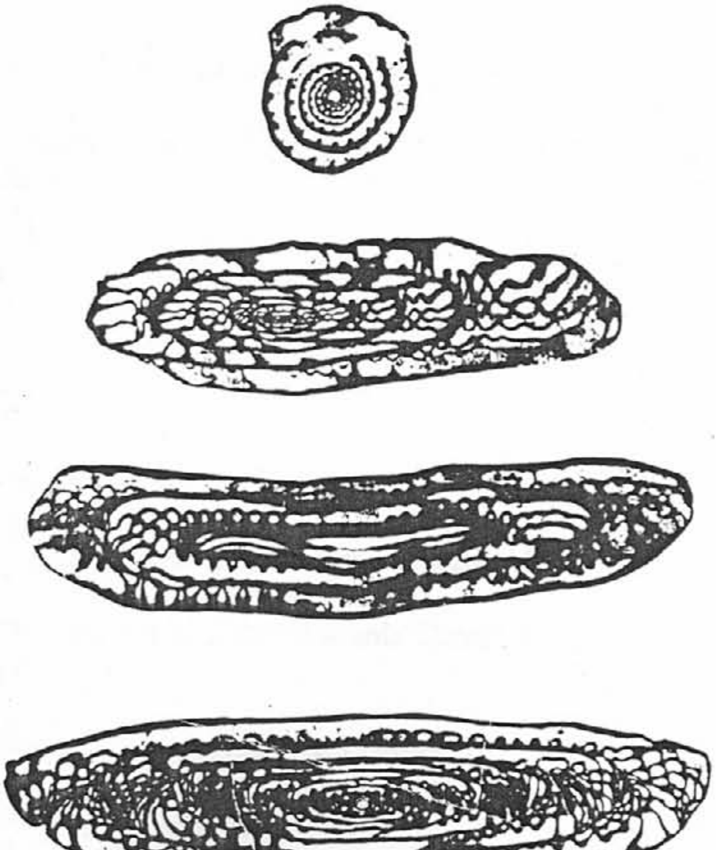
Permophiles

No. 17 November, 1990

A NEWSLETTER OF SCPS



SUBCOMMISSION ON PERMIAN STRATIGRAPHY

INTERNATIONAL COMMISSION ON STRATIGRAPHY

INTERNATIONAL UNION OF GEOLOGICAL SCIENCES (IUGS)

CONTENTS

Cover:

Monodiexodina paralinearis (Thorsteinsson) from Lower Permian of Ellesmere Island, Canadian Arctic Archipelago. Original photographs provided by R. Thorsteinsson.

1. CHAIRMAN'S NOTE

It is planned to hold a business meeting during the International Congress on the Permian System of the Globe to be held in Perm, 5 - 10 August 1991 (see Permophiles 16, item 5, for first circular). Further details available from Dr. B.I. Chuvashov, Institute of Geology and Geochemistry of the Urals, Scientific Centre of the Academy of Sciences of the USSR, SR-620219, Sverdlovsk, USSR and Dr. A.E.M. Nairn, Earth Sciences and Resources Institute, University of South Carolina, Columbia, SC 29208, U.S.A.

Jin Jugan

2. SECRETARY'S NOTE

I was most encouraged to receive so many significant contributions for this issue of "Permophiles". Those of you who were thinking about sending something, but did not quite get round to it, might like to know that the next issue is planned for June 1991!

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3. CARBONIFEROUS-PERMIAN STRATA AND PALAEOBIOTA OF XINJIANG

Situated in the Hinterland of Asia, the Xinjiang Uighur Autonomous Region is the largest of the 28 provinces and regions of China (occupying one-sixth the total area of the country). In topography, the whole territory of Xinjiang from north to south consists of the Altai, Tianshan and Kunlun Mountains together with the intermontane Junggar and Tarim basins. The Tianshan Mountains within the border of China range from east to west for a distance of over 2,000 kilometres, generally measuring 3,000-5,000 metres above sea level. The Taklimakan Desert, which has been called the place where one can never get out after once getting, in, has an area as large as 320,000 square kilometres. In the past, the well-known Swedish scientist Dr. Sven Hedin once led his large camel caravan into this area, making explorations under conditions of extreme hardship and difficulty. Unfortunately, the ruthless physical environments there almost caused the complete annihilation of his men.

Today, the study of biostratigraphy in Xinjiang still remains at a relatively lower level, especially in several areas where further studies are needed to fill the gaps in biostratigraphy.

Within the border of Xinjiang, the Carboniferous and Permian Systems are extremely widespread and especially well-developed in the Tianshan District. Since these two systems represent the most important horizons containing mineral deposits of gold, copper, iron and manganese together with coal, petroleum, natural gas, etc., many Chinese scholars have greatly intensified their investigations and studies on these rocks in recent years.

In the Carboniferous of Xinjiang, there exist two sedimentation types which are entirely different from each other, with the paired metamorphic belts of the Tianshan Mountains as their boundary dividing the whole region into two parts. The north part was developed with eugeosynclinal deposits of the mobile type. There the marine deposits of Tournaisian to Moscovian age have a relatively wide distribution. The sea water began to recede in late Moscovian and from then on continental deposition took place in the North Tianshan Mountains and their northern areas. In the south part deposition of a stable platform facies, lacking volcanic and clastic rocks occurred; there the marine environment persisted until the Kungurian Stage. However, there also exist marine deposits corresponding to the Guadalupian Stage in the Karakorum Mountains District and the southeastern Kunlun Mountains District close to the Xizang-Kashmir Region. However, no marine deposits corresponding to the Djulfian and Changhsingian Stages have yet been discovered from the above mentioned areas.

The Carboniferous biotas of Xinjiang apparently belong to two different biogeographical provinces. The biotas in the north part are closely related to those from Kazakhstan and the Kuznetsk Basin, USSR, and North America, while the biotas in the south part are similar to those from the South of China (the Tethys Realm). With the disappearance of the Tianshan Sea Trough during the Early Permian, the Angara Flora which had originally occupied an area north of Tianshan, began to intrude southwards, and mingled with the Euramerican Flora in northern Tarim during the Late Permian.

For the last few years, I have been carrying out investigations, together with my colleagues, on the

Carboniferous-Permian strata and biotas around the vast expanse of Xinjiang. A large amount of biostratigraphical data have been procured from different localities. The following papers and monographs have been completed and will be published in the next one or two years:

i) The Carboniferous System of Tarim and its Circumjacent Areas (with full text in Chinese and English; to be published in the first half of 1991);

ii) The Permian System of Tarim and its Circumjacent Areas (with full text in Chinese and English; to be published in the first half of 1991);

iii) A series on the Carboniferous of Northern Xinjiang, including:
Volume I. Carboniferous Biostratigraphy (with full text in Chinese and abstract in English; to be published in the first half of 1991);
Volume II. Carboniferous Lithofacies Palaeogeography (with full text in Chinese and abstract in English; to be published in the first half of 1991);
Volume III-IV. Systematic Records on Carboniferous Palaeobiota (tentatively scheduled to be published in 1992).

The peculiar natural landscape of Xinjiang is extremely fascinating, but the most enchanting scenery is the world famous Silk Road--an ancient passageway for transporting, silk cloth about 2,200 to 1,000 years ago. Here I would like to extend my cordial welcome to all of my colleagues in different countries in the hope that, if possible, they could come to Xinjiang to make field excursions and carry out scientific research on the Carboniferous-Permian strata and fossil biotas of Xinjiang in cooperation with Chinese colleagues.

Liao Zhou-ting
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and Palaeontology, Academia Sinica)

4A. CORRELATION OF THE PERMIAN AND TRIASSIC OF CIRCUMPACIFIC AND TETHYS REGIONS. IGCP PROJECT 271.

During the Symposium of Shallow Tethys III held in Sendait Japan 20-23 September, 1990, members of IGCP Proj. 272 (Late Paleozoic and Early Mesozoic Circum-Pacific events and their intercontinental correlation) met twice, under the chairmanship of Dr. J.M. Dickins, to discuss affairs of mutual concern. Numbers of attendants totalled about a dozen in the first meeting and nearly 20 in the second.

