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SPORE CORRELATIONS BETWEEN THE RHENISH SLATE MOUNTAINS AND THE RUSSIAN PLATFORM NEAR THE DEVONIAN-CARBONIFEROUS BOUNDARY

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(1 figure, 2 tables, 2 plates)

INTRODUCTION

Spore correlations between USSR and Western Europe are diffucult for two reasons. Firstly the palynological taxonomy has arised separately in both regions which has involved misinterpretation and duplication of species names. Secondly, the zonal concept used for correlation may also be different. This is well exampli-fied at the Devonian-Carboniferous boundary where the Soviet palynologists use assemblage zones charac-terized by dominant species (*vide H. lepidophytus/ H. pusillites/L. malevkensis* Zones *in* BYVSHEVA, 1976, 1978) whereas western palynologists use inter-val zones characterized by first (or last) occurrences of selected species (*vide* LL/LE/LN/VI Zones *in* HIGGS & STREEL, 1984).

We want to propose here a correlation between the Rhenish Slate Mountains in West Germany and the eastern part of the Russian platform in Udmurtia. The palynological details of these sections, which re-present "basinal" facies, are published elsewhere (BYVSHEVA, 1976, 1978*; HIGGS & STREEL, 1984) and need not be completely repeated here. We just want to emphasize briefly how the different systematic and zonal systems might be reconciled if more contacts between scientists from both regions could be achieved.

SPORE CORRELATION

VAN VEEN (1981) was the first to attempt lateral correlation between BYVSHEVA' results from Udmurtia and his own work in Western Europe, i.e. in Southwest Ireland. He used the sudden prominence of laevigate and murornate forms *(? Dictyotriletes trivialis)* as well as of *Tumulispora* spp., to support a correlation between the abrupt transition of Byvsheva's *pusillites* Zone/ *malevkensis* Zone and his own LN/LCr transition. Such a correlation is an example of a major quantitative change which might be correlated between both regions despite the fact that the dominant species of the respec-tive assemblages are not all the same.

In the present paper, a different approach has been adopted. We have attempted to identify the western interval zones in the Russian platform material. For this purpose, 4 samples have been selected, 3 from the Udmurtia boreholes and 1 from the Malevka type region.

The samples from Udmurtia were chosen for their key stratigraphical positions in the sequence studied by BYVSHEVA (1978). Sample 17460/22 from borehole 292 is the first level carrying a *V. pusillites* assemblage while sample 20075/5 from borehole 277 is one of the highest levels obtained which carries the succeeding *T. malevkensis* assemblage. Sample 17849/2 from bore-hole 290 represents a typical *V. pusillites* assemblage of the ml_0 type (with co-abundance of *R. lepidophyta, V. pusillites*, etc. . . See BYVSHEVA 1976).

Sample 132 comes from the type Malevka horizon taken in the central part of the Russian platform near the city of Tula (Glubokovskaya K1 (124957) borehole, interval 123. 1 - 125.9 m). A fauna carrying the conodont *Siphonodella semichatova* was found at 116 m, 10 metres above this sample.

The western authors of the present paper (K.H. & M.S.) have carefully examined slides made out of these sam-ples in order to recognize as many species as possible which are also known in Western Europe**. The most appropriate correlation can be made with two sections of the Rhenish Slate Mountains : Riescheid and Hassel-bachtal where faunal data are available.

* *If T.V. BYVSHEVA has formely used the Naumova classifi-cation of miospores, she presently prefers to use the western palynologists' classification.*

** *The authors thank very much G. CLAYTON (Dublin, Ireland) and G. PLAYFORD (Brisbane, Australia) for their advice on part of the material here revised.*

Table 1. Common species between spore assemblages of the Rhenish Slate Mountains and the Russian Platform at the Devonian-Carboniferous.

