundary definition. Using average sedimentation rates of 150 m per million years, this sampling frequency represents average intervals of 10,000 years. Conodont successions thus far documented at Aidaralash can be correlated with deeper water sections elsewhere (e.g., Usolka), thus providing a means for correlation between the different facies and different sections - regionally and world-wide. At the Usolka section, a suggested alternative reference section, sampling for average 10,000 year intervals would require sampling frequency of approximately 10 centimeters. The Usolka section, in comparison to the Aidaralash section, is condensed, and in our view (Spinosa, Snyder), possesses a high potential for condensed biostratigraphic zones. The Aidaralash section, therefore represents a better choice for a boundary stratotype - particularly if the conodont yields are sufficient. Furthermore, the close, and frequently direct, association of conodonts, fusulinaceans, ammonoids and palynomorphs, makes the Aidaralash section a logical choice to serve as the boundary stratotype, as does that fact that the its selection has been supported by many Russian workers.

REDISTRIBUTION AND REWORKING OF FAUNAL ELEMENTS

Opposition has been voiced by a few individuals to selection of the Aidaralash Section as the C-P boundary stratotype. Reworking of fusulinaceans and conodonts has been mentioned as the main concern, but significant reworking has not been documented. Fusulinaceans and ammonoids occurring in Beds 17 through 20 are not reworked. Reworking of conodonts has not been documented as a serious problem although a definitive statement will be made (by Scott Ritter and Valery Chernykh) after examination of the 1993 samples.

Unquestionably, fusulinaceans and ammonoids within Beds 1 through 39, were *redistributed* by mass gravity flows and bottom currents into environments other than those in which the organisms lived. This *redistribution* is not time-significant and serves only to enhance the biostratigraphic utility of biotic elements by increasing geographic range. No fusulinids, that were *reworked* from lower horizons, have been documented to occur in Beds 17 through 20, although some long-ranging, Gzhelian to Asselian, species do occur. Ammonoids are not reworked. First appearances of any biotic element have a low probability of reworking.

Reworking does occur in clasts within the Bed 40 conglomerate and occasionally thereafter in stratigraphically higher conglomerate units. Clearly *reworked* Devonian through Bashkirian or Moscovian fossils within clasts of conglomerate units, reflect structural uplift or eustatic sea level drop (regression) of a portion of the eastern shelf of the Pre-Uralian trough. These occurrences, however, do not impair the validity of the Aidaralash section to serve as the stratotype or the proposed position of the C-P boundary.

There is no *documented* evidence of extensively reworked Gzhelian or Asselian conodonts in Beds 17 through 20. The detailed sampling frequency for Bed 19 (representing average duration as short as 10,000 years between samples) is intended to determine whether reworking of conodonts does exist at Aidaralash and whether reworking actually is more problematic at Aidaralash than at other suggested stratotype sections such as Usolka. Based on *documented* results to date, first occurrences of fusulinids and ammonoids, and probably conodonts, in Beds 1 through 39 reflect valid evolutionary first occurrences that are potentially suitable for definition of clines.

In conclusion, the stratigraphic section at Aidaralash demonstrates many of the characteristics necessary for boundary stratotypes and should be considered an excellent choice for stratotype of the C-P boundary:

a) The sedimentary succession is continuous across the C-P boundary and it is not marked by structural complications or a sequence boundary hiatus;

b) There exists the common occurrence of diverse biotic elements - fusulinaceans, conodonts, ammonoids and palynomorphs in direct or close association;

c) Ammonoids and fusulinaceans form morphologic clines across the P-C boundary and it is anticipated that clines will also be described amongst the conodont successions;

d) Aidaralash is not a condensed section and does not preserve condensed biostratigraphic zonation;

e) Selection of the Aidaralash section as the stratotype has received support from many Russian workers.

This informal note has been prepared by Snyder and Spinosa with the generous assistance of the others whose names appear above. However, because of deadline considerations, others have not had the opportunity of editing many of the assumptions and conclusions and therefore should not held accountable.

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6. CORRELATION OF THE LOWER PERMIAN OF THE URALS AND CANADA

Permian deposits are widespread in the western sector of the Arctic. They have been intensively studied for a long time, but up to present correlation has been speculative due to a number of reasons. The most important is the fact that research associations have been studying the respective regions in detail, for example, Spitsbergen, Greenland, the Arctic Canada, but until recently there has been no opportunity to make direct comparisons other than those made from the literature. In a great extent this work is complicated by different approaches to the taxonomy of fusulinids used by the Soviet and North American research workers.

To solve some problems of the Permian Arctic stratigraphy two regions which have good representative sections are important, i.e. the polar part of the Urals and Novaya Zemlya on the one hand and Arctic Canada on the other. In this paper we shall concentrate our attention upon the possibility of correlating the boundary deposits of the Carboniferous and Permian of Canada and the Urals according to fusulinids. We emphasize the fact that results are preliminary and further work is still necessary.

The conclusions are based on personal observations of the author, who in 1988 and in 1991 during short visits to the Institute of Sedimentary and Petroleum Geology, Calgary, had the opportunity to get acquainted with foraminifera of some sections of the Lower Permian of the Arctic Canada. The author is grateful to Drs. W.W. Nassichuk and B. Beauchamp of the Institute of Sedimentary and Petroleum Geology for this opportunity.

A comparison of the fusulinid zones of the Belcher Channel Formation with the standard section of the Lower Permian of the Urals has been presented before /2,3/:

THE CANADIAN ARCTIC ARCHIPELAGO		THE URALS
Belcher Channel Formation	*Schwagerina* jenkinsi* *Schwagerina* hyperborea* *Parafusulina belcheri*	Artinskian
	Schwagerina paralinearis*	Lower Sakmarian
	Schubertella kingi *Pseudofusulinella uthaensis* *Pseudoschwagerina** grinelli*	Asselian

**Pseudofusulina*, in terms of Soviet micropaleontologists
***Daixina*, in terms of Soviet micropaleontologists

In 1991 I had the opportunity to study the collection of thin sections of well-oriented fusulinids from the Ellesmere Island section (Fig. 1, 2). Here along the shore outcrops of Greely Fiord (sections 56 and 80) the Lower Permian is represented by the following terrigenous-carbonate suites:

a) Antoinette
b) Mount Bayley
c) Tanquary.