Correlation of the Permian and Triassic of Circumpacific and Tethys regions comprises one of the main topics. 15 papers were devoted to them in the symposium, and Prof. K. Nakazawa presented correlation charts of Permian and Lower Triassic of Circumpacific, Tethys and Japan herself, (see item 4B, this Newsletter). Discussions were concentrated on the subdivision of Permian System (bipartite or tripartite) and the P/T boundary. Emphasis was also placed on the significance of Guadalupian (Punjabian, Midian)-Julfian and mid-Triassic events, which have displayed widespread and somewhat synchronous orogenic, eustatic, volcanic and biotic changes. Although no definite conclusions have been reached the participants all agree to carry on these topics in future meetings and communications.

The following meetings, either independent or in connection with other conventions, have been proposed by Dr. Dickins for 1991 and 1992:

- Gondwana Symposium, Hobart, Tasmania, Australia, 25-30, June, 1991.

- Permian Meeting, Urals USSR, 5-10 August, 1991, excursion 10-20 August.

- Carboniferous-Permian Symposium, Buenos Aires, Argentina, 26-27, Sept., 1991, excursion 28 Sept. - 4 Oct. on marine Triassic, Chile.

- IGCP 272 Meetings Vladivostok, USSR, 8-18 (or 20). Sept, 1992 (see below).

- IGCP 272 Meeting in connection with North American Paleontological Convention, Missoula, Montana, USA, late June-early July, 1992, 3 days meeting, 7-10 days excursion--Permian-Triassic in terranes and craton (Dinwoody; Phosphoria Fms etc.), Wyoming & Montana, suggested by Profs. G. Stanley and D. Boyd.

If you are interested in any of these meetings please contact Dr. Dickins directly. Of the Vladivostok meeting(1992), I was asked to inform you of the preliminary suggestion and get your reactions. If an appropriate number of answers are positive, the proposer will begin to organize and distribute the First Circular. Because I will be abroad till early May, 1991, please write to Dr. Zakharov directly with your reply.

Vladivostok Meeting organizer: Dr. Yuri Zakharov.

Address: Far-Eastern Geological Institute of Far-Eastern Branch, Acad. Sci., USSR. Vladivostok 690022.

Name: Combined Meeting of two projects: IGCP 272 and a new IGCP project (Gondwana dispersion and Asian accretion; leaders: Ren Jishen, Clive Burrett and Jacques Cuerut)

Time of meeting: 2 days of meeting, 7-8 days of excursion in the Primorye regions about 8th-18th (or 20th) Sept. directly after the IGC meeting in Kyoto, Japan.

Field excursion:

i) Ussurian Gulf; Permian reef limestones and Lower Triassic sediments.

ii) Amurian Bay; Lower and Middle Triassic sediments.

iii) Pervaja Retchka river; Upper Permian volcanogenic rocks of the Vladivostokian Fm.

iv) Senkina Shapka Mt.; Upper Permian limestones (Chandalaz Fm).

v) Nakhodka; Upper Permian reef limestones.

vi) Eastern Sikhote-Alin; Cretaceous olistostrome sediments with Permian-Triassic blocks.

Fees and funding: all costs including meals and transportation would be about $400 for each person. Limited funding is possible from the allotment of IGCP.

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4B. CORRELATION CHARTS FOR THE PERMIAN AND LOWER TRIASSIC OF THE WORLD

5. STRATIGRAPHIC PROBLEMS OF THE EUROPEAN PERMIAN SYSTEM

Evolution of separate parts of the European continent proceeded in the Late Paleozoic according to a different plan and thus defined a substantial discrepancy in stratigraphic succession of Permian sections. Permian deposits are represented by a variety of combinations including marine carbonate and terrigenous sediments, lagoonal and surficial accumulations, volcanogenic complexes. Their proportions in actual sections determines difficulties and potentialities of detailed subdivision and correlation. The whole diversity of Permian sections in Europe can be reduced to several main types.

i) The Uralian type - the lower division of the system is composed of the marine accumulations of two subtypes: 1 - marine flyschoid successions (the Uralian subtype proper), and 2 - carbonate ones including reefogenic formations (platform subtype).

The upper division of the system is represented in this way by the Ufimian surficial red beds, Kazanian marine and lagoonal formations, as well as surficial terrigenous rocks of the Tatarian stage.

In the northern part of the East-European platform the whole section of the upper division of the system consists of marine carbonate - terrigenous rocks. There are grounds to believe that Permian sections of this very type - carbonate or sometimes with sulphates in the lower division and carbonate-terrigenous, essentially marine at the top - are also in the southern part of the Barents Sea.

ii) The Novozemelsky type is characterized by predominantly marine terrigenous successions occurring within the whole Permian section up to the Triassic boundary. It is also supposed to be widely distributed, to the north from Novaya Zemlya archipelago in the Barents Sea.

iii) The Donetsk type of sections typical of the southern East-European platform includes marine carbonate-terrigenous facies in its lower part (not higher than the top of the Asselian) and is overlapped by thick terrigenous surficial red beds up to the boundary with the Triassic system.

iv) The Caucasian type is represented in its lower part by a succession of red terrigenous surficial deposits; the upper division contains thick

Classification of Waterhouse & Gupta, '83					Standard of Cis-Ural & Tethys. Kotlyar, '84-88			Japan (Up. Pm: Kitakami, Mid.-Low. Pm: Akiyoshi)				Transcaucasia	Central Iran (Abadeh)			Pakistan (Salt Range)		
Transcaucasia Series	Dorashamian	Gangetian	Yichang (Loping) Ser.	Changxing.		Dorasham.	Paratirolites	Toyoman Series	Mitaian	Palaeofusulina, Colaniella parva, "Hedlicottia", Paratirolites?		Dorasham	Hambast Formation	Unit 7	Paratirolites			Lower Unit of Kathwai
							Shevyrevites								Paratirolites-Shevyrevites			
							Dzhulfites											
		Ogbinan					Iranites								Shevyrevites			
		Vedian					Phisonites											
	Djulfian	Baisalian		Lungtan.		Dzhulfian	Vedioceras			Araxoceras, Prototoceras, Xenodiscus		Dzhulfa		Unit 6	Vedioceras			
							Araxoceras								Araxoceras	Chhidru	1 - 4	Cyclolobus,
		Urushtenian					Araxil. / Codon.-Araxil.								Araxilevis			Codonofusiella-Reichelina
							C.-R.						Abadeh	Unit 5	Codon.-Reichel.			
Guadalupian Series	Punjabian	Chhidruan	Guadalupian Series	Capitanian	Tatarian Upper	Midian	Lepidolina kum.	Kanokuran Series	Kuman	Lepidolina kumaensis		Hachik		Unit 4	Sphaerulina	Wargal	5	Colaniella minim.
		Kalabaghian			Tatarian Lw.		Yabeina globosa			L. multiseptata Yabeina globosa,		Arpa	Surmaq Formation	Unit 3	Orientoschwag.		1 - 4'	Nanlingella simp.
					Kazanian	Murgabia	Neoschw. marg.		Akasa.	Neoschw. margaritae		Gnishik		Unit 2	Neoschw. margar.			Chusenella
	Kazanian	Sosnovian					N. craticulifer.			N. craticulifera				Unit 1	Neoschw. cheni			
				Wordian			N. simplex		Nabeyaman	N. simplex	Parafusulina kaerimizensi.	Asny			Eopolydiexodina			
		Kalinovian			Ufimian	Kuberg	Cancellina cuta.			Cancellina					Schwagerina	Amb Form.	Upper	Plant fossils
							Misell., Armenia			Misellina claudiae								
	Kungur.	Irenian		Roadian		Bolor.	Mis. parvicosta.					Davali					Lower	Codonofusiella, Monodiexodina kattaensis
		Filippovian			Kg.		Mis. dyhrenfur.	Sakamotozawan Series	Kabayaman	Mis. dührenfurthi								
Cisuralian Series	Beigenz.	Krasnoufimian	Cisuralian Series	Beigenz	Artinskian	Yakhtashian	Chalaroschwag. vulgaris			Pseudofusulina vulgaris					Darvasites			
		Saraginian																
	Sakmarian	Aktastinian		Sakmarian			Chalaroschwag. solita		Kawaguchian							Milawahan Group		Sardhai Format.
		Sterlitamak.			Sakmar	Sakmar	Robustschwag.-			Robustoschwagerina shellwieni								Warchha Ss.
		Tatsubian					Paraschwagerina											
	Asselian	Kumaian		Asselian	Asselian	Asselian	Schw. sphaerica	Nagatoan Series		Pseudoschw. miharan.								Dandot Formation
		Uskalian					Schw. molleri			Ps. muongthensis								Tobra Foramtion
		Surenian					Schw. vulgaris			Sphaeroschw. fusifor								