SECTIONS and SAMPLES	RHENISH SLATE MOUNTAINS															RUSS. PLAT.			
	HASSELBACHTAL										REISCHEID					TULA	UDMURTIA		
	VI					LN				LE	LE		LL			VI	LN		LE
																ml2		mlo	
MIOSPORE TAXA	Hb 10	Hb 11-13	Hb 9	Hb 14-15	Hb 15-17	Hb 18-19	Hb 22-23	Hb 7	Hb 5	Hb 1	Rh 6-7	Rh 10	Rh 12-13	Rh 13	Rh 15	132	5	2	22
Archaeozonotriletes minutus																	x	x	x
Convolutispora oppressa			x		x	x				x		x	x	x	x	x	x		
C. vermiformis			x			x	x	x	x		x							x	x
Cyrtospora cristifer, fig. 8	x		x	x	x	x		x	x						x	x		x	x
Dictyotriletes submarginatus					x		x									x		x	
D. trivialis													x				x	x	
Diducites plicabilis	x	x	x	x			x	x					x				x		
D. poljessicus			x	x			x	x	x				x	x	x				x
Discernisporites micromanifestus						x	x	x				x		x	x	x			
Endosporites admirandus		x		x			x										x		
Grandispora echinata, fig. 14														x	x			x	
Hymenozonotriletes explanatus, fig.13			x			x	x	x		x	x				x		x	x	x
Knoxisporites literatus			x			x	x	x		x	x	x					x	x	x
Lophozonotriletes excisus, fig. 10	x		x		x			x	x				x			x	x	x	x
L. triangulatus				x			x						x			x	x	x	x
Pulvinispora scolecophora		x	x		x		x		x	x	x					x			
Punctatisporites irrasus							x	x								x			
P. minutus															x	x	x		x
P. plamus			x			x	x	x	x			x			x		x		
Pustulatisporites sp. A (Higgs 1975) fig.3					x	x	x		x							x	x	x	
Retispora lepidophyta, fig. 15-16			x		x	x	x	x	x		x				x		x	x	x
Retusotriletes crassus						x	x	x	x		x	x	x	x	x		x		
R. famenensis			x				x	x											x
R. incohatus						x											x		x
R. minor	x	x	x	x	x	x	x	x	x			x	x	x	x	x	x		
Rugospora flexuosa, fig. 7						x	x											x	x
Spelaeotriletes crustatus					x	x	x		x		x	x			x				x
S. obtusus																		x	x
Spinozonotriletes uncatus						x	x									x	x		
Umbonatisporites abstrusus, fig.4-5						x		x							x		x		x
Vallatisporites pusillites, fig.18-20						x		x								x		x	x
V. vallatus, fig. 17			x		x		x	x	x		x	x		x	x	x	x	x	x
Velamisporites magnus			x				x	x								x	x		
Velamisporites perinatus							x										x		x
Verrucosisporites nitidus, fig. 1-2			x	x	x	x	x	x	x					x	x		x	x	

The proposed correlation between both regions is demonstrated on Figure 1. Table 1 shows the list of species common to both regions and is given in the western nomenclature. In addition to the species present in the two sections of the Rhenish Slate Mountains, there are a few others known from elsewhere in Western Europe which have been recognized in the Russian platform material. They are also considered in the systematic comments.

SYSTEMATIC COMMENTS

In the following section the authors have focused their attention on specific identity, disregarding for the time being, the generic status of the taxa.

