

NOTES ON THE SEDIMENTOLOGY AND PALEOBOTANY OF THE
WERFENER SCHICHTEN IN THE WESTERN GAILTALER ALPS
NEAR KÖTSCHACH (CARINTHIA, AUSTRIA).

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ZUSAMMENFASSUNG

Erstmalig werden bestimmbare Pflanzenreste in tonig-siltigen Lagen an der Basis der Werfener Schichten des Drauzuges aus der Umgebung von Laas bei Kötschach, Kärnten, beschrieben. *Pleuromeia* cf. *sternbergii* (Muenster) Corda, *Voltzia* sp., "Wurzelreste", "Samen" und etliche nicht näher identifizierbare Blattfragmente wurden gefunden. Die pflanzenführenden Lagen sind einer rot- und graugefärbten, überwiegend grobklastischen Serie eingeschaltet und geben damit wichtige Hinweise auf die lithologische Entwicklung der Trias-Basis-schichten im westlichen Drauzug.

SUMMARY

During fieldwork near Kötschach in Carinthia (Austria) in the summer of 1975 plant remains in the "Werfener Schichten" (Trias) were discovered for the first time. *Pleuromeia* cf. *sternbergii* (Muenster) Corda, *Voltzia* sp., "roots", "seeds" and some leaf fragments of uncertain identity could be recognized. The plant-bearing beds are situated in between a series of red and gray coloured, mainly coarse-grained clastics, from which important indications could be obtained on the lithological development of the triassic basal layers in the western Drauzug.

INTRODUCTION:

During field work in the summer of 1975 some plant remains have been found by Dr. Elisabeth Scheriau-Niedermayr (Wien) in slates and siltstones belonging to the lower part of the Werfener Schichten. They have been collected for further investigation. The locality is situated at an altitude of 1050 m along a forest road from the hospital of Laas to Jukbühel, under construction in the last year.

Along this road (fig. 1) the lower parts of the Werfener Schichten became exposed.

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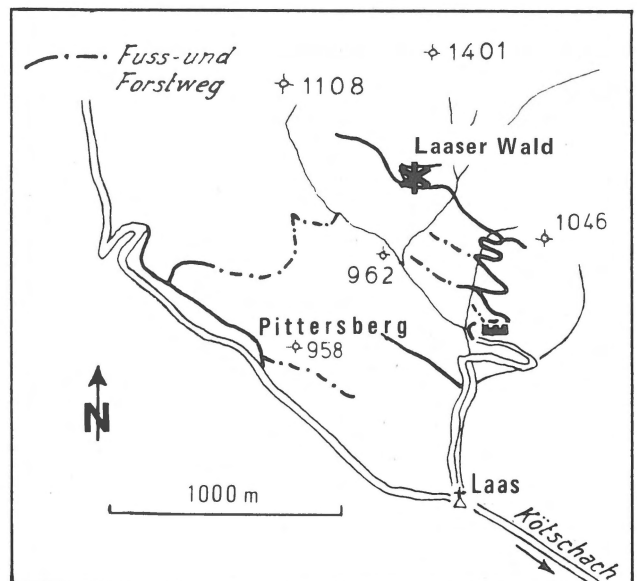
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THE SEDIMENTS

The sequence considered here consists mainly of more or less coarse grained, light red coloured sandstones, partly rich in pebbles; cross bedding is abundant (fig. 2). Subordinate are layers of fine grained sandstones, siltstones and thin slate beds. Characteristic for this part of the section, - and this can be observed also in other places of the western Gailtaler Alps, - is a thick layer of quartzconglomerate of about 8 m, consisting of at least 95% of angular and subangular quartz pebbles. The rest consists of quartzite and gneiss pebbles. Pebbles of quartz porphyry (which are very common in the underlying "Permoskythsandstones") are conspicuously absent. The slates and siltstones which contain the plant remains are situated about 40 m above this conglomerate.

Fig. 1

Localities of plant remains from the "Werfener Schichten" situated to the north of Laas, indicated with an asterisk.