4Bi NAKAZAWA 1989

Classification of Waterhouse & Gupta, '83

Transcaucasia Series	Dorashamian	Gangetian	Yichang (Loping) Ser.	Changxing.
		Ogbinan		
		Vedian		
	Djulfian	Baisalian		Lungtan.
		Urushtenian		
Guadalupian Series	Punjabian	Chhidruan	Guadalupian Series	Capitanian
		Kalabaghian		
	Kazanian	Sosnovian		Wordian
		Kalinovian		
	Kungur.	Irenian		Roadian
		Filippovian		
Cisuralian Series	Beigenz.	Krasnoufimian	Cisuralian Series	Beigenz
		Saraginian		
	Sakmarian	Aktastinian		Sakmarian
		Sterlitamak.		
		Tatsubian		
	Asselian	Kumaian		Asselian
		Uskalian		
		Surenian		

Standard of Cis-Ural & Tethys. Kotlyar, '84-88

		Dorasham.	Paratirolites	
			Shevyrevites	
			Dzhulfites	
			Iranites	
			Phisonites	
		Dzhulfian	Vedioceras	
			Araxoceras	
Tatarian	Upper		Araxil.	Codon.-Araxil.
			C.-R.	
	Lw.	Midian	Lepidolina kum.	
			Yabeina globosa	
Kazanian		Murgabia	Neoschw. marg.	
			N. craticulifer.	
			N. simplex	
Ufimian		Kuberg	Cancellina cuta.	
			Misell., Armenia	
		Bolor.	Mis. parvicosta.	
Kg.			Mis. dyhrenfur.	
Artinskian		Yakhtashian	Chalaroschwag. vulgaris	
			Chalaroschwag. solita	
Sakmar		Sakmar	Robustschwag.-	
			Paraschwagerina	
Asselian		Asselian	Schw. sphaerica	
			Schw. molleri	
			Schw. vulgaris	

India (Kashmir)

E_1 Member of Khunamuh Form. ?		
Zewan Format.	D	Xenodiscus
	C	Cyclolobus
	B	.
	A	Colaniella
Panjal Volcanic Rocks		

South China (Lower Yngtze & Yunnan)

Changhsing.	Palaeofusul.	Pseudotirol.	Rotodiscocer.-Pleuronodoc.
			Pseudostephan.-Tapashanites
			Shevyrevites-Paratirolites
Wuchiaping	Codonofus.		Sanyangites
			Araxoceras-Conglingites
			Anders.-Prototo.
Maokouan			Lepidolina kumaens.
			Lepidolina-Yabeina
			Neoschwagerin-Chusenella
Chihsia			Parafus.-Cancellina
			Misellina ovalis
			Brevaxina otakiens.
Changmoan			Pamirina chinling.
			Chalaroschw. tument.
			Pseudof. vulgaris-Laxifusulina intqua
Mapingian			Pseudoschw. robusta-Zellia changkungens.
			Pseudoschw. parab.-Sphaeroschw. sphaer.
			Pseudoschw. morsei-Robustoschw. ziadus.

Far East USSR (Primorye)

Ljiudiansa hor.		Colaniella parva
		Eusanyangites
		Cyclolobus kislevae Xenodiscus
Chadalaz		Lepidol. kumaens.
		Parafusulina str.
		Monodiex.-Metadol.
Vladiostoc	limestone facies	Neoschwagerina craticulifer.
		Cancellina
Abrek		Misellina claudiae
Konjush.		Chalaroschw. vulgaris-Pseudofusulina ex gr. kraffti
Dunay		Schwagerina sphaerica gig. - Acervoschwag. indolasa

U.S.A. (Texas)

Ochoan		
La Colorada		
Guadalupian	Capitan.	Reichelina
		Yabeina texana
		Polydiexodina
	Wordian	Parafusulina
		Parafusulina-Skinnerina
	Rd	
Leonardian		Parafusulina-Schwagerina
		Skinnerella-Schubertella
		Schwagerina crassitectoria
Wolfcamoian		Schwagerina
		Paraschwagerina-Pseudoschwag.
		Triticites-Pseudofusulina

Svalbard (W. Spitsb.)

Kapp Starostin Formation	Hovtinden Mb.
	Svenskeegga Member
	Vøring

			conodont	South Alps		Abadeh, Iran			Salt Range			Kashmir			South China		East Greenland	
LOWER TRIASSIC	Smithian		*N. waageni*	Werfen Formation	Campil Mb.	Lower Triassic		*Claraia aurita* *Cl. extrema* *N. dieneri*	Mianwali Formation	Mittiwali Mb.	*Meekoceras*	Khunamuh Formaiton	H	*Owenites*	Quinlong Formation	*Meekoceras*	Wordie Creek Formation	*Meekoceras*
	Dienerian		*N. paksitan.*		Siusi Mb.						*Paranorites*		G	*Prionites*		*Prionolobus*		*Proptychites*
			Neospathodus critagalli								*Koninckites*		F	*Vishnuites*		*Koninckites*		
			N. dieneri		*Claraia aurita*						*Gyronites*			*Ophiceras*		*Gyronites* *Claraic aurita*		*Vishnuites*
			N. kummeli		*Claraia clarai*			*Vishnuites,* *Lytoophiceras,* *Claraia julfens.* *I. isarcica*										
	Griesbach.	Upper	*N. carinata*		Mazzin Mb. *Claraia wangi* *Bellerophon*					Kathwai Memb.	Upper Unit *Ophiceras*		E3	*O. tibetic.*		*Ophiceras* *Claraia stachei*		*Ophiceras*
			I. isarcica															
		Lower	*Hideodus parvus* (*H. minutus*)					*Claraia sp.* *H. parvus*			Middle Unit *Ophiceras*		E2	*Otoceras woodwardi*		*Claraia wangi*		*Otoceras boreale*
					Tesero Hor.			?			Lower Unit		E1	*Marginifera*		Mixed beds 1,2		*O. concavum* *Hypophiceras*
PERMIAN	Dorasham. (Changxing)		*Neogondolel. subcarinata chnagxingens.*	Bellerophon Format	?	Hambast Formation	7	*Paratirolit.* *Julfotoceras* *Julfotoceras* *Dzhulfoceras* *Shevyrevites*				Zewan Formation			Changxing	*Rotodiscoceras* *Pleuronodoceras*		
			N. subcarin. subcarinata		*Janiceps* *Ombonia* *Comelicania,*								D	*Neogondolel. subcarinata*		*Pseudostephanit.* *Tapashanites*		
	Dzhulfian (Wujaping)		*N. orientalis*		*Stearoceras,* *Aviculopecten*		6	*Vedioceras*	Chhidru F.		*Oldhamina*		C	*Cyclolobus.* *Xenodiscus*	Wujiaping	*Araxoceras* -*Konglingites*		
								Araxoceras			*Cyclolobus,* *Xenodiscus*					*Prototoceras* -*Anderssonoceras*		
			N. leveni			Abadeh F.	5	*Codonofusiel.* *Reichelina*	Wargal		*Nototyhris djoulfensis*		B	*Costiferina*				Martinia ls.
	Midian		*N. bitteri*				4	*Staffella*			*Colaniella*		A	*Colaniella*	Maokou	*Yabeina-Lepidolina*		Posidonia sh.
																		"Productus" ls.