The lower contact of the Antoinette Formation is tectonic. Fossil remains in most of the sections are not observed, but close to the upper part a rich and diverse foraminifera fauna is present in GSC locality 52901. Here in a total of 74 thin sections I defined small foraminifera *Eotuberitina* sp., *Earlandia* sp., *Syzrania* sp., *Ammovertella* sp., *Globivalvulina* sp., *Palaetextularia* sp., *Nodosaria bella* Lip., *N. longa* Sul. Fusulinids include *Schubertella sphaerica* Sul., *Sch. paramelonica* Sul., *Pseudofusulinella* ex. gr. *pulchra* (Raus et Bel.), *Ps. usvae plicata* Sham. et Scherb., *Ps. minuta* Grozd. et Leb., *P. pokoimiensis* Grozd., *Triticites globoides* Z. Mikh., *P. petschoricus* Raus. et Bel., *Daixina* ex. gr. *sokensis* (Raus), *Pseudofusulina krotowi* (Schellw.), *P. subnathorsti* (Lee), *P. venusta* Konov., *P. sphaeroidea* (Raus.), *P. exuberata* Sham., *P. malkovskyi* Ket., *P. modesta* Scherb., *P. sphaerica* (Sham.), *P. firma* (Sham.), and *P. primitiva* Sham. et Scherb. In addition occur the algae *Claracrusta catenoides* (Homan), *Globuliferoporella symetrica* (Jonson), and *G. angulata* Tchuv.

This complex of fusulinids include the "Urals species". If to proceed from the usual vertical distribution in the Urals sections, it would appear, that here is mixed up the fusulinids of the whole Asselian Stage from the *Daixina bosbytauensis* Zone to the *Schwagerina sphaerica-P. firma* Zone. This part of the Antoinette Formation should be dated as the last zone. The previously recorded fauna from this bed includes *Schubertella* sp., *Pseudofusulinella* sp., *Para-schwagerina* sp. The first two genera are presented by many specimens. *Paraschwageria* are possibly named in error (the swollen diaxines with thin and quite irregularly folded septas).

The next level with fusulinids occurs at the base of the Mount Bayley Formation (GSC locality 52440). According to previous records the section here is characterized by *Schwagerina* sp. In addition I found the fusulinids *Pseudofusulina* ex. gr. *fecunda* Sham. et Scherb., *P.* aff. *rhomboides*, Sham. et Scherb., which are characteristic of the Middle and Upper parts of the Asselian.

280 m higher above the base of the Tanquary Formation there is the next level containing fusulinids (GSC locality 52902). In thin sections *Schubertella sphaerica* Sul., *Fusiella* sp., *Pseudofusulina* ex gr. *sulcata* Korzh., *P.* aff. *baschkirica* Korzh., *Eoparafusulina linearis* Thorst., *Schwagerina sphaerica* Scherb., *Sch. sphaerica compressa* Scherb., *Sch. sphaerica sokensis* Scherb were determined. According to fusulinids this level should be correlated with *Schwagerina sphaerica-Pseudofusulina firma* Zone - that is the upper part of the Asselian of the Urals.

GSC locality 52434 (Fig. 2), belonging to the Middle part of the Tanquary Formation, contains, according to our data, the following fusulinids: numerous and morphologically very diverse *Eoparafusulina linearis*, and also several

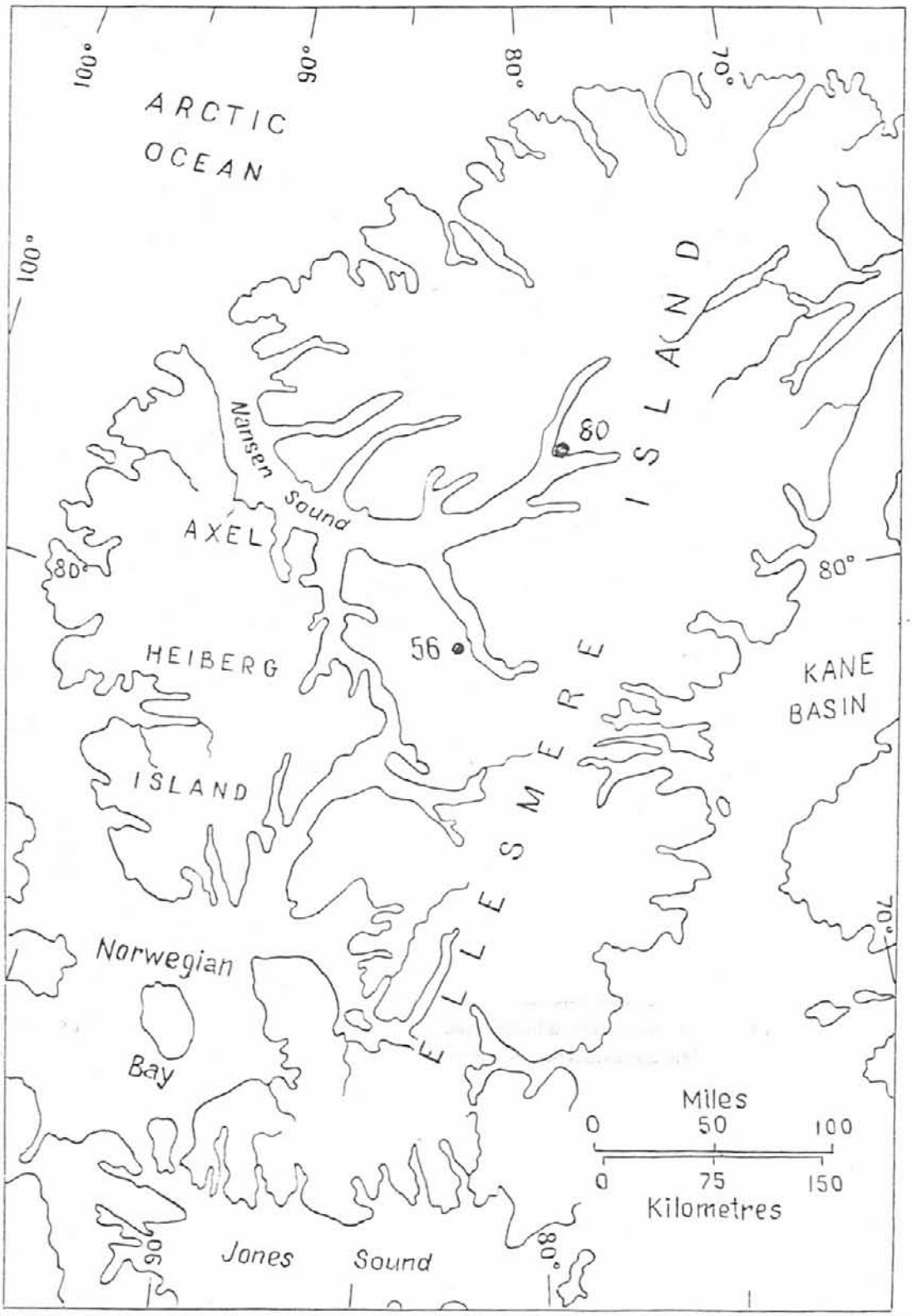

Fig. 1. Localities (56, 80) of the Lower Permian sections in the Arctic Canada from which fusulinids have been studied.