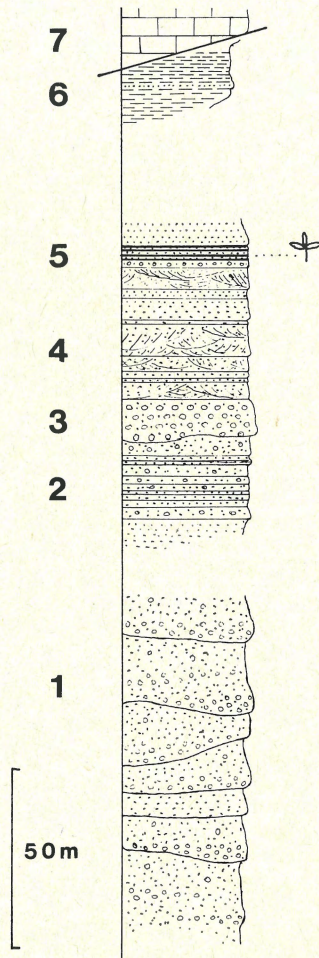


Fig. 2
Diagrammatical section of the succession of permo-skythian layers along the forest road from the hospital at Laas to Jukbühel.

1- "Permo-skythian sandstone": series of red sandstones with many pebbles and conglomeratic layers, 2 - light red to pink coloured, thick banded sand- and siltstones and conglomerates, 3 - quartz conglomerate, 4 - light pink coloured sandstones and fine grained conglomerate, thin to thick banded, with cross bedding 5 - gray sandstones and siltstones (with plant remains), 6 - thin layers of variegated shales, silt - and sandstones with partly high carbonate ratio, 7 - Alpine "Muschelkalk". variegated shales, silt - and sandstones with partly high carbonate content, 7 - Alpine "Muschelkalk".

The slate layers are thin, maximal 15 cm and are coloured light green to gray green. The more sandy bands contain abundant mica. The slates are intercalated between light red to gray coloured coarse grained clastics.

Unfortunately most of the plant remains are badly preserved and can therefore only partly be identified. The remains described here are stored at the Department of Geology and Palaeontology of the Museum of Natural History in Vienna.

Petrographically the investigated sediments may be described as conglomerates, quartzwackes, lithic arenites, quartzarenites and siltstones. The sorting coefficient of the sand and siltstones amounts to 1.30 to 1.40; the coarser sediments are moderately sorted.

Coarse grained rockfall, laterally changing in thickness, cross bedding and well to moderately rounded components point to a fluviatile sedimentary environment near a coast. The heavy mineral content of these sediments is characterised by the presence of apatite, next to zircon and some rutile and tourmaline (table 1). The apatite content is considered as a significant lithostratigraphic characteristic for the Werfener Schichten of the western part of the "Drauzug" (Niederma yr, 1975). Accessory barite is common in most of the heavy mineral concentrates; it is also represented as late diagenetic mineral in fissures on quartzcrystal crusts, covering the abundant joints in these coarse grained clastics (Niederma yr & Scheriau-Niederma yr, 1974). As can be seen in table 1, the heavy mineral spectra of these sediments are quite different from those of the underlying "permoskythsandstones" which are characterised by nearly pure zircon maxima; the zircon populations of both series can readily be distinguished.

The plant remains

The following plant fossils have been recognized:

Pleuromeia cf. *sternbergii* (Muenster) Corda

Voltzias sp.

"seeds" of *Pleuromeia*???

"seeds" of unknown affinity

some undeterminable leaf fragments

"roots"

Pleuromeia cf. *sternbergii* (Muenster) Corda

Pl. I, figs. 1-4, pl. II, fig. 1; text-figs. 3 and 4

Description:

Two bases of the stem and also some parts of the stem itself have been found. The base of the stem shows the classical fourparted and blunt construction of the rhizom with very short distances between the dichotomies. The surface of the rhizom shows some faintly discernable marks of rootlets. The relatively long and slender rootlets are noticeable in the sediment and are relatively clear on the specimen in text-fig. 3. They are related to the marks at the rhizom.