4Biii NAKAZAWA 1989

sequences of marine carbonate rocks. Sections of the Caucasian type are similar to those from some South European Permian formations (Hungary, Italy, Greece, Cyprus).

v) The Carnian type is characterized by carbonate (including reef) deposits occurring in the Lower Permian (not higher than the Sakmarian). Its upper part consists of surficial predominantly fragmental rocks. Along with the Carnian Alps, after which this lithotype was named, the sequence is also observed in Yugoslavia.

vi) The Sicilian type could be described by the development of marine flyschoid series at the bottom of the section and carbonate ones at its top.

vii) Central-European type of sections are spread over vast territories of western USSR, Poland, Czechoslovakia, GFR, GDR, Denmark, Netherlands, Great Britain, Greenland, as well as on the Barents, North and Irish sea floors. This is a two-component section. Its lower and larger part (probably, up to the level of Middle Tatarian) is composed of surficial red incomplete successions of the Rotliegende. Its top (Zechstein) consists of carbonate-sulphate deposits with areas of potassium and rock salts.

Structural features and paleontological characteristics of most (not all, of course) of the different types of section define the aims and potentialities of a stratigraphic study of the Permian system of the continent.

Significant progress in the correlation of European Permian deposits could be achieved through a unification of research efforts from many countries under a single programme. At present stratigraphers have attained much success in the generation of regional stratigraphic schemes, but their mutual correlation is based mostly on assumptions and fabrications instead of real facts.

The main stratigraphic problems of the European Permian system could be expressed in the following:

i) Determination of the Carboniferous - Permian boundary in terrestrial facies and equivalent marine deposits. This boundary can be traced with confidence within vast areas of the Urals and Eastern parts of the East-European platform, as well as in sections of types 2, 3 and 5; but this is done with great difficulty when correlating sections of types 4 and 7.

The problem could be solved by paleomagnetic techniques. Their application is necessary, in the first place, in stratigraphic sections of Southern Preduralye, where magnetic datum points could be attached to well defined paleontological boundaries. However, the most significant role in solving this problem should be given to the correlational potential of miospores and macroscopic plant remains. Complexes of such organisms should also be correlated with faunistic ones.

ii) Standard definition of the boundary between the upper and lower divisions of the Permian system as well as boundaries between stages of the lower division. We mean here the utilization of a standard Permian scale for the whole territory of Europe. The greatest difficulties arise when establishing stage boundaries of the lower division and division boundaries in sections belonging to types 4, 5 and 7. Solution of the task may be possible through application of unknown potentialities of rarely used faunistic groups including myarians, vertebrates, insects, micro - and macroflora together with magnetostratigraphic studies, utilization of data on cyclic sedimentogenesis and elements of event stratigraphy.

iii) The most complicated problem is the correlation of stages of the standard scale for the upper division of the Permian system. Major difficulties are related to the correlation of the inherent lithostratigraphic and ecostratigraphic boundaries beyond the type stratigraphic region. Resolution of this problem may be attained by studying sections transitional between the Uralian and Novozemelsky types. In the north of the East-European platform and on Novaya Zemlya the whole upper division of the system is represented by marine formations. It means that by studying transition sections in these localities there may be a potential for establishing both stages, and the limits of the upper division in the marine facies. There is no need to emphasize that such work requires application of a complete range of stratigraphic methods.

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6. THE SOLUTION TO THE PROBLEM OF THE CARBONIFEROUS/PERMIAN BOUNDARY IN THE USSR

ISC (Interdepartmental Stratigraphic Committee) of the Commission on the Permian System has been engaged in an active consideration of the Carboniferous/Permian boundary problem for over ten years. After abolition of the Orenburgian stage in the General Scale adopted in the USSR in 1973 (Resolutions, 1982), the Carboniferous/Permian boundary was drawn on the basis of the fusulinid scale and fixed at the top of the *Daixina sokensis* Zone. It was presumed that the Orenburgian according to V.E. Ruzhentsev corresponds in its stratotype to the *Sphaeroschwagerina vulgaris - S. fusiformis* Zone, whereas the Asselian in the stratigraphic succession established by E.V.Ruzhentsev, started at the level of the *Sphaeroschwagerina moelleri - Schwagerina fecunda* Zone (Pnev et al., 1975, 1978). The subsequent studies of the sections in the South Urals, and prior to that in Central Asia have shown that between the *Daixina sokensis* and *Spaeroschwagerina vulgaris - S. fusiformis* (s.str.) zones there is an independent unit characterized by a peculiar fusulinid assemblage and distinguished as the *Daixina bosbyatuensis - D. robusta* Zone (Leven, Davydov, 1979; Davydov, 1982; 1984). In its stratotype the Orenburgian stage corresponds exactly to the *Daixina sokensis* and *Daixina bosbytauensis - D. robusta* zones. V.E. Ruzhentsev (1950, 1952) started the Asselian with beds assigned to the *Sphaeroschwagerina vulgaris - S. fusiformis* Zone (s.str.) (Popov, Davydov et al., 1985).

However, the rehabilitation of the Ruzhentsev's data and ideas was not accompanied by reconstruction of the initial position of the boundary. There was disagreement among the specialists, and the two versions were debated: i.e. for the boundary to be placed at the base of the *Daixina bosbytauensis - D. robusta* Zone or at its top. The former version is convenient from the practical viewpoint in the Urals and the Russian Platform, and, thus it was upheld by the majority of regional specialists, among them the fusulinid workers. The second version was confirmed by ammonoid evidence and was adhered to by a great number of investigators who study the problems outside the study area (Resolutions, 1985). In the last few years problems were clearly formulated whose solution would enable a decision to be made on the most suitable boundary, acceptable to the majority of specialists. With regards to the historical significance of the South Urals sections, their discontinuous character, as well as the abundance of stratigraphically important groups of fossils, it was proposed to choose a boundary, which, after discussion at the International Subcommission on the Permian System, could be applied globally.

In 1978-80, the paleontologists of VSEGEI proposed a boundary stratotype on the basis that the Carboniferous/Permian boundary be drawn according to the goniatite scale between the genozones *Shumardites - Vidrioceras* and *Svetlanoceras - Juresanites*; i.e. the base of Bed 20 in the Aidaralash section (Popov et al., 1985; Popov, Davydov, 1987). The above proposals were actively debated at several meetings of the ISC Commission on the Permian System (1985-1987).

In 1987, a field trip was organized to the Aidaralash section, in which the leading specialists on the Carboniferous and Permian stratigraphy participated, among them the members of the corresponding commissions and their bureaus. Besides the visual examination of the sections additional ammonoid specimens were collected (several levels, not characterized earlier, were discovered), as well as fusulinids; L.Z. Achmetshina and R.I. Kozitskaya collected a considerable amount of rock material for conodonts, took samples for spore and pollen analysis, and samples for paleomagnetic studies. The examination of all the collected material totally confirmed the earlier data on the ammonoid distribution (Popov et al., 1985; Davydov, Popov, 1986). There was considerable disagreement among the specialists as regards the zonal subdivision of the Aidaralash section on the basis of fusulinids (Pnev et al., 1978; Resolution, 1987; Davydov, Popov, 1986). As a result it was decided to organize the colloquia in 1988-1989 on fusulinids of the Aidaralash section with a view to defining more precisely the zonal affinities of certain beds. Such colloquia were held during 1989 (January, Leningrad; December, Sverdlovsk), and their participants came to the following conclusions. Beds 1-6 of the Aidaralash sections undoubtedly, belong to the *Daixina sokensis* Zone. Starting with Bed 9, the fusulinid assemblage of the *Daixina bosbytauensis - D. robusta* Zone appears. In the Aidaralash section this range can be subdivided in greater detail (*Daixina [Ultradaixina] postsokensis* and *Daixina [Ultradaixina] postgallowayi* zones, according to Davydov, 1988). The lower boundary of the *Sphaeroschwagerina vulgaris - S. fusiformis* Zone in the Aidaralash section is drawn between beds 19-5 and 19-6, where the fusulinid species composition is renewed, and the zonal indices appear (Fig.1). The upper boundary of the zone can be drawn with a lesser degree of assurance due to a peculiar character of fusulinids in the given section, and the predominance of the Tethyan elements among them. This boundary is drawn at Bed 26 with a certain degree of reservation. Beds 27 and 28 yield the fusulinid assemblage (diverse *Pseudoschwagerina* and others), pointing definitely to their belonging to the Zone *Sphaeroschwagerina moelleri - Schwagerina fecunda* Zone.