- **Asperispora acuta** (KEDO) VAN DER ZWAN 1980. This species possesses prominent bulbous based spinae and galeae. Mistakenly, several Western European palynologists e.g. DOLBY & NEVES 1970, HIGGS 1975 and VAN DER ZWAN & VAN VEEN (1978) have assigned much smaller and more delicately ornamented forms to this taxon.
- **Concentricisporites concentricus** BYVSHEVA 1976. This is probably what KEEGAN (1977) referred to as *Lophozonotriletes* sp. HIGGS (Irish range LE-VI).
- **Dictyotriletes glumaceus** BYVSHEVA 1972 is very close to *D. fimbriatus* (WINSLOW) KAISER 1970 which ranges grom LL to VI in western Europe.
- **Lophozonotriletes triangulatus** (ISCHENKO) HUGHES & PLAYFORD, 1961 is used by PLAYFORD (1976) for cingulate and verrucate (rounded shaped) spores, to combine *L. rarituberculatus* (LUBER) KEDO 1957 (a latter homonym of *L. rarituberculatus* NAUMOVA 1953 which is a different species), and *L. malevkensis* (NAUM. *in* LITT.) KEDO 1963. BYVSHEVA now used the genus *Tumulispora* STAPLIN & JANSONIUS 1964 and continues to distinguish between *T. rarituberculata* (LUBER) POTONIÉ 1966 and *T. malevkensis* (NAUMOVA) TURNAU 1978.
- **Lophozonotriletes variverrucatus** PLAYFORD 1962 (transferred to *Tumulispora* by STAPLIN & JANSONIUS 1964), is distinguished from *L. triangulatus* by possessing smaller more numerous verrucae and the wedge shaped nature of the zona. It is very similar to *Archaeozonotriletes malevkensis* KEDO, 1963 on which it has priority.
- **Rugospora flexuosa** (JUSCHKO) STREEL *in* BECKER *et al.*, 1974 is obiously synonymous with *Trachytriletes radiatus* (JUSCHKO) KEDO 1974 (*in* BYVSHEVA 1976, 1978). The comparisons of Pl. 1, fig. 4 and Pl. 2, fig. 26 *in* JUSCHKO (1960) of *Trachytriletes flexuosus* and *Camptotriletes radiatus* suggest the second name to be more appropriate. Pending a reexamination of the type material, a new combination in the genus *Rugospora* is not attempted here.
- **Spelaeotriletes crustatus** HIGGS 1975 is characterized by dense granulate ornamentation and is probably similar to *Spelaeotriletes microgranulatus* BYVSHEVA 1976.
- **Verrucosisporites nitidus** PLAYFORD, 1964. This species has dense verrucae and thus a well developed negative reticulum. *Lophotriletes mesogrumosus* KEDO 1963 which is present in some of the Russian samples has more widely spaced verrucae which are of variable size, shape and distribution on each specimen.
- **Vallatisporites vallatus** HACQUEBARD 1957 is obviously synonymous (at least in part) with *Hymenozonotriletes pusillites* KEDO 1957. However, the Russian morphological concept of *H. pusillites* is broad and Western palynologists have differentiated a smaller ornamented form *Vallatisporites vallatus* and a coarser spinose form *V. pusillites* (KEDO) *sensu* DOLBY & NEVES 1970 or *Cirratriradites hystricosus* WINSLOW *sensu* STREEL & TRAVERSE 1978. The arbitrary biometric limit of 2 mμ between these forms is used here on Table 1. The authors note that the specimens assigned to *V. pusillites* from the Russian platform are generally less coarsely and densely ornamented than those recorded from the Rhenish Slate Mountains.

STRATIGRAPHIC RESULTS

Sample 17460/22 contains the association of *R. lepidophyta* and *H. explanatus* but lacks *V. nitidus.* It therefore correlates with the LE Zone.

Sample 17849/2 and 20075/5 contain *V. nitidus. R. lepidophyta* is abundant in 17849/2 but rare in 20075/5. Both samples correspond to the LN Zone. The rarity of *R. lepidophyta* is characteristic of the upper part of the LN Zone in Western Europe, which more or less coincides with the LCr Zone of VAN VEEN (1981).

Sample 132 does not contain *R. lepidophyta* but is characterised by numerous specimens of *Lophozonotriletes* and *Convolutispora.* In these respects it compares well with the VI Zone.

All the species which are common to both regions (Table 1) do not invalid these correlations.

To clarify and improve the correlation with the western zonation we propose to subdivide the *T. malevkensis* Assemblage Zone of the Russian platform into two Subzones; a lower subzone **with rare** *R. lepidophyta* and an upper subzone **without** *R. lepidophyta* (Table 2).