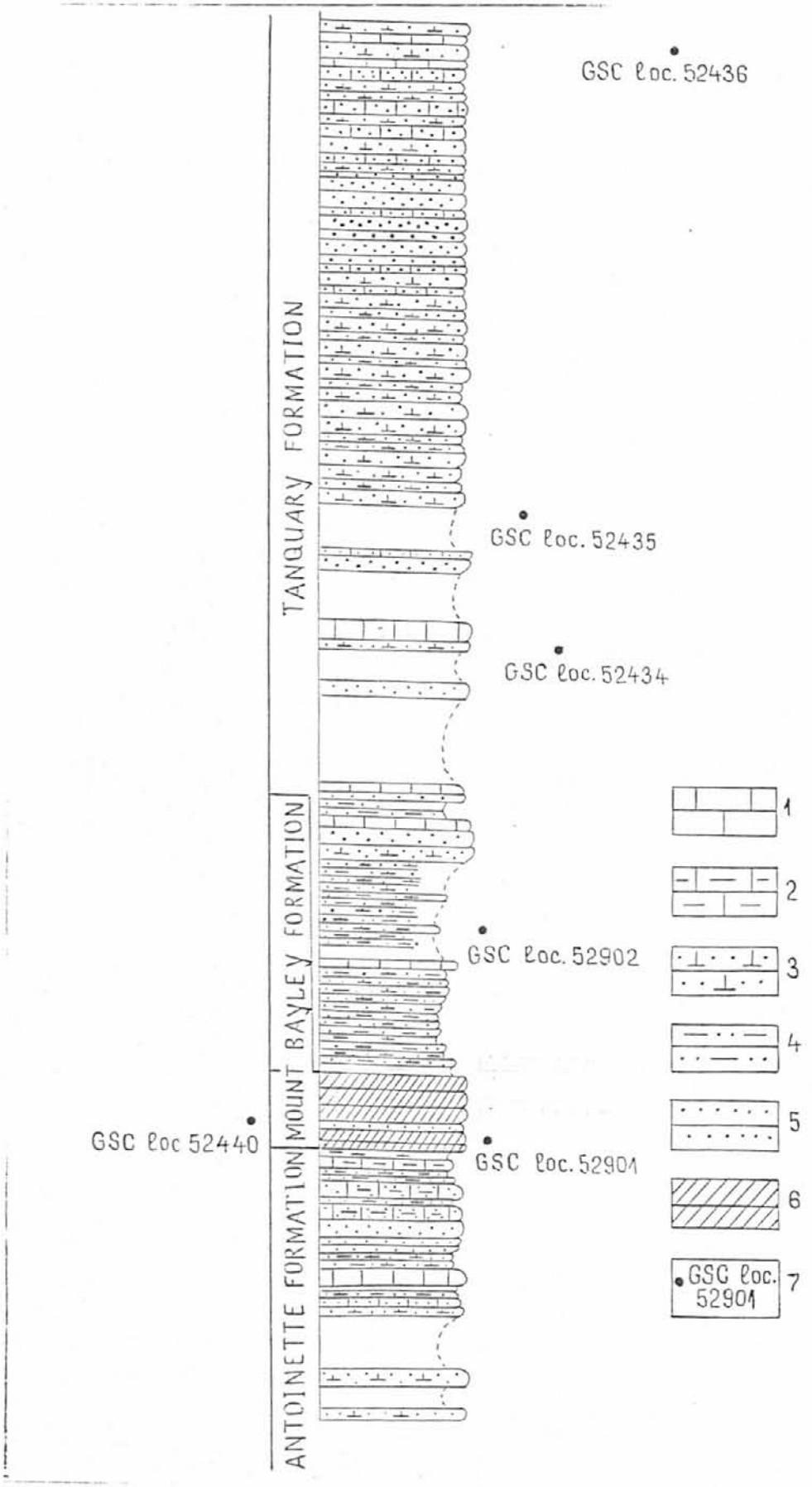

Fig. 2. The stratigraphical column of the Lower Permian of Greely Fiord (according to the data of the Institute of Sedimentary and Petroleum Geology, Geological Survey of Canada): 1-limestones; 2-clayey limestones; 3-arenaceous limestones; 4-argillites and aleurolites; 5-sandstones; 6-cherty limestones; 7-the levels of sampling of fusulinids.

species of the genus *Paraschwagerina*, a number of which are identical or close to the Urals species *P. juresanensis* Raus., *P. mira* Raus. There are some forms that are very close to *Pseudofusulina moellery* (Schellw.). Algae include numerous *Tubiphytes obscurus* Masl., *Globuliferoporella* sp., *Epimastopa urtasimensis* Tchuv. The age of GSC locality 52434 in which, according to documentation, presented to me, there have been found *Paraschwagerina* sp. and *Eoparafusulina*, undoubtedly, corresponds to the lower part of the Tastubskian horizon of the Sakmarian stage of the Urals, to the fusulinid *Pseudofusulina moellery* Zone.

In GSC locality 52435 from the middle part of the Tanquary Formation, are fusulinids, morphologically close to *Pseudofusulina collosa* Raus., *P. karagasensis* Raus., suggesting a correlation with the Sterlitamakskian horizon of the Sakmarian stage.

Fusulinids of the upper part of the Tanquary Formation have been studied in section 80, situated 100 miles to the northeast of section 56, along the shores of Greely Fiord (see fig. 2). The upper part of the formation contains detrital limestones, arenaceous limestones and sandstones. The fusulinid assemblage contains the forms, close, or identical to, *Pseudofusulina urdalensis* Raus., *P. pedissequa* Viss., *P. postpedissequa* Raus., *P. irginae* Shirink, which characterize in the Urals the *Pseudofusulina pedissequa-P. concavutas* Zone of the lower part of the Artinskian stage.

Our views and the age determination of the fauna in the section do not coincide with the conclusions of Canadian stratigraphers. In the lower part of the Tanquary formation (1) there have been found the conodonts *Streptognathodus constrictus* and *S. elongatus*, which the authors (for some reason) correlate with Sterlitamakskian horizon of the Urals. The fusulinids, that have been found out in the lower part of Tanquary Formation, surely indicate that this part of section belongs to the upper part of Asselian stage. This conclusion is supported by the conodonts complex.

In conclusion, I would like first of all to stress that the Lower Permian of the Arctic Archipelago of Canada contains fusulinid assemblages, in which side by side with endemic taxa there are many genera and species typical of the Urals, including the representatives of the genus *Schwagerina* (in terms of Soviet micropaleontologists). This fact, as far as I know, is pointed out here for the first time. A large number of fusulinids in the Lower Permian deposits of Canada and their obvious similiarity with the fusulinids of European Russia allows one to assume, that this group can serve as the base for interegional correlative constructions when using more rare ammonoids and conodonts.