The ammonoid workers (M.F. Bogoslovskaya, T.B. Leonova, A.M. Pavlov, A.V. Popov) are unanimous in their assumption that the Carboniferous/Permian boundary should be correlated with the appearance of a number of taxa, which define the character of evolution of the Permian ammonoid biota: families Paragastrioceratidae (initial genus *Svetlanoceras*), Metalegoceratidae (initial genus *Juresanites*), Perrinitidae (initial genus *Properrinites*), Popanoceratidae (initial genus *Protopopanoceras*), as well as the genera *Prostacheoceras, Kargalites, Tabantalites*, and others. By this time, many genera, which determine the biochronotype of the Carboniferous system become extinct: *Uddenites, Uddenoceras, Prouddenites, Shumardites, Marathonites* etc. V.E. Ruzhentsev connected the lower boundary of the Sakmarian (*s. lato*) (when distinguishing it in 1936) with this turning-point in ammonoid evolution. When subsequently the lower part of the Sakmarian was segregated as the Asselian, the position of the lower boundary, and the arguments for drawing it here remained unchanged. The opinion about this boundary put forward more than 50 years ago by V.E. Ruzhentsev as the boundary of two systems, i.e. the Carboniferous and the Permian, has not changed significantly with years. A great amount of new evidence obtained in the last few years, enables confirmation and provision of more convincing and reliable arguments for the above-mentioned boundary. In the Aidaralash section, the transitional beds from the Carboniferous to the Permian have a rich ammonoid record. In accordance with the latest Resolutions of the Commission on the Permian System of the Interdepartmental Stratigraphic Committee of the USSR of June 12,, 1990, the Carboniferous/Permian boundary and, therefore, the lower boundary of the Asselian is drawn on the basis of the goniatite scale between the genozones *Schumardites - Vidrioceras* and *Svetlanoceras - Juresanites*. The Aidaralash section, where joint occurrences of ammonoid, fusulinids, conodonts, and miospores are recorded, was approved as the boundary stratotype. The boundary is drawn between beds 19/5 and 20 in the phylogenetic lineage *Artinskia irinae - A. kazahstanica*. In the fusulinid scale this boundary is drawn between the zones *Daixina bosbytauensis - D. robusta* and *Sphaeroschwagerina vulgaris - S. fusiformis* (*s. str.*).

The relationship between the established boundary and the conodont scale is, as yet, less definite. Judging by the available evidence, the lower boundary of the *Streptognatodus wabaunsensis* Zone is drawn within the fusulinid *Daixina sokensis* Zone. Some workers associate the Carboniferous/Permian boundary with the base of the *Streptognathodus constrictus - St. barskovi* Zone. The first appearance of the conodonts *Streptognathodus constrictus* above the base of the fusulinid *Sphaeroschwagerina vulgaris - S. fusiformis* Zone (Bed 22). According to I.S. Barskov, the available material does not as yet allow a precise definition in the Aidaralash section of the position of the operational level of the phylogenetic succession of conodonts of the lineage *St. alius* → *St. constrictus* and *St. elongatus* → *St. barskovi*. Therefore, I.S. Barskov proposed choosing the boundary on the basis of the following conodont assemblage: *Streptognathodus flangulatus, St. cristellaris, St. barskovi, St. constrictus, St. asselicus*. The level of the chosen boundary approximately coincides with the appearance of the conodonts *St. flangulatus, St. asselicus*.

Mass occurrence of these species, as well as the first appearance of *St. cristellaris, St. constrictus, St. barskovi* are recorded in beds 21 and 22 (Fig.1). The proposed point of view has been elaborated in the course of discussions and the work of the ISC Commission on the Permian System and is shared by the majority of specialists who study this problem.

We would also like to drawn the attention of the members of the International Subcommission to the fact that the Aidaralash section displays continuous exposures of monofacies marine, off-shore deep water deposits from the upper part of the Gzhelian to the Sakmarian (inclusive). The section represents a unique combination of three stratigraphically important groups, commonly found under different facies environments: ammonoids, fusulinids and conodonts. The ammonoids were collected from 40 horizons; fusulinids and conodonts from more than 60 horizons. The section uniformly abounds in these fossils, which display good preservation. An especially good faunal record occurs in the beds where it is proposed to draw the C/P boundary. The section also contains palynological assemblages. The results will be published in the Guide on the South Urals sections, which is being prepared for publication. Paleomagnetic characteristics have been studied. Their data have been partly published (Kramov, Davydov, 1984); the latest results will be presented in the above Guide.

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Figure 1 Distribution of the main fossil species in the Carboniferous/Permian boundary deposits of the Aidaralash section. Page 13

Ammonoids:

1 - *Boesites primoris* Ruzh.
2 - *Aristoceras appressum* Ruzh.
3 - *Uddenites tuberculatus* Ruzh.
4 - *Somoholites ikensis* Ruzh.
5 - *Aristoceras serum* Bog. et Pop.
6 - *Prothalassoceras jaikense* Ruzh.
7 - *Prothalassoceras inflatum* Ruzh.
8 - *Prothalassoceras bashkiricum* Ruzh.
9 - *Almites reverendus* Bog. et A. Pop.
10 - *Eoasianites vodoresovi* Ruzh.
11 - *Daixites meglitzkyi* Ruzh.
12 - *Uddenites convexus* Ruzh.
13 - *Artinskia irinae* Razh.
14 - *Prouddenites terminalis* Ruzh.
15 - *Daixites subattenuatus* Bog. et Shkol.
16 - *Prothalassoceras serratum* Maxim.
17 - *Daixites antipovi* Ruzh.
18 - *Svetlanoceras primore* Bog. et A. Pop.
19 - *Prostacheoceras principale* Bog. et A. Pop.
20 - *Boesites aktubensis* Bog. et A. Pop.
21 - *Artinskia kazakhstanica* Ruzh.
22 - *Neopronorites rotundus* Maxim.
23 - *Prothalassoceras biforme* Geras.
24 - *Daixites attenuatus* Ruzh.
25 - *Eoasianites trapezoidalis* Maxim.
27 - *Artinskia nalivkini* Ruzh.
28 - *Prostacheoceras juresanense* Maxim.