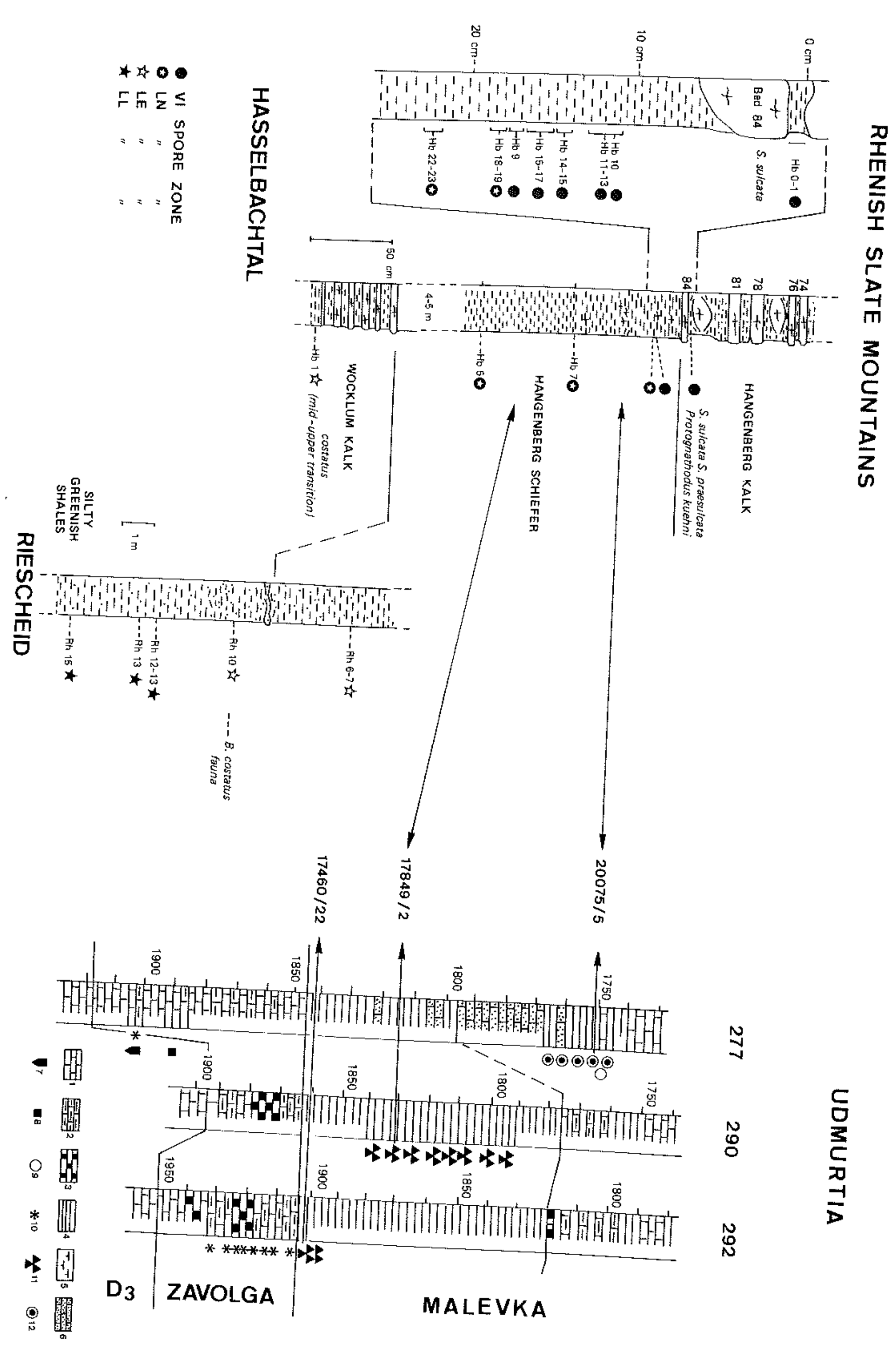

Fig. 1. Biostratigraphical comparison at the Devonian-Carboniferous boundary between several Rhenish Slate Mountains (FRG) and Udmurtia (USSR) sections.
1. limestone, 2. muddy limestone, 3. bituminous limestone, 4. mudstone, 5. carbonaceous mudstone, 6. sandstone, 7. *Quasiendothyra* ex. gr. *communis*, 8. *Q. konensis, Q. communis*, 9. *Parathurammina cushmani, Bisphaera malevkensis, B. irregularis, Vicinesphaera squalida, V. angulata, Archaesphaera minima*, 10. *R. lepidophyta* ass., 11. *V. pusillites* (ml_0)ass., 12. *T. malevkensis* ass.

Table 2. Correlation between russian platform assemblage Zones and Subzones and Rhenish Slate Mountains interval Zones.

Assemblage Zones	Assemblage Subzones	Interval Zones	Age
T. malevkensis ml_2	without *R. lepidophyta*	VI	CARB.
	with rare *R. lepidophyta*	LN	----* DEVONIAN
V. pusillites	ml_0 with *H. explanatus* and *R. lepidophyta*	LE	
R. lepidophyta	*R. lepidophyta tener*	LL	

* approximate position of the base of *Siphonodella sulcata* in the Rhenish Slate Mountains.