I think there are two kinds of sections in the transitional beds between the Carboniferous and Permian in the Arctic Canada. The first of them could be represented by marine deposits with mainly *Pseudofusinella* fauna. The second type of section should contain a more diverse foraminifera fauna, including *Schwagerina*, *Paraschwagerina* and *Pseudoschwagerina* (in terms of Russian micropaleontologists).

REFERENCES

BEAUCHAMP, P., OLCHOVY, B., HENDERSON, CH., (1990). A newly recognized Lower Permian reef tract, West-Central Ellesmere Island, Arctic Archipelago. Geol. Surv. Canada, Current research. Part B., Paper 91-1B, p. 23-32.

CHUVASHOV, B.I., (1977). About the biogeographical relations of the Early Permian Basin of the Urals and Preuralye (Paleobiogeographical zonation and biogeography.), Novosibirsk, Nauska, p. 116-131.

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7. LOWER PERMIAN BRACHIOPODS FROM KARAKORUM, PAKISTAN

Lower Permian brachiopod assemblages have been found in the Karakorum Range, from its western termination (Upper Yarkhun, Chitral) eastward to the Chapursan and Shimshal valleys (Upper Hunza Valley). Research is in progress on the Permian of the whole mountain range. Previously Permian brachiopods have been illustrated by Reed (1925) on material collected by Hayden in 1914 in the Baroghil area and by Fantini Sestini (1965) on material collected by Desio in 1962 in the Hunza area.

The earliest assemblage is Asselian-Early Sakmarian in age and has been found in the middle part of the Gircha Formation (Fig. 1), cropping out in the Chapursan Valley. It consists of *Cancrinella irwinensis*, *Trigonotreta stokesii*, *Trigonotreta lyonsensis* and *Spirelytha petaliformis*. Bivalves are also present with *Etheripecten* sp., *Deltopecten* sp., *Leiopteria* sp. and small *Eurydesma* sp.

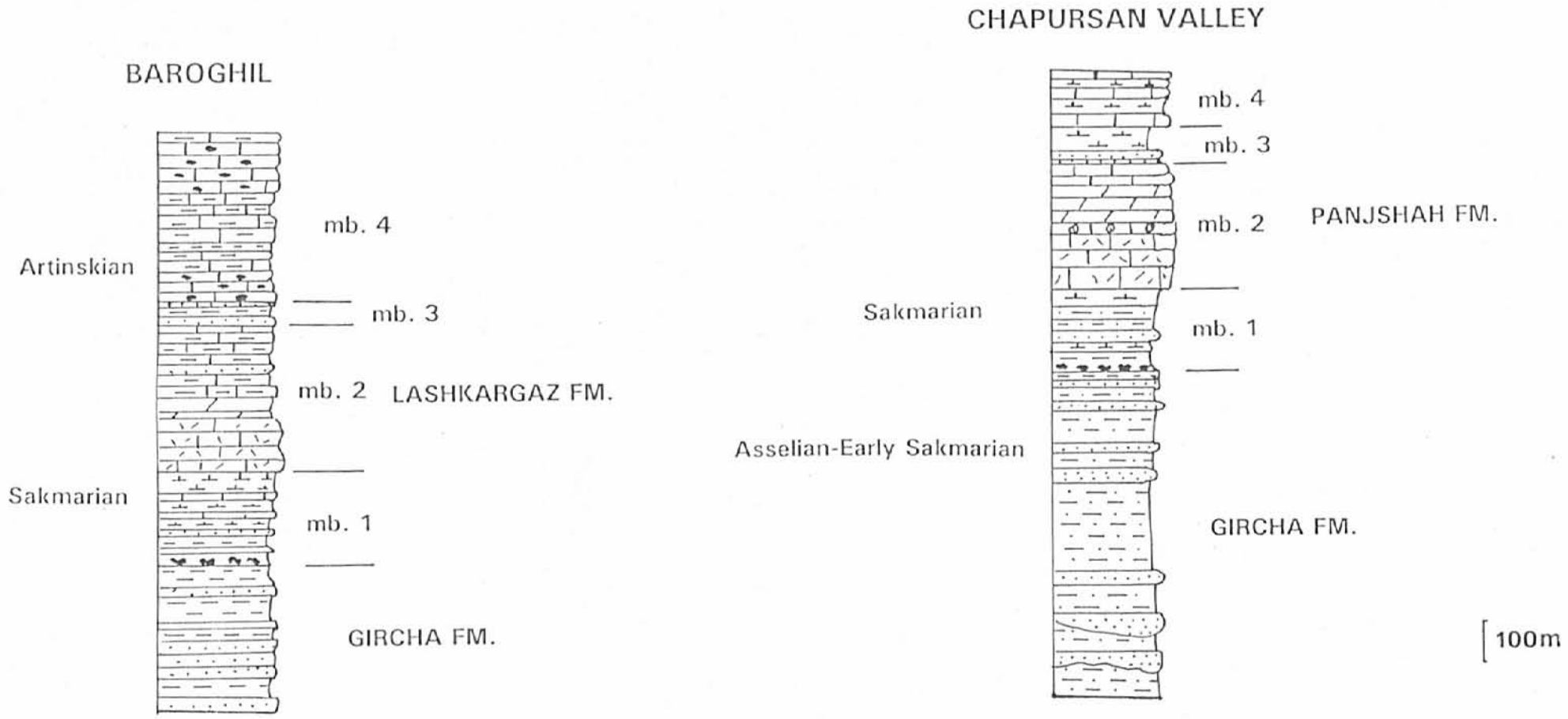

Fig. 1. Synthetic stratigraphic sections showing the Gircha Fm. and the Panjshah Fm. in the Upper Hunza Valley (on the left) and the Gircha Fm. and the Lashkargaz Fm. in the Chitral-Baroghil area (on the right).

The second assemblage has been detected in the Sakmarian first member of the Panjshah Formation (Fig. 1) in the Chapursan, Abgarch and Shimshal valleys (tributary valleys of the Upper Hunza). It consists of *Derbyia* cf. *baroghilensis*, *Permochonetes pamiricus*, *Cancrinella irwinensis*, *Globiella* cf. *rossiae*, *Cleiothyridina ailakensis*, *Cleiothyridina semiconcava*, *Spirigerella* sp., *Trigonotreta* n. sp., *Elvina tibetana*, and *Elvina tenuisulcata*. The bivalve *Parallelodon desioi* is also present. A correlatable assemblage has been found in the first member of the Lashkargaz Formation, cropping out in the Baroghil area. This asemblage consists of *Derbyia* cf. *baroghilensis*, *Globiella* cf. *rossiae*, *Cleiothyridina ailakensis*, *Cleiothyridina globulina*, *Spirigerella* sp., *Trigonetreta* sp. and *Elivina tibetana*. The Sakmarian age of this assemblage is confirmed by the presence of the conodont *Adetognathus paralautus*.