Text-figs. 3 and 4 show the base of the stem from underneath. This stem was situated perpendicularly to the bedding plane, possibly still in its growing position.

The rootlets are growing obliquely outwards. The rhizom measures diagonally about 4 cm. Except for the H-shaped groove in the centre of the rhizom no more details can be observed.

Discussion:

After M ä g d e f r a u (1931) only three species of *Pleuromeia* are considered to be well established: *P. sternbergii*



Fig. 3

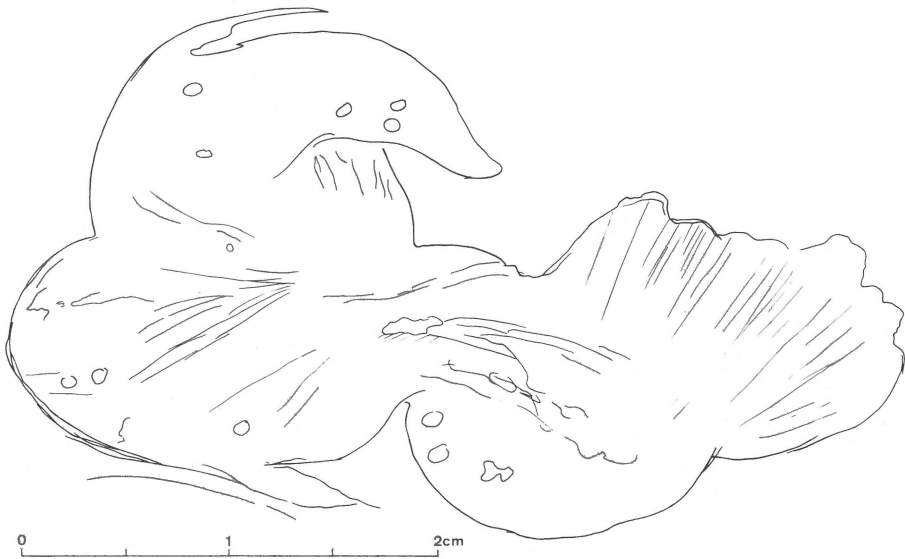


Fig. 4

(Muenster) Corda, *P. oculina* (Blanckenhorn) Potonié and a species from east Siberia, which according to M ä g d e f r a u (1931) is wrongly designated as *P. sternbergii* by K r i s h t o f o v i t c h (1923). In the meantime N e j b u r g (1960) described *P. rossica*.

The greatest base of the stem of *P. sternbergii* known to M ä g d e f r a u (1931) measures diagonally 17 cm. However, he did not mention minimum sizes. Our specimens are half the size mentioned above, but are not different in shape.

Our specimens are larger than those of *P. rossica* figured by N e j b u r g (1960). The sporangia or "seeds" described by Nejb urg (1960) may possibly be compared with the "seeds" shown in text-fig. 7.

On the ground of oecological investigations by K r a s s i l o v & Z a k h a r o v (1975) *Pleuromeia* may be assumed to have been growing near the shore; the xerophytic habitus and the shape of the rhizophores point to an adaptation to a mangrove environment.

This inference based on palaeobotanical observations is in accordance with the conclusion from the previously mentioned results of the sedimentological investigation of the Werfener Schichten. The older assumption that *Pleuromeia* was growing at the margins of drying up pools in a desert is nowadays considered to be very doubtful.

Pleuromeia sternbergii is characteristic of the Buntsandstein.

Voltzia sp.

Pl. II, figs. 3, 5, 8; text-figs. 5 and 6

Description:

Twigs with widely inserted leaves. Leaves needle-shaped, long, often nearly perpendicularly, but always with a wide angle standing away from the axis, pointed and growing on protruding furrows.