The occurrence of *V. nitidus* is rather rare in the Russian platform and is therefore somewhat difficult to use for zonal purposes particularly as it remains a minor element within the *V. pusillites* (ml_0) assemblage. The exact stratigraphical position of the *V. pusillites* assemblage with rare *R. lepidophyta* (ml_1), well known from the western part of the Russian platform in Bielorussia, has yet to be demonstrated in Udmurtia. If the *R. lepidophyta* assemblage and the *V. pusillites* (ml_0) assemblage are found directly in succession in Udmurtia, the younger subzones of the *T. malevkensis* zone are not. Therefore a continuous registration of spores from the *V. pusillites* assemblage to the *T. malevkensis* assemblage has still to be found in the Russian platform.

It is striking to denote on Figure 1 the close similarity of the lithostratigraphy in both regions. The sudden change in lithology between the Zavolga limestone beds and the Malevka shaly beds in Udmurtia coincides almost exactly with a similar change between the Wocklum Kalk and the Hangenberg Schiefer in the Rhenish Slate Mountains. The more sandy facies in the upper part of the Malevka shaly beds (borehole 277) matches a similar situation in several sections, in the upper part of the Hangenberg Schiefer. The retourn of the limy facies in the uppermost part of both sequences might also be more or less contemporaneous.

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SPORE CORRELATIONS BETWEEN THE RHENISH SLATE MOUNTAINS AND THE RUSSIAN PLATFORM NEAR THE DEVONIAN-CARBONIFEROUS BOUNDARY

ABSTRACT

An attempt is made to correlate the Devonian-Carboniferous transitional beds of the Rhenish Slate Mountains and the Russian Platform by mean of miospores, although different zonal concepts are used in both regions.

The *T. malevkensis* assemblage Zone of the Russian Platform is subdivided into two subzones, the lower one corresponding to the uppermost part of the *lepidophytus-nitidus* Zone, the upper one to the *verrucosus-incohatus* Zone.

Systematic comments are made.

PLATE 1

All figured specimens X 1000, unless stated otherwise

Fig. 1-2. *Verrucosisporites nitidus* PLAYFORD, Udmurtia, Malevka hor., bor. 277, 20075/5.

Fig. 3. *Pustulatisporites* sp. A (HIGGS 1975) Tula, Malevka hor., Glubokovskaya K-1 bor., 132.

Fig. 4-5. *Dibolisporites abstrusus* (PLAYFORD) PLAYFORD 1976, Udmurtia, Malevka hor., bor. 277, 20075/5; 5 : detail, X 2000.

Fig. 6. *Dictyotriletes glumaceus* BYVSHEVA, Udmurtia, Malevka hor., bor. 277, 20075/5.

Fig. 7. *Rugospora flexuosa* (JUSCHKO) STREEL, Udmurtia, Malevka hor., bor. 290, 17849/2.

Fig. 8. *Cyrtospora cristifer* (LUBER) VAN DER ZWAN, Udmurtia, Malevka hor., bor. 290, 17849/2.

Fig. 9. *Concentricisporites concentricus* BYVSHEVA, Udmurtia, Malevka hor., bor. 277, 20075/5.

Fig. 10. *Lophozonotriletes excisus* NAUMOVA, Udmurtia, Malevka hor., bor. 277, 20075/5.