A third assemblage occurs at the top of the second member of the Lashkargaz Formation in the Baroghil area, consisting of *Neochonetes costata*, *Paramesolobus sinuosus* and a new Rhynchonellid genus. Gastropods are also present.

The last brachiopod assemblage has been detected in the third member of the Panjshah Formation (Upper Hunza Valley) and in the fourth member of the Lashkargaz Formation (Baroghil area). It consists of *Neochonetes* (*Sommeriella*) *baroghilensis*, *Neochonetes costata*, *Paramesolobus sinuosus*, *Costiferina* sp. and *Marginifera* sp. at present in study. The age is Artinskian on the basis of the occurrence of the conodont assemblage *Gondolella bisselli* and *Sweetognathus whitei*.

The study of fusulinids, still in progress, will add further precision to the stratigraphic positioning.

REFERENCES

ANGIOLINI, L., GAETANI M., JADOUL F., AND NICORA A., (1992). The Permian succession of the Chapursan Valley. Abstract Volume of the 7th Himalaya Karakorum Tibet Workshop, Oxford.

ANGIOLINI, L., GAETANI M., JADOUL F., AND NICORA A., (1993). The Permian succession of the Karakorum and E Hindu Kush. Abstract Volume of 8th Himalaya Karakorum Tibet Workshop, Vienna.

FANTINI, SESTINI N., (1965). Permian fossils of the Upper Hunza Valley in Desio A., Italian expeditions to the Karakorum and E Hindu Kush: IV Paleontology, Zoology, Botany, **1**, pt. 1.

GAETANI, M., GARZANTI, E., JADOUL F., NICORA A., PASINI, M., TINTORI, A., AND KANWAR S.K.A., (1990). The north Karakorum side of the Central Asia geopuzzle. Geol. Soc. America Bull., **102**.

REED, F.R.C., (1925). Upper Carboniferous Fossils from Chitral and the Pamirs. Pal. Ind. N. S. 6, n. 4.

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8. THE POTENTIAL STRATIGRAPHIC LEVELS FOR GUADALUPIAN/LOPINGIAN BOUNDARY

In the last issue of "Permophiles", it was urged to define the base of the post-Guadalupian Series of Permian upon which the upper boundary of the proposed Guadalupian Series is pending. The solution of this problem desires detailed information on the succession of conodonts and also other taxa, critical for zoning the interval from Capitainian to Wuchiapingian or Dzhulfian. For presenting the current status of this boundary problem an approximate correlation of the main boundary sections is made here in light of the new data obtained from South China.

The last epoch or sub-epoch of the Permian, which is defined roughly as a post-Guadalupian time interval has been formally named as Lopingian (Huang, 1933; Sheng, 1962), Dzhulfian (Glenister & Furnish, 1970; Furnish, 1973), Transcaucasian (Waterhouse, 1976, 1981), and others. Among them, the Lopingian is probably one of the most suitable names for this epoch since it was proposed relatively early, and also is represented by a fully developed marine sequence with a highly diverse fauna and particularly successive pelagic conodont zones. In some regional stratigraphic schemes, this epoch is simply referred to as the Upper Permian. However, the usage of such an informal epoch name as the Upper Permian should be discouraged because of the unsettled controversy of a bipartite or tripartite Permian.

The stratigraphic range and contents of this epoch vary with different authors. Some authors prefer integrating several regional stages to form this epoch following an interpretative succession, for example, the Dzhulfian of Furnish (1973) contains Changhsingian, Chhidruan and

Araksian which are set up respectively based on sections in areas distant from each other. Others proposed this epoch using an essentially complete regional succession, such as the Lopingian which is composed of the Wuchiapingian and the Changhsingian stages of South China. In order to minimise possible bias, only sections having available fossil lists based on the first occurrence of relevant species on a sample-by-sample basis through the critical interval from the Capitainian to the Wuchiapingian stage are qualified to be chosen for correlation.

The marine depositional sequences of this epoch were mainly developed in marginal seas of continental shelves and shelf seas around the low-lying microcontinents in Paleotethys, but sporadically in intracratonic seas. These sequences represent commonly the lowstand system tract of a second order cycle with its main part in the Triassic. The base of this cycle is marked by a global regression to cratonic margin. Coincidentally, a benthos crisis appeared as the first phase of the End-Permian mass extinction. It is indicated by sudden decrease in diversity of corals, fusulinids and bryzoans, rapid changeover in taxa of conodonts and ammonoids in Paleotethys, and also disappearance of edemic taxa following the close of epicontinental seas. As a result of this global lowering of sea level and its associated benthos crisis, the lower boundary of the Lopingian is generally distinct in lithological sequences and faunal successions, and particularly so in Paleotethys. On the other hand, this event presents considerable problems for developing a continual sequence with nektic or planktic fossils, which are useful for global correlation. It was dominated by nearshore merrillinid-hindeodid biofacies from late Capitainian to early Wuchiapingian in most sections. The pelagic gondolellid succession, most critical for detailed zonation, is scarce and very often interrupted by nearshore biofacies in a short interval.

A. In South China, the base of Lopingian is conventionally placed at the base of the *Anddersonceras-Prototoceras* Zone and "*Clarckina bitteri-C. liangshanensis*" Zone, which occur in lower middle part of the Wuchiaping Formation. In shelf depositional sequences, terrigenous beds are sandwiched in between the Wuchiapingian and latest Maokouan marine beds with the fusulinids of *Yabeina-Metadoliolina* Zone. In slope sequences of late Maokouan, namely the Kuhfeng Formation, we found in Dukou of Sichuan Province a succession of conodonts comprising *Mesogondolella serrata*, *M. aserrata*, *M. postserrata*, *M. altudaensis* zones and at least two new zones in its uppermost part (Fig. 1). From a section with integrated benthic and pelagic fossils of late Maokouan, it was confirmed that the uppermost three conodont zones of the Kuhfeng Formation correspond with *Yabeina-Metadoliolina* Zone in stratigraphic level. The Wuchiaping Formation in Dukou Section contains *Clarckina orientalis*, *Cl. transcaucasica*, *Cl. leveni* and *Cl.* aff. *liangshanensis* Zone. It is noteworthy that at the type section, *Cl. liangshanensis* appears firstly from a bed 85 m above the base of Wuchiaping Formation, whereas in Dukou and Nanjiang, it occurs in middle and upper parts of Wuchiaping Formation ranging from upper part of *Cl. leveni* Zone to *Cl. orientalis* Zone. Beneath *Cl. leveni* Zone is a distinct conodont assemblage characterized by a new species closely related to *Cl. liangshanensis*. It is suggestive that the turning point between the Maokouan fauna and the Lopingian fauna approaches the base of *Cl.* aff. *liangshanensis* Zone. This fact implies that the currently used base of the Lopingian is at least one zone higher than the presumed turning point.