Fusulinids:

29 - *Occidentoschwagerina kizilkiensis* Dav.
30 - *Pseudofusulinoides kljasmica* (Sjom.)
31 - *Pseudofusulinoides buzulukensis* (Dobr.)
32 - *Daixina (Ultradaixina) postsokensis* Dav.
33 - *Daixina (Ultradaixina) bosbytauensis* Bensh
34 - *Schwagerina ossinovkensis* (Scherb.)
35 - *Occidentoschwagerina alpina* (Kahl. et Kahl.)
36 - *Occidentoschwagerina chatcalica* Bensh
37 - *Licharevites thompsoni* (Grozd.)
38 - *Rugosochusenella pseudogregaria* (Bensh)
39 - *Dutkevitchia tachygrada* (Bensh)
40 - *Dutkevitchia kargalensis* (Raus.)
41 - *Schwagerina vozhgalensis* (Raus.)
42 - *Schwagerina biconica* (Scherb.)
43 - *Daixina (Ultradaixina) postgallowayi* Bensh
44 - *Schwagerina robusta* (Raus.)
45 - *Dutkevitchia ruzhenzevi* (Raus.)
46 - *Licharevites fornicatus* (Kanm.)
47 - *Daixina (Ultradaixina) dashtidzhumica* Dav.
48 - *Rugosochusenella paragregaria* (Raus.)
49 - *Dutkevitchia complicata* (Schellw.)
50 - *Licharevites nitidus* (Kahl. et Kahl.)
51 - *Licharevites sartauensis* Dav.
52 - *Licharevites inglorius* (Bensh)
53 - *Sphaeroschwagerina salomatiensis* (Ket.)
54 - *Licharevites esetensis* Dav.
55 - *Sphaeroschwagerina buzulukensis* (Dobr.)
56 - *Sphaeroschwagerina shamovi primitiva* (Lev. et Scherb.)
57 - *Sphaeroschwagerina vulgaris darvasica* (Lev. et Scherb.)
58 - *Sphaeroschwagerina aktjubensis* (Scherb)
59 - *Sphaeroschwagerina volongica* (Scherb.)
60 - *Sphaeroschwagerina kolvica* (Scherb.)
61 - *Sphaeroschwagerina shamovi shamovi* (Scherb.)
62 - *Schwagerina versabile* (Bensh)
63 - *Licharevites gareckyi* (Scherb.)
64 - *Paraschwagerina distincta* Lev. et Scherb.
65 - *Dutkevitchia devexa* (Raus.)
66 - *Schwagerina subnathorsthy* (Lee)
67 - *Paraschwagerina akhunovi* Raus.
68 - *Sphaeroschwagerina fusiformis* (Krot.)
69 - *Sphaeroschwagerina* aff. *moelleri* (Raus.)
70 - *Pseudoschwagerina inexplorata* Lev. et Scherb.
71 - *Zigarella* aff. *pseudopointeli* (Raus.)
71.a - *Sphaeroschwagerina postvulgaris* (Bensh)
72 - *Pseudoschwagerina robusta* (Meek)
73 - *Pseudoschwagerina uddeni* (Beede et Kniker)
74 - *Sphaeroschwagerina kargalensis* (Scherb.)
75 - *Sphaeroschwagerina asiatica* (M. Maclay).

Conodonts:

76 - *Streptognathodus elongatus* Gunn.
77 - *St. simplex* Gunn.
78 - *St. alius* Akhmet.
79 - *St. acuminatus* Gunn.
80 - *St. insignitus* Akhmet.
81 - *St. wabaunsensis* Gunn.
82 - *St. nodulinearis* Chern. et Resh.
83 - *St. flangullatus* Gunn.
84 - *St. asselicus* Isak.
85 - *St. cristellaris* Chern. et Resh.
86 - *St. constrictus* Chern. et Resh.
87 - *St. barskovi* Kozur
88 - *St. fuchengensis zhao*
89 - *St.* ex gr. *fusus* Chern. et Resh.

aff = affinis; c = conformis; ex. gr. = ex gregia.

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7. PERMIAN STRATA IN THE BRITISH ISLES - AN UPDATE

A phase of considerable research activity and publication on Permian rocks of the British Isles was followed in the late 1980s by a less active spell which is now drawing to a close as several major publications grind through editorial mills. The net results of the research are 1) a considerable advance in knowledge of the sedimentology and palaeogeographical evolution of the region during late Permian time and 2) a more modest advance in the dating of some Permian continental rocks.

The results of much of the research in the early part of the decade were published in Harwood & Smith (1986), in which 9 papers dealt mainly with aspects of Zechstein (late Permian) sedimentology in north-east England and a further paper made recommendations (summarized in Figure 1 and Figure 2) on the nomenclature of English Zechstein strata. Other papers in the 1986 volume were on the sedimentology and stratigraphy of Zechstein strata in Poland (6) and Germany (4) with a final paper on

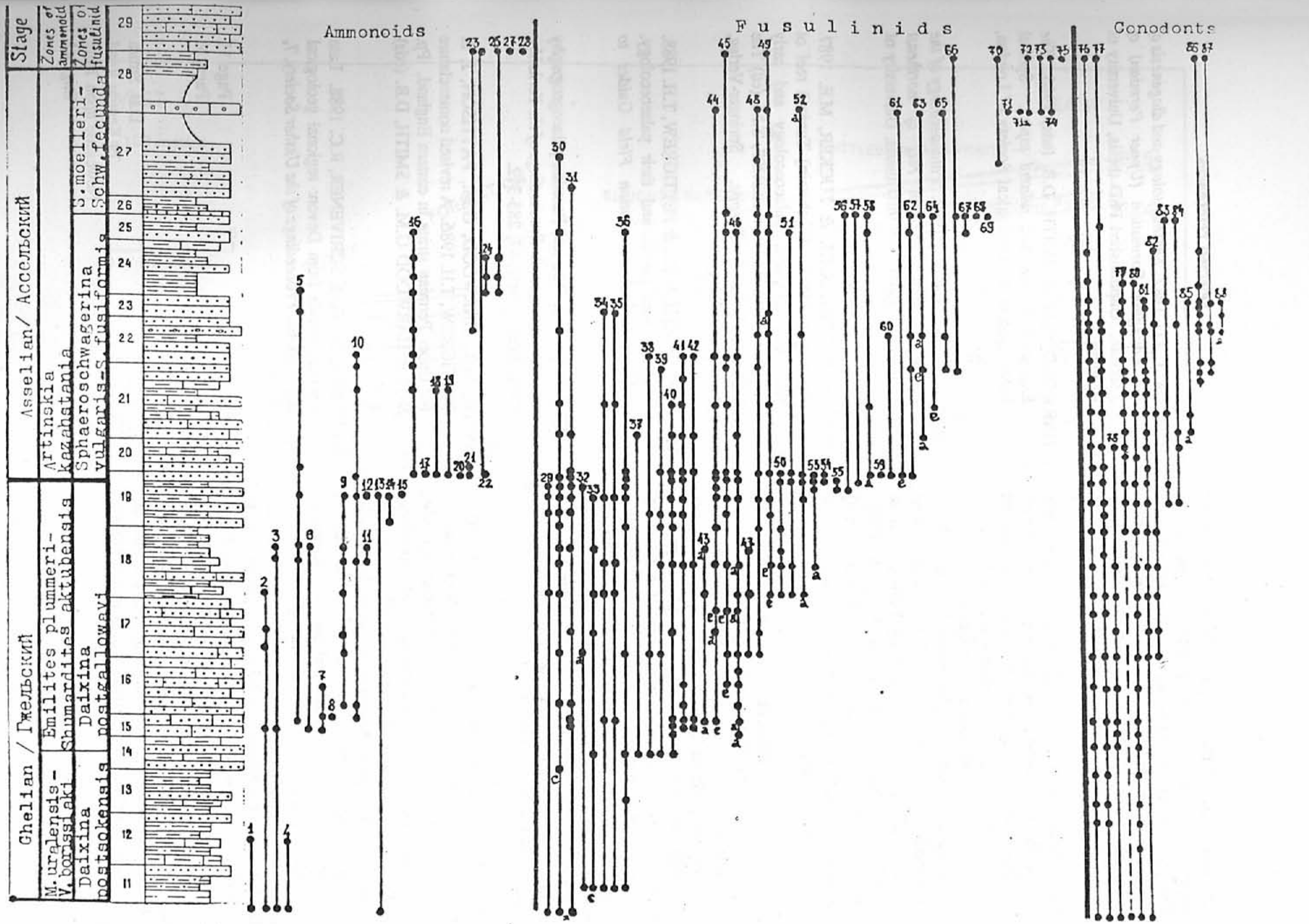

Figure 1. Davydov *et al.*

carbonate rocks of the Kungurian Basin. None of the papers helped to solve the problem of the age of Zechstein rocks in terms of world stages but an important contribution by Schweitzer usefully summarized and correlated the land macroflora of the English and German Zechstein sequences.