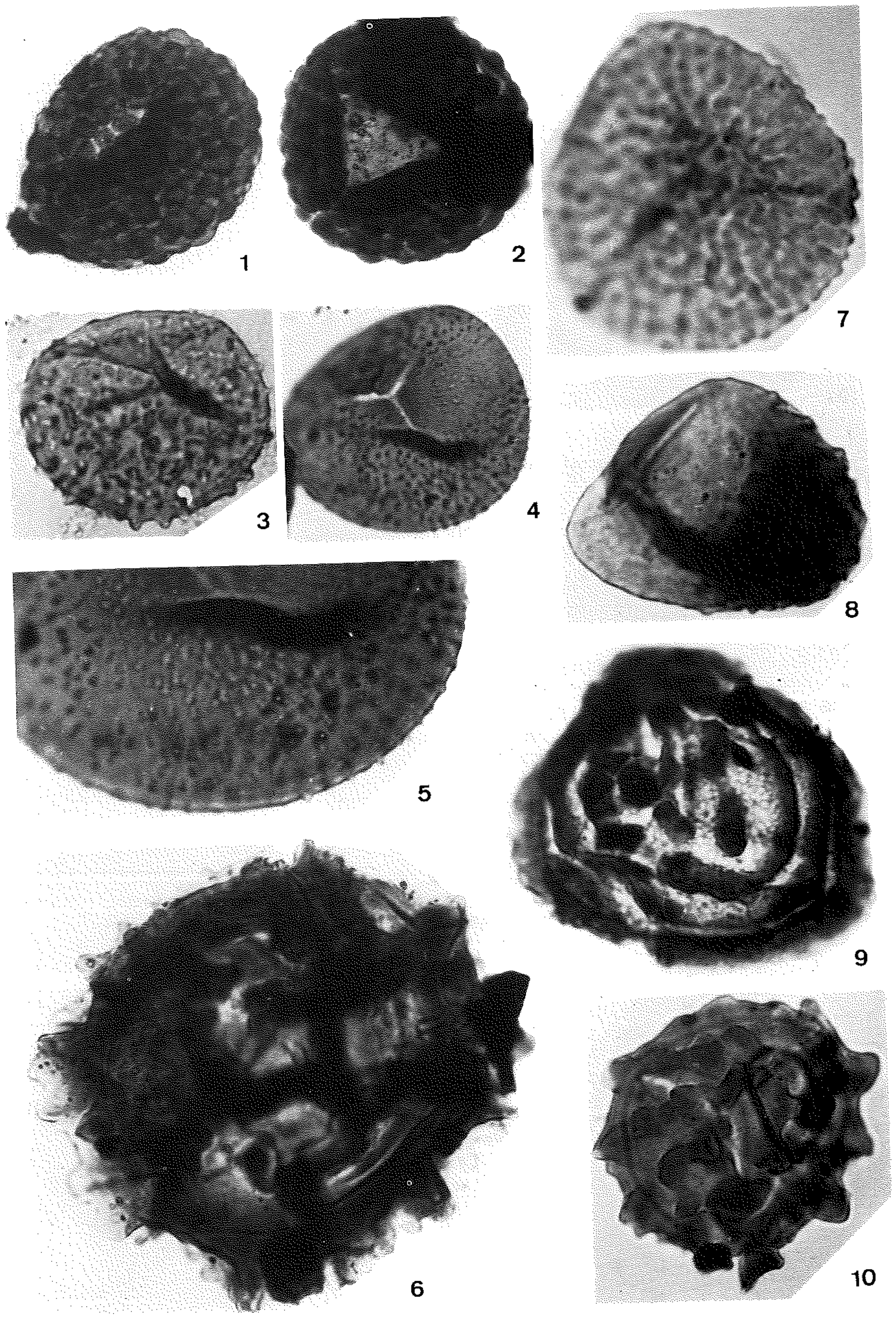

PLATE 2

All figured specimens X 1000, unless stated otherwise

Fig. 11-12. *Lophozonotriletes variverrucatus* PLAYFORD, Tula, Malevka hor., Glubokovskaya K-1 bor., 132.
12. transitional form to *L. triangulatus* (ISHCHENKO) HUGHES & PLAYFORD; it is called *T. malevkensis* (NAUMOVA) TURNAU by T.V. BYVSHEVA.

Fig. 13. *Hymenozonotriletes explanatus* (LUBER) KEDO, Udmurtia, Malevka hor., bor. 290, 17849/2.

Fig. 14. *Grandispora echinata* HACQUEBARD, Udmurtia, Malevka hor., bor. 290, 17849/2.

Fig. 15-16. *Retispora lepidophyta* (KEDO) PLAYFORD,
15. Udmurtia, Malevka hor., bor. 290, 17849/2.
16. Udmurtia, Malevka hor., bor. 277,2007515.

Fig. 18-20. *Vallatisporites pusillites* (KEDO) DOLBY & NEVES,
18. Tula, Malevka hor., Glubokovskaya K-1 bor., 132.
19. Udmurtia, Malevka hor., bor. 292, 17460/22.
20. detail, x 2000.

Fig. 21. *Asperispora acuta* (KEDO) VAN DER ZWAN, Udmurtia, Malevka hor., bor. 277, 20075/5.