B. In Texas, U.S.A, the Guadalupian/Lopingian boundary was presumably placed in between the *M. postserrata* Zone and *M. altudaensis* Zone, and also *Lantchechites* zone and *Rechelina* Zone in the upper part of Altuda Formation (Fig. 1). This boundary can be precisely correlated to the base of *M. altudaensis* Zone in the uppermost part of Kuhfeng Formation in South China, as the Altuda Formation and the Kuhfeng Formation share the same succession of conodont zones from *M. serrata* to *M. altudaensis* Zone. Apparently, the conodonts of *M. altudaensis* Zone should not be dated Dzhulfian and early Changhsingian as suggested by Kozur (1992).

C. In the Abadeh Region of Iran, the Abadhian is considered as a stage of post Guadalupian but pre Dzhulfian age and therefore, the base of Abadhian has been repeatedly accepted as the lower boundary of the last epoch of the Permian (Fig. 1). The gondolellid conodonts are rare in the Abadeh Formation except *Cl. bitteri* appears firstly in the uppermost part of Abadeh Formation. The latter is adopted here as *Cl.* "*bitteri*", since it has been re-identified as a possible *Clarckina liangshanensis*. Recently, Bagbhani (1991) has reported that *Metadoliolina* were found from the Unit 4 and the lowermost part of Unit 5. This suggests that the Abadhian stage is likely an equivalent of the *Yabeina-Metadoliolina* Zone of uppermost Maokouan and that the base of Abadhian might be close to that of *M. altudaensis*. The *Cl.* "*bitteri*" Zone of Unit 4, roughly corresponding to the Araksian or the basal stage of Furnish's Dzhulfian, seems correlatable to the *Cl.* aff. *liangshanensis* Zone.

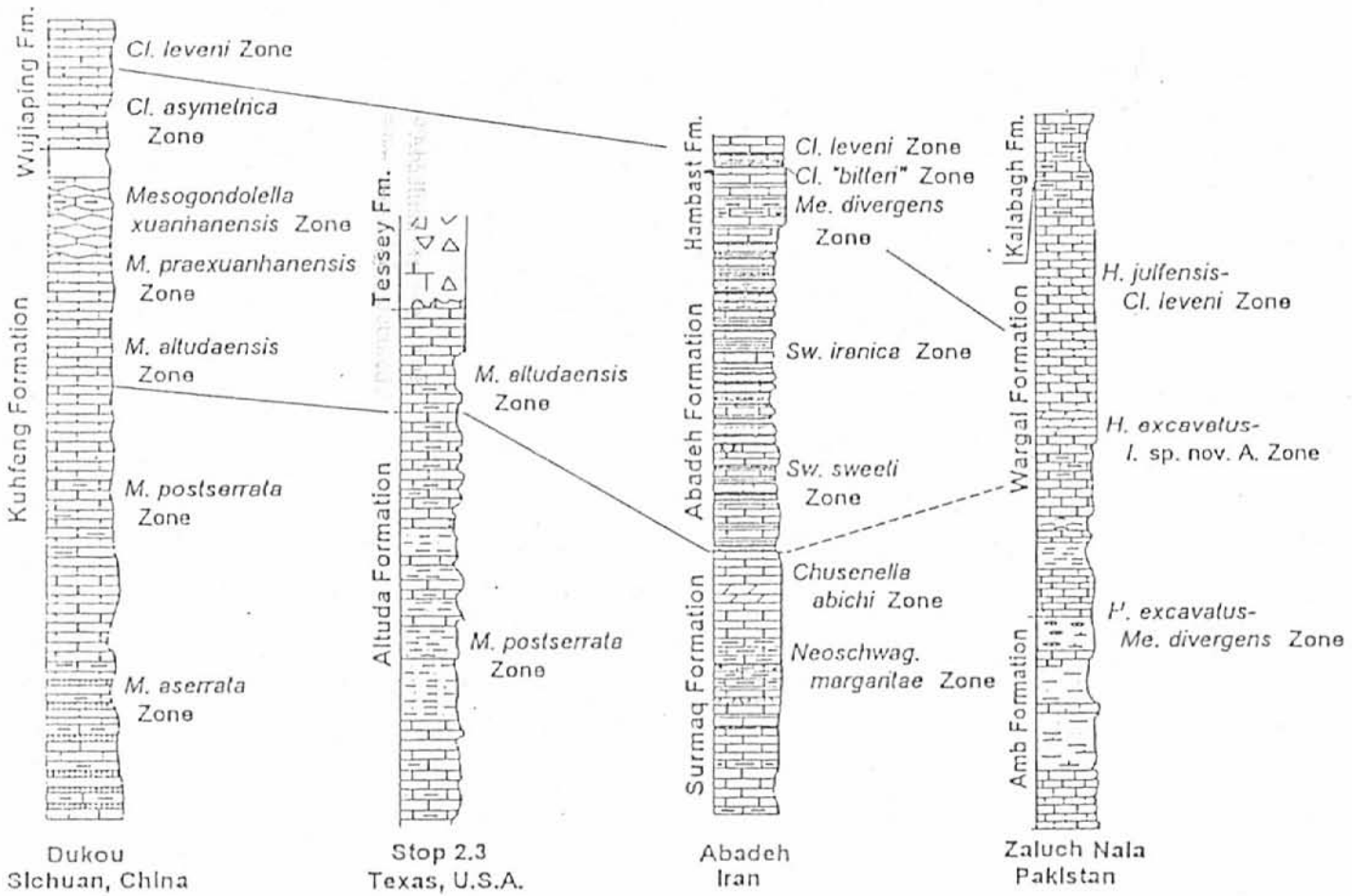

Figure 1: Correlation of sections crossing the Guadalupian/Lopingian boundary. (The total thickness of strata is about 150 m in Dukou, 70 m in stop 2, 800 m in Abadeh and 200 m in Zaluch Nala.) Cl.-Clarckina, H.-Hindeodus, M.-Mesogondonella, Me.-Merellina, Neoschwag.-Neoschwagerina, Sw.-Sweetognathodus, Z.-Zone

D. In the Salt Range of Parkistan, the Panjabian consisting of Kalabaghian and Chhidruan has been referred to the first stage of this epoch. Based on stratigraphic distribution of the fusulinids, Units 1 and 2 were correlated to the upper Maokouan, and Units 4 and 5 (Kalabagh Member of Wargal Formation), to the Abadhian-Dzhulfian, but no fusulinids have been found in Unit 3. Wardlaw (in press) reported that the conodonts from Wargal Formation are dominated by the species of *Merrillina* and *Hindeodus* and might be divided into the *Hindeodus excavatus-Merrillina divergens* Zone, the *Hindeodus julfensis-Cl. leveni* Zone and a transitional zone of the former two from Unit 3. Compared with the Lopingian sequence in South China, Units 4 and 5 correspond approximately with the middle and upper Wuchiapian, while Units 1 and 2, correspond to the upper Maokouan. It is interesting that Unit 3 represents the depositional transition formed during the interval of lowering of sea level between the end-Guadalupian and the earliest Lopingian. The Guadalupian/Lopingian Boundary might be placed above or below Unit 3, but much lower than the base of Panjabian.