Most subsequent works on English Zechstein strata, like those in the 1986 volume, concentrate on aspects of their sedimentology; they include important unpublished regional studies of Cycle 1 slope and reef carbonates, on the Cycle 1 - 2 shelf-lagoon evaporite-clastic sequence and a detailed study by Hollingworth (1987) of the palaeoecology of Cycle 1 reef faunas; the latter formed the basis of briefer publications by Hollingworth & Tucker (1987) and Hollingworth & Pettigrew (1988). The writer (Smith 1989) has recently published a set of palaeogeographical maps depicting Zechstein evolution in north-east England.

A number of papers in the last few years have dealt with aspects of the sedimentology of early Permian rocks in the British Isles but these rocks contain few biostratigraphically useful fossils and can be dated only approximately. An exception is the Whipton Formation of south-west England that forms part of a sequence formerly regarded as early Permian (ie pre-Zechstein) but has yielded palynomorphs indicative of a late Permian (Kazanian to Tatarian) age; this discovery has wide implications on the age of lithologically and stratigraphically similar rocks in a number of other cuvettes in England and Scotland.

Work currently incomplete or in press includes a review of specimens in Sunderland Museum of *Permonautilus cornutus* (Golovkinsky) 1868 from the Zechstein Cycle 1 reef (T. Pettigrew, personal communication September 1990); this form was originally reported from the Kazanian of the USSR. More general works in progress include a comprehensive account of the classic marine Permian strata in the Sunderland area of northeast England, a lengthy review of all the sites of Special Scientific Interest in marine Permian strata in northern England and a contribution to the Geological Society of London's long-awaited Palaeogeographical Atlas of the British isles; this atlas contains 12 maps depicting the Permian evolution of the region, and is to be published early in 1991. Work in progress includes a second edition of the Geological Society's Special Publication No. 5, "A correlation of Permian strata in the British Isles".

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Figure 1 Page 15
Figure 2 Page 16

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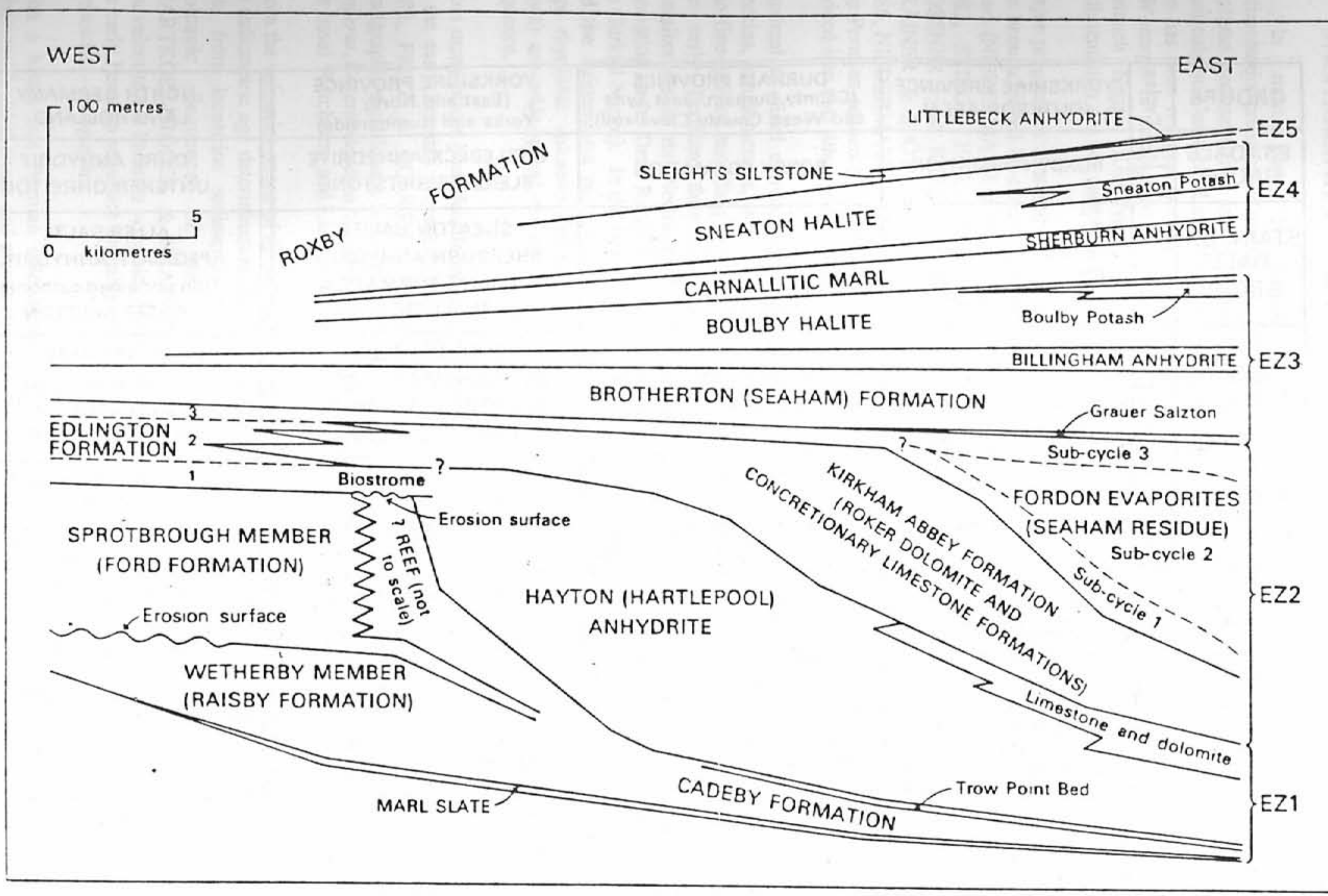

Figure 1. Relationships of late Permian strata in N.E. England; Yorkshire names with Durham names (where different) in brackets. Nomenclature after Smith *et al.* 1986. Reproduced from Smith 1989, fig. 1 by permission of the Yorkshire Geological Society. The cycles correspond approximately to those identified in Zechstein strata in continental Europe but in England do not include non-marine red beds such as the Carnallitic Marl (=Roter Salzton).

GROUPS	Cycles	YORKSHIRE PROVINCE (OUTCROP AREA)	DURHAM PROVINCE (County Durham, east Tyne and Wear, County Cleveland)	YORKSHIRE PROVINCE (East and North Yorks and Humberside)	NORTH GERMANY AND HOLLAND	Cycles
ESKDALE GROUP	EZ5	ROXBY FORMATION	ROXBY FORMATION	LITTLEBECK ANHYDRITE SLEIGHTS SILTSTONE	OHRE ANHYDRIT UNTERER OHRE TON	Z5
STAINTON-DALE GROUP	EZ4	SHERBURN ANHYDRITE UPGANG FORMATION ROTTEN MARL	SHERBURN ANHYDRITE UPGANG FORMATION ROTTEN MARL	SNEATON HALITE SHERBURN ANHYDRITE UPGANG FORMATION CARNALLITIC MARL	ALLER SALZE PEGMATITANHYDRIT Thin unnamed carbonate ROTER SALZTON	Z4
TEESSIDE GROUP	EZ3	BILLINGHAM ANHYDRITE BROTHERTON FM ? ? ?	BOULBY HALITE BILLINGHAM ANHYDRITE SEAHAM FORMATION	BOULBY HALITE BILLINGHAM ANHYDRITE BROTHERTON FORMATION GRAUER SALZTON	LEINE SALZE HAUPTANHYDRIT PLATTENDOLOMIT GRAUER SALZTON	Z3
AISLABY GROUP	EZ2	EDLINGTON FORMATION	SEAHAM RESIDUE ROKER DOLOMITE AND CONCRETIONARY LIMESTONE	FORDON EVAPORITES KIRKHAM ABBEY FORMATION	STASSFURT SALZE & BASALANHYDRIT HAUPTDOLOMIT AND EQUIVALENTS	Z2
DON GROUP	EZ1 b EZ1 a	b Sprotbrough Member, a Wetherby Member } CADEBY FORMATION MARL SLATE	HARTLEPOOL ANHYDRITE FORD FORMATION RAISBY FORMATION MARL SLATE	HAYTON ANHYDRITE CADEBY FORMATION MARL SLATE	WERRAANHYDRIT ZECHSTEINKALK KUPFERSCHIEFER	Z1
		BASAL PERMIAN (YELLOW) SANDS AND BRECCIAS	YELLOW (BASAL PERMIAN) SANDS AND BRECCIAS	BASAL PERMIAN SANDS AND BRECCIAS	ROTLIEGENDES	

Figure 2. Classification and correlation of Permian lithostratigraphical units in N.E. England, North Germany and Holland; nomenclature after Smith *et al.* 1986.