Discussion:

S c h ü t z e (1901) mentions a number of *Voltzia* species from the Werfener Schichten of the Trias of the Alps. From the 'Buntsandstein' *Voltzia heterophylla* Brgt. and *V. acutifolia* Brgt. have been described. The last species has been figured only by S c h i m p e r & M o u g e o t (1844). These authors figured a larger axis with secondary twigs with short and broader leaves. The species therefore is rather different from our specimens.

In the meantime a host of new species have been introduced. However, determination of most of these species presents some problems if only a few moderately preserved specimens are available. Particularly it is difficult to distinguish *V. recubariensis* (Massalongo) Schenk from *V. heterophylla* (M ä g d e f r a u, 1956). The more outward bending leaves of our specimens suggest a relationship with *V. heterophylla*.

Voltzia hungarica Heer, mentioned by H e r i t s c h (1939) from the Grödener Schichten has broader and shorter

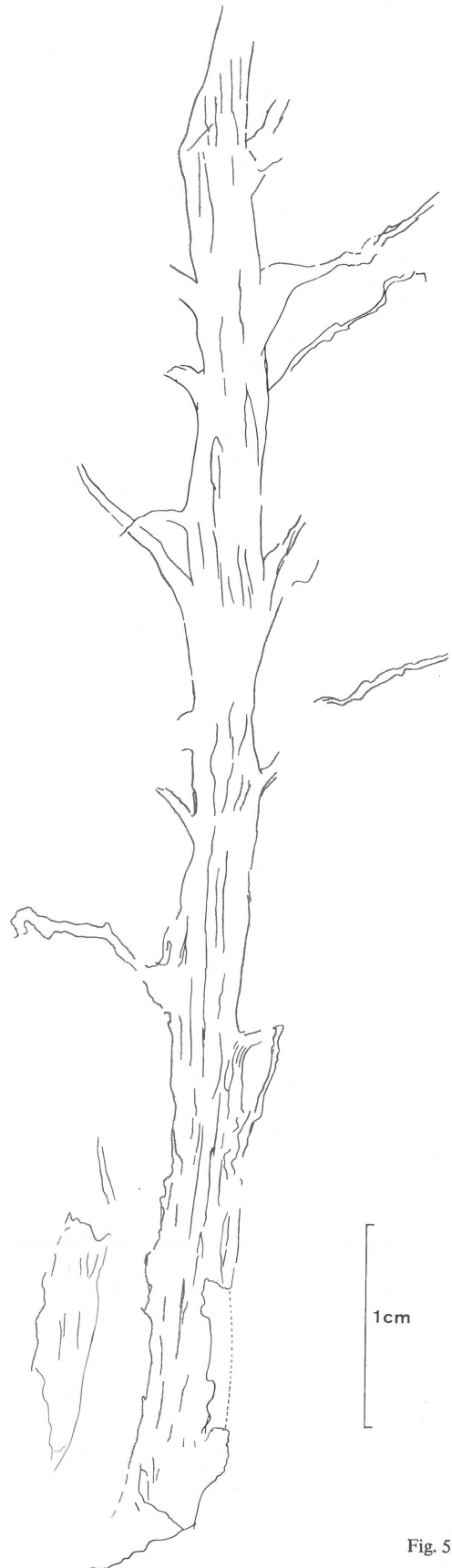


Fig. 5



Fig. 6

leaves and is not heterophyllous. This species on its turn is difficult to distinguish from *V. boeckhiana* Heer (cf. Tuzson, 1909), of which the twigs may be slightly smaller.

Although, on the basis of the material obtained an accurate determination is impossible, similar fragments from the 'Buntsandstein' mostly are determined as *Voltzia heterophylla*.

Fliche (1910) assumes that *Voltzia heterophylla* occurs in the Lower and Middle Trias but according to Felix (1924) this fossils is typical for the Upper 'Buntsandstein'.