A survey of selected sections has shown two conodont zones, namely, *M. altudaensis* Zone and *Cl. leveni* Zone are recognizable internationally, but an interval between these two zones has much more complicated biological and geological development than had been realized. The base of *M. altudaensis* in Texas and South China is approximately correlatable to the base of Abadhian. It apparently is the best, and also the only choice for the upper boundary of Guadalupian, if the Guadalupian Group would be selected as an international standard of its equivalent strata. However, it should not be regarded as a natural boundary since it does not reflect any evolutionary event in geological and biological development from the Guadalupian to Lopingian.

No available section is ideal as a continual succession of conodont assemblages exhibiting a lineage evolution between *M. altudaensis* Zone to *Cl. leveni* Zone, but the sections in Central Abadeh Region and South China seem to be the most complete, in which the base of *Cl.* aff *liangshanensis* Zone or *Cl.* "*bitteri*" Zone is likely to approach the theoretical turning point. Wardlaw suspected that *Cl. bitteri*, a dominant element of conodonts in shallow water during late Guadalupian, had immigrated into Paleotethys and became the predecessor of other species of *Clarckina* dominated during the Lopingian. Since *Cl.* aff *liangshanensis* is closely related to *Cl. bitteri* both in morphological features and in stratigraphic level, the incoming of *Cl.* aff. *liangshanensis* should be the most promising indication of the stratigraphic level for the Guadalupian/Lopingian boundary.

N.B. A paper on the conodonts from the Kuhfeng Formation of Dukou Section, Sichuan will be published in "Acta Micropalaeontologica Sinica" this year.

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9. STRATOTYPE OF GUADALUPIAN SERIES

The type Guadalupian has been proposed formally as the international standard for a Middle Permian Series (Glenister *et al.*, 1992 - reprints are available from the lead author). Composite stratotypes for the component stages (in ascending order, Roadian, Wordian, Capitanian) were proposed within or closely adjacent to the Guadalupe Mountains National Park in Texas, southwestern United States of America. In proposing the Guadalupian, it was recognized that candidacy of the section would be viable only after permanent satisfactory access was assured. This assurance was received in the letter of October 13, 1993, from Guadalupe Mountains National Park Superintendent Larry E. Henderson to Brian F. Glenister. Relevant text follows.

"With regard to your letters of May 20 and September 24 concerning designation of part of Guadalupe Mountains National Park as International Standard Rock Reference for the Middle Permian (Guadalupian) interval, we propose the following:"

"The National Park Service and Guadalupe Mountains National Park would be very honoured to have part of the Guadalupe Mountains National Park designated as an International Standard Rock Reference for the Middle Permian (Guadalupian) interval ... We see no conflict with this designation and the purpose for which the park was established. We have checked this with the regional and national levels of the National Park Service, and they both concur."

As for the concern over access, we do not see this as an issue. Parks are open to the public, and we see no problem with geologists being able to access the designated Standard Rock Reference site within Guadalupe Mountains National Park. Access from time to time might be restricted due to safety or other concerns, but this would be rare. In addition, physical accessibility at any given time due to large numbers of visitors might be impacted, but we

deal with that satisfactorily now when we get large geology groups. This is because parking and road access to some locations is limited, but access would not be denied anyone, just logistics of access from time to time when large numbers visit at once. We also consider potential damage to other natural resources as a part of the logistics of access to any particular site."

"We encourage research in our national parks and endorse bona fide research at Guadalupe Mountains National Park. Good research is essential for a better understanding of the geology of the area. There is no restriction to nationality for conducting research. This does not mean that we automatically issue a collecting permit to everyone who applies to collect in the park. If we did, the quality of the benchmark standard could very rapidly deteriorate. We do review all applications for collecting permits and evaluate the necessity to collect in light of the research being done. Options such as collecting outside the park, using previous collections, and so forth, are encouraged to preserve the resource found in the park. When the research requires collection within the park, then it is considered under the policies of the National Park Service and a collecting permit may be issued, at the discretion of the park superintendent." [Copies of the pertinent rules and regulations were enclosed, and appear reasonable and acceptable (BFG)].

"Trusting that the above information will assist you in expediting the process of designating the Middle Permian (Guadalupian) interval in Guadalupe Mountains National Park as an International Standard Rock Reference, please advise us if there is additional information or clarification required."

REFERENCE

GLENISTER, B.F., BOYD, D.W., FURNISH, W.M., GRANT, R.E., HARRIS, M.T., KOZUR, H., LAMBERT, L.L., NASSICHUK, W.W., NEWELL, N.D., PRAY, L.C., SPINOSA, C., WARDLAW, B.R., WILDE, G.L., AND YANCEY, T.T., (1992). The Guadalupian: Proposed International Standard for a Middle Permian Series. International Geology Review, 34, p. 857-888.

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10. SEMINAR ON UPPER PERMIAN PALYNOMORPHS, KAZAN UNIVERSITY, KAZAN, TATARSTAN, RUSSIA (AUGUST 23-29, 1993)

A seminar was organized by members of the Kazan University (Boris Burov, Natalia Esaulova, Victor Igonin, Ivan Zharkov and Vladislav Badalov) concerning the general stratigraphy, magnetostratigraphy, biostratigraphy and palynostratigraphy of the Upper Permian of Russia. This consisted of a series of talks, informal discussions, examination of palynomorphs, visits to outcrops in the general vicinity of Kazan, and collection of palynological samples.

Special attention was paid to palynomorphs of the Ufimian, Kazanian and Tatarian stages of Russia, although some comparative material from the Canadian Arctic was also studied and discussed.

Problems concerning the correlation of the partly marine Kazanian and essentially non-marine Tatarian were discussed. It would appear that palynology, in association with magnetostratigraphy, may be the most likely tools to help resolve correlation problems between these two stages, although the abundance of red beds in the Tatarian means that horizons containing palynomorphs are rare at some localities.

Palynological samples collected by members who attended the seminar are being processed at laboratories in Canada, Australia and Russia, and it is hoped that productive samples will form the basis for future co-operative work and discussion.