8. PERMIAN AND EARLY TRIASSIC STRATIGRAPHY OF THE EASTERN ALPS

In most parts of Europe post-Variscan sedimentation commenced during the Late Carboniferous. Molasse sedimentation in the Eastern Alps (Upper Austroalpine Units) of ?Late Westphalian to Stephanian age has been reported only from a few places (at the NW-margin of the Gurktal Nappe, KRAINER 1989a,b; Steinach Nappe, KRAINER 1989c), whereas bulk sedimentation did not start before the earliest Permian.

Major progress in stratigraphy and depositional history has been achieved by extensive investigations in recent years (NIEDERMAYR & SCHERIAU-NIEDERMAYR 1982, STINGL 1983, 1984, 1987, MOSTLER & ROSSNER 1984, KRAINER 1985, 1987a,b, 1989d,e, KRAINER & SPÖTL 1989, KRAINER & STINGL 1986, NIEDERMAYR 1985, POSCHER 1985).
The Permian sequence, which rarely contains fossils, is divided into two lithostratigraphic units.

Proximal to distal alluvial fan sediments (red-colored breccias, conglomerates, immature sandstones) grading into fine-grained sandflat-playa complexes characterize the early Permian throughout all tectonic units (Basalbreccia in the Northern Calcareous Alps, Laas Formation in the Drau Range, Werchzirm Formation in the Gurktal Nappe). In the Drau Range, Gurktal Nappe and the westernmost part of the Northern Calcareous Alps rhyolithic volcanics (ignimbrites and pyroclastic flows) are wide-spread on top of this early Permian sequence.

From many places plant fossils are known from the base of the early Permian sequence (Van AMEROM et al. 1982, FRITZ & BOERSMA 1987a,b, 1988). Of stratigraphic significance is the occurrence of *Callipteris conferta*, *Ernestiodendron filiciformae* and *Walchia* sp. in the basal Werchzirm and Laas Formation.

From the volcanics on top of the early Permian sequence no radiometric age determinations exist. Based on new data from lacustrine sediments within the Bolzano Volcanic Sequence of the Southern Alps (HARTKOPF-FRÖDER & KRAINER in prep.), an equivalent to the Permian volcanics of the Eastern Alps, the early Permian sequence probably reaches up to Late Artinskian - Kungurian.

With a hiatus late Permian siliciclastic sediments of ephemeral braided rivers and playas (typical "red beds" termed Gröden Formation) overlie early Permian intramontane basin fillings and mark a sudden and significant change in sedimentation.

In the central and eastern realm of the Northern Calcareous Alps a few hundred metres of halite-bearing marine evaporites were laid down in an approximately E-W-trending late Permian rift, now represented by a strongly deformed decollement horizon at the base of the Northern Calcareous Alps (SPÖTL 1988). Stratigraphical and paleoenvironmental data (S-isotopes of sulphate minerals, bromide content in halites, pollen and spores, as well as scarce marine bivalves) unequivocally support a marine origin for these late Permian evaporites ("Alpine Haselgebirge") (SPÖTL 1989).

In the southern part of the Eastern Alps (Drau Range, Gurktal Nappe) fluvial to shallow marine sedimentation prevailed during the Scythian. The transition between late Permian (Gröden Formation) and Scythian (Alpine Buntsandstein Formation) is documented by an abrupt change in the depositional environment and composition of the deposits, caused by a climatic shift, presumably corresponding to the Permian/Triassic boundary (BRANDNER *et al.* 1986, KRAINER 1987b).

Based on transgressional and regressional events the Scythian sequence of the Drau Range can be subdivided into three megasequences (Lower and Upper Alpine Buntsandstein Formation, Werfen Formation), which can be event-correlated with the fossiliferous marine South Alpine Tethys stratigraphy (KRAINER 1987b).

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RECENT PUBLICATION:

KRAINER, K. (1989):
Composition and evolution of Lower Permian molasse sediments (Ponte Gardena Conglomerate) at the base of the Bolzano Volcanic Complex, Southern Alps (N Italy). - N. Jb. Geol. Paläont. Mh., 1989 (7): 400-424, Stuttgart.

ABSTRACT:

The Ponte Gardena Conglomerate (Lower Permian) of the Dolomites (Southern Alps, N Italy), cropping out between the overlying Bolzano Volcanic Complex and the underlying low-grade metamorphic basement, represents coarse-grained alluvial fan sediments deposited under semiarid climatic conditions. Different composition of the Ponte Gardena Conglomerate at the type locality (Ponte Gardena) and in the Valle di Fersa (Valsugana) suggests different age and strong block faulting during Early Permian. At the type locality the sediments are composed of fragments which are all derived from the underlying basement, only in the uppermost part small amounts of volcanic rock fragments occur. In the Valle di Fersa (Cima di Mezzodi section) volcanic rock fragments, esp. rhyolithic types, volcanic quartz and feldspars are frequently found within the whole section (esp. in sandstones and in the sandy matrix of the conglomerates), indicating that deposition took place after the first volcanic eruptions. In the sediments two types of detrital feldspars occur: alkalifeldspars of metamorphic origin and albites derived from intermediate to rhyolithic volcanic rocks of the Bolzano Volcanic Complex. Albites originated during albitization of plagioclases and alkalifeldspars in the volcanic rocks. The difference in composition of the sediments is also reflected in the different heavy mineral spectra of the two studied sections. The sediments (molasse sediments) formed in intermontane basins which developed by block faulting as a result of crustal thinning.

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9. PALEONTOLOGICAL DATA FROM THE BOLZANO VOLCANIC COMPLEX, SOUTHERN ALPS (NORTHERN ITALY)

Within the Bolzano Volcanic Complex of the Southern Alps (Northern Italy) fluvial and lacustrine sediments occur in different horizons. The sediments, marking stillstands in volcanic activity, were deposited in small basins which formed by block faulting.

Radiometric age determinations on biotite from rhyodacitic and rhyolithic ignimbrites showed ages around 270 m.y. (D'AMICO 1986).

In lacustrine sediments from the upper part of the Bolzano Volcanic Complex NW of Bolzano (between unit B and C sensu BRANDNER & MOSTLER 1982) a rich palynomorph assemblage was found. The palynomorphs are very well preserved within thin silica layers, which were precipitated from the alkaline lake waters.

The assemblage is characterized by bisaccate - taeniate, bisaccate non-taeniate and monosaccate palynomorphs and species of the genus *Vittatina*. Subordinate are trilete and monolete palynomorphs. Of stratigraphic significance are multi-taeniate elements and species of the genus *Lueckisporites* and *Potonieisporites*. The assemblage indicates a Late Artinskian to Kungurian age and is under investigation. A detailed description of the sediments and palynomorph assemblage is in preparation.

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10. MEETING OF ASSOCIATION DES GEOLOGUES DU PERMIEN.

A meeting of the Geologists' Association of the Permian is scheduled for 5-8th July 1991. There will be a field trip (5-7th July) to Permian sections in Burgundy (Eastern France), followed by a Round Table discussion on 8th July concerning the Autunian stratotype. Anyone wishing for further information should contact Dr. Georges Gand, Université de Bourgogne, Centre des Sciences de la Terre, 6 Boulevard Gabriel, 2110 Dijon - France.

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