"Seeds"

Pl. II, figs. 2, 5a.; text-figs. 7 and 8

Discussion:

The "seeds" (or sporangia) shown in text-fig. 7 are ellip-

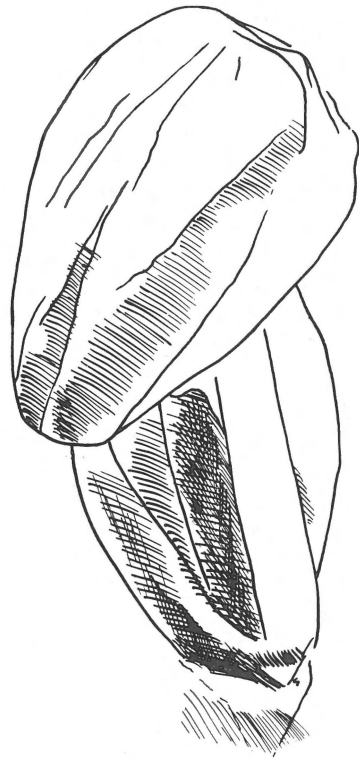


Fig. 7

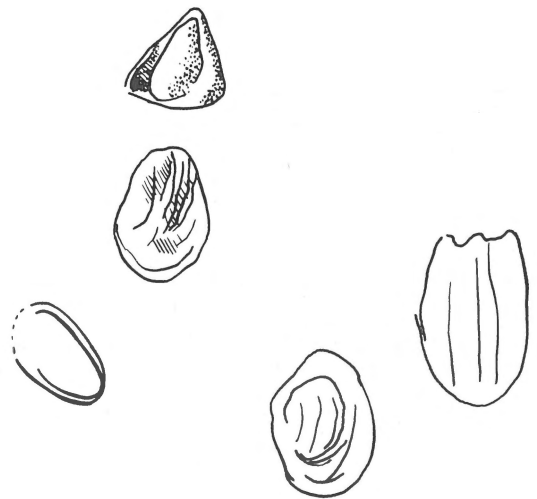


Fig. 8

tical organs of a simple shape. Except for some longitudinal folds or ribs nothing typical can be noticed. A certain resemblance exists with the "seeds" of *Pleuromeia rossica*, figured by Nejbürg (1960, figs. 3 and 8).

The "seeds" shown in text-fig. 8 are small. It is not known to what kind of plant they belong.

"Roots"

Pl. II, fig. 4; text-figs. 9a and 9b

Discussion:

Text-fig. 9a shows one of the two long, thin, slightly sinuously somewhat longitudinally striated axes, that have been found. Alternating on both sides of the axis are small secondary axes branching of nearly perpendicularly.

The axis is determined as a root fragment.

Text-fig. 9b (Pl. II, fig. 4a) shows bifurcating axes of smaller dimensions. The branching system is apparently not strictly dichotomous.

These axes also are interpreted as root remains.

ACKNOWLEDGMENTS

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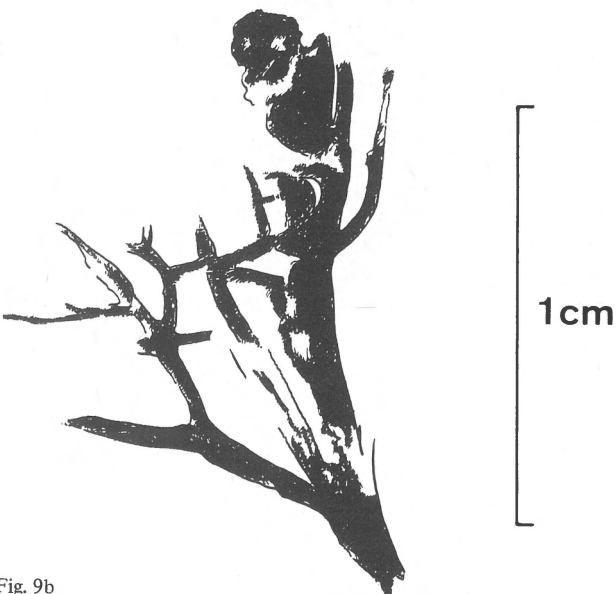