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11. UPPER PERMIAN DEPOSITS OF THE VOLGA-URAL REGION

Kazan State University and VSEGEI (Geological Institute, St. Petersburg) are planning to hold a conference entitled Upper Permian Deposits of the Volga-Ural Region

Proposed program:

1. Discussion of the stratigraphy and correlation of the Upper Permian of Russia and adjacent regions;
2. Study palynological material and collection of flora;
3. Study monographical collections at the geological museum;
4. 2 or 3 days excursion to the stratotypes and cross-sections along the Volga river;
5. Magnetostratigraphy

Duration:
7 days, July 3-10, 1994 at the Kazan University

Cost:
$80-100 a day
Participants will be accomodated in hotels.

Leaders:
G.V. Kotlyar, and N.K. Esaulova

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12. PERMO-TRIASSIC BOUNDARY IN UPPER HUNZA VALLEY (N. KARAKORUM)

The Permian succession of the Chapursan and Shimshal valleys (Fig. 1) records the downwarping of a terrigenous and carbonate shelf during Midian, with deposition of pelagic cherty limestones, locally including mega-breccia bodies (Kundil Formation). The age of the Kundil Formation has been inferred by the presence of Midian-Djulfian conodonts (*Gondolella idahoensis* and *Sweetognathus hanzhongensis* at the base, *Gondolella bitteri* and *Gondolella rosenkrantzi* at the top). At the top of this formation, 100 m of thin bedded marly limestones alternating with black shales and marls crop out, constituting the Wirokhun Formation. In the first 40 m of the Wirokhun Formation the conodont association *Iranognathus* cf. *tarazi*, *Gondolella orientalis* and *Gondolella subcarinata* has been detected, suggesting Djulfian-Dorashamian age; whereas at the top the conodont association *Neospathodus dieneri*, *Gondolella carinata* and *Hindeodus* sp. indicate Early Triassic (Early Dienerian) age.

The Wirokhun Formation is thus a pelagic unit which contains the Permo-Triassic boundary.

REFERENCES

ANGIOLINI, L., GAETANI M., JADOUL F., AND NICORA A., (1992). The Permian succession of the Chapursan Valley. Abstract Volume of the 7th Himalaya Karakorum Tibet Workshop, Oxford.

GAETANI, M., GARZANTI, E., JADOUL F., NICORA A., PASINI, M., TINTORI, A., AND KANWAR S.K.A., (1990). The north Karakorum side of the Central Asia geopuzzle. Geol. Soc. America Bull. **102**.

NICORA, A., ANGIOLINI L., AND GAETANI, M., (1992). The Permian/Triassic boundary in Hunza Valley (N Karakorum). Absract Volume of the 7th Himalaya Karakorum Tibet Workshop, Oxford.

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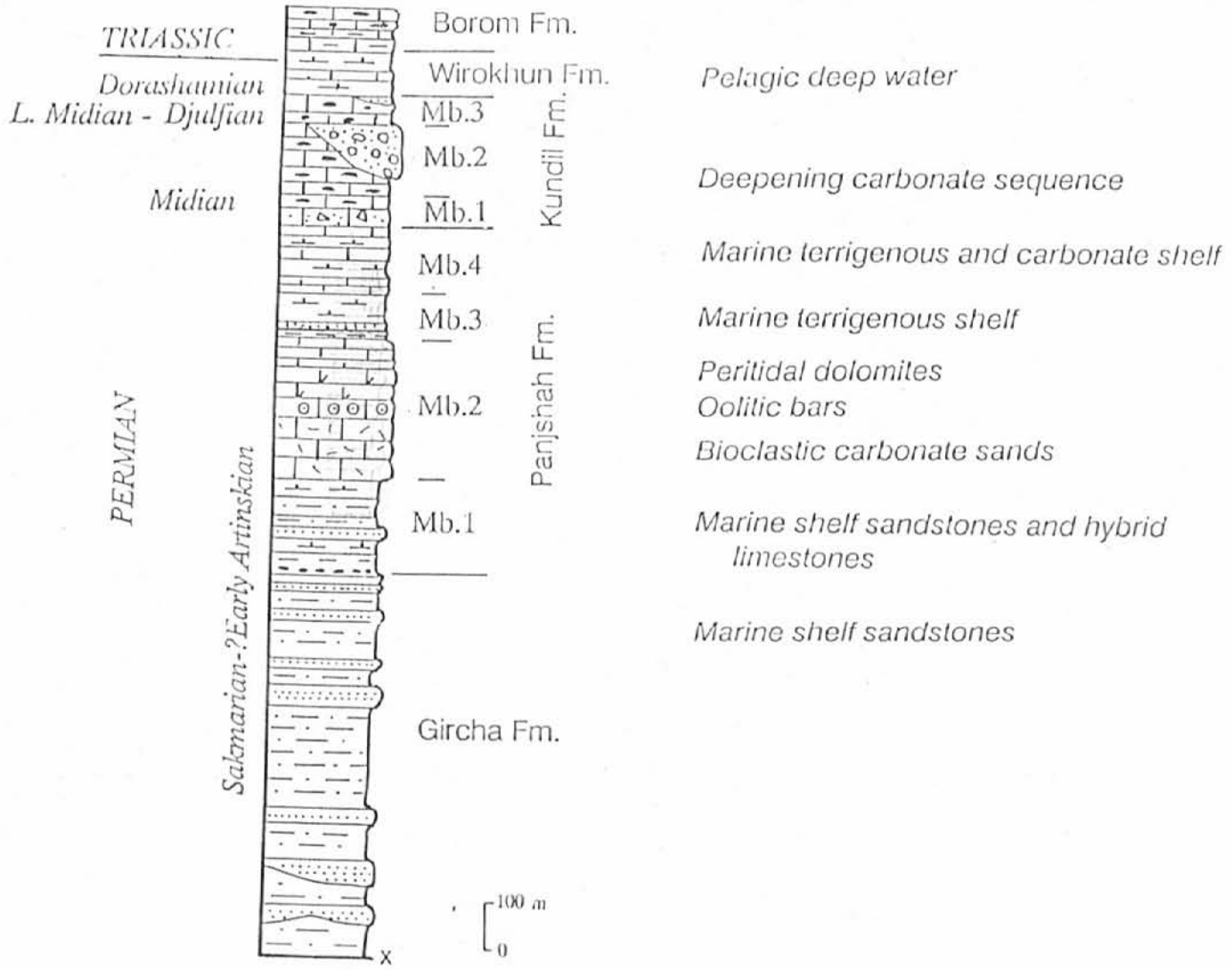

Fig. 1. The Permian succession of the Chapursan Valley.

13. PERMIAN/TRIASSIC BOUNDARY WORKING GROUP

Information concerning two of the four candidates for the Global Stratotype Sections (Meishan and Shansi, China) has been published in the newsletter of the Triassic Subcommission on Stratigraphy (Albertiana 11). The next issue of Albertiana will contain articles concerning Selong-Xishan (Tibet) and Guryul Ravine (Kashmir).

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