Fig. 9b

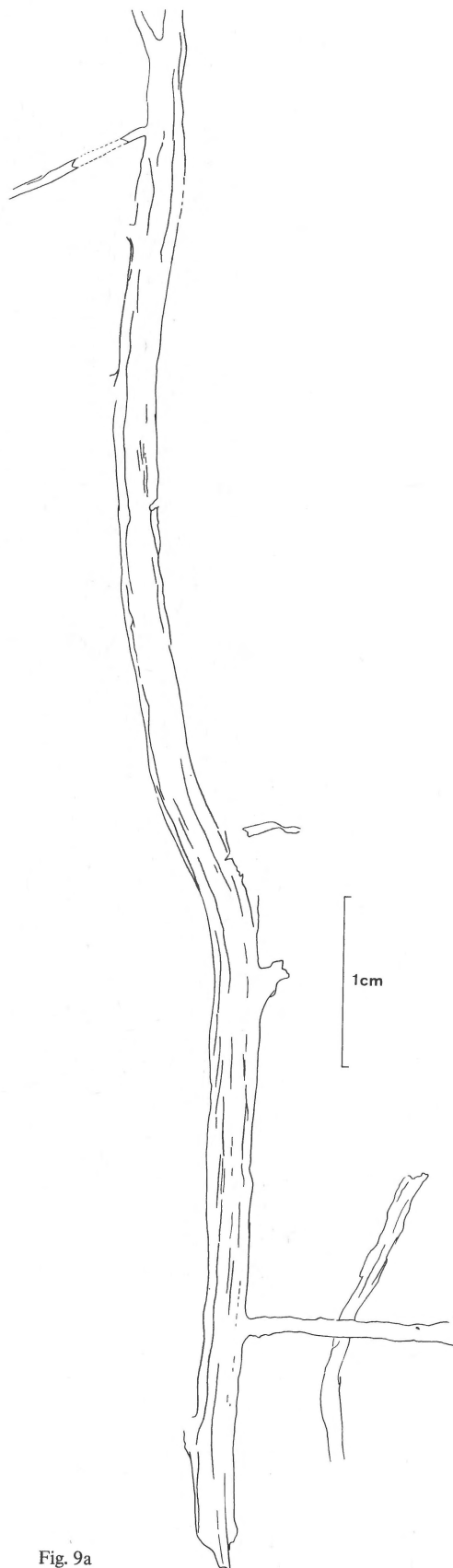


Fig. 9a

EXPLANATION OF PLATES

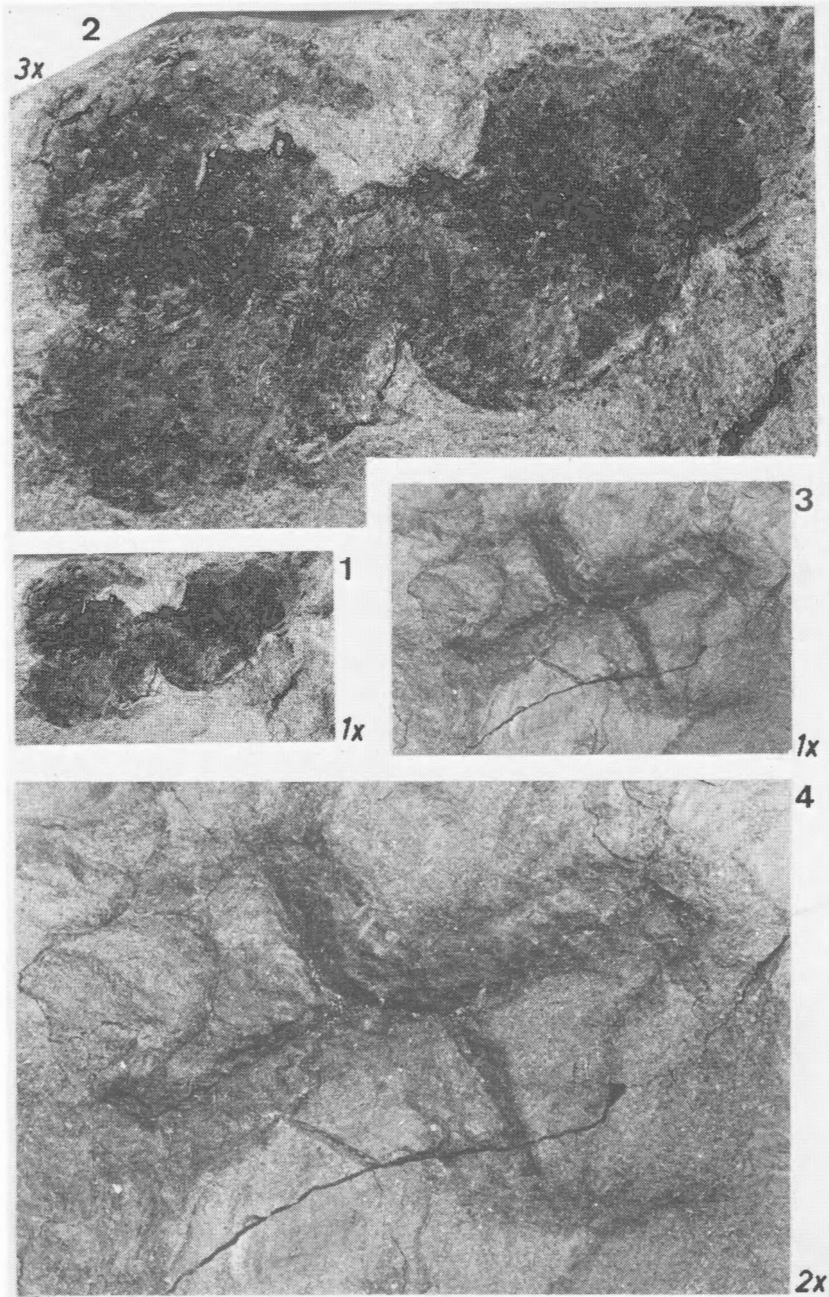


Fig. 1, 3
Pleuromeia cf. *sternbergii* (Muenster) Corda Base of rhizome. 1 X
 Photo Willemsen: 66257/9; 856/10

Fig. 2
Pleuromeia cf. *sternbergii* (Muenster) Corda
 As for fig. 1, 3 X

Fig. 4
Pleuromeia cf. *sternbergii* (Muenster) Corda
 As for fig. 3, 2 X

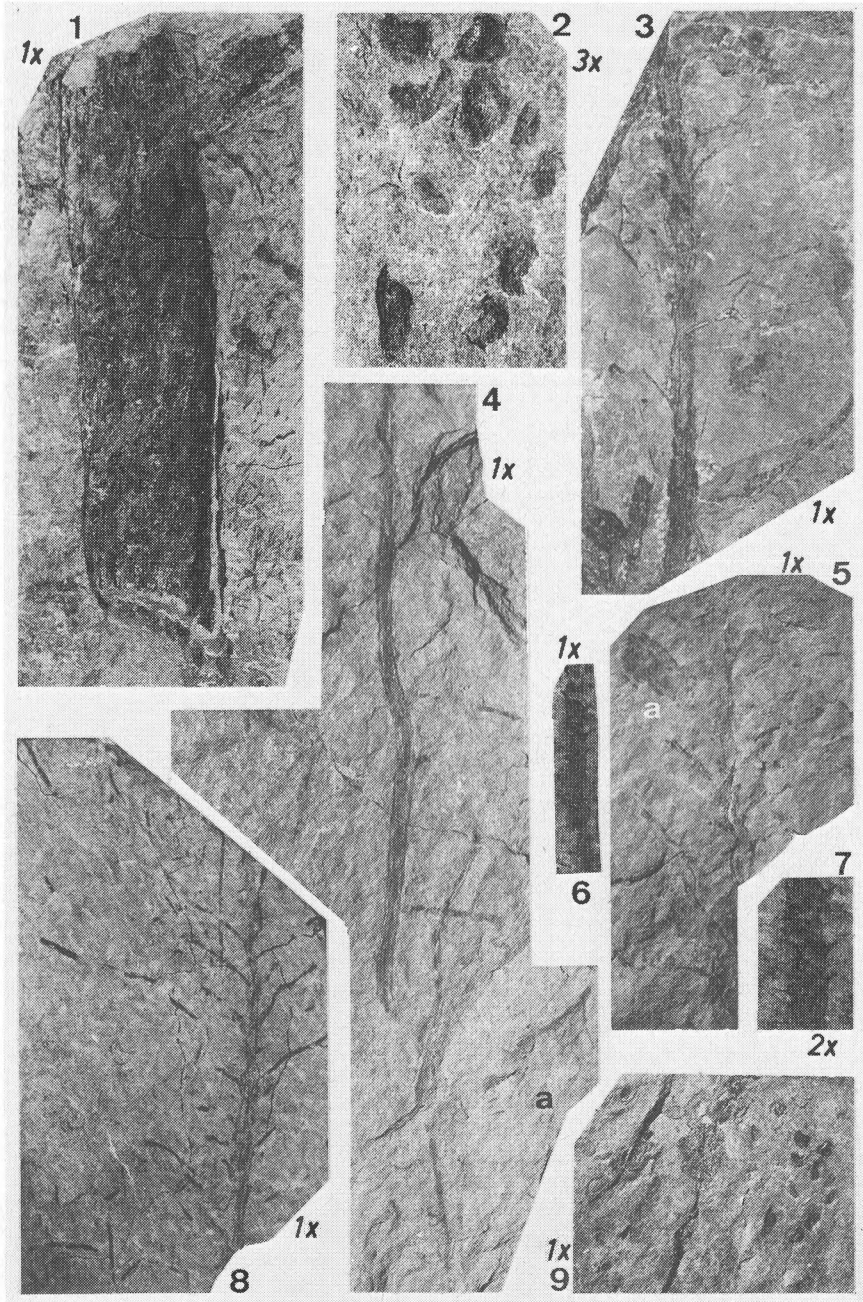


Plate II

Fig. 1
Pleuromeia cf. *sternbergii* (Muenster) Corda
Stem, 1 X
Photo Willemsen: 856/1

Fig. 2, 9
"Seeds" (or sporangia)
Photo Willemsen: 66257/1

Fig. 3,5,8
Voltzia sp.
Twigs, 1 X

Fig. 4
"Roots", 1 X
see text. fig. 9 b
Photo Willemsen: 66257/6

Fig. 5a
"Seeds" (or sporangia)
Photo Willemsen: 856/5;66257/4;856/30

Fig. 6
cf. *Voltzia* sp.
Axis, 1 X
Photo Willemsen: 856/9

Fig. 7
As for fig. 6, 2 X

Table I

Analyses of heavy minerals from the section along the forest road from the hospital of Laas to Jukbühel, Gailtaler Alps. Traces are indicated with +. The vertical arrangement of the samples is in accordance with the stratigraphic position in the section.

sample	rock	opaque minerals	Biotite, Chlorite	translucent minerals	Garnet	Zircon	Tourmaline	Rutile	Apatite	Epidote	Hornblende	Brookite	Anatase	Sphene	Zoisite	Monazite	Xenotime
"Werfener Schichten"																	
37/71	sandstone, dark gray	92	4	4	2	69	6	2	21								1
278/75	fine grained conglomerate, gray	95	1	4	1	17	9	6	63	+	3	1					
276/75	siltstone, gray-green	31	50	19	3	23	5	6	53	2	4		2		1	1	+
229/74	sandstone, light gray	78	8	14	2	51	8	2	34	2			1				
230/74	fine grained sandstone, light red	85	4	11	1	75	1	2	20	+			1				+
36/71	sandstone, light red	83	10	7	1	34	10	4	51								
231/74	fine grained conglomerate, light red	79	5	16		70	11	9	10								
232/74	sandstone, light red	76	2	22		36	3	2	58					1			+
277/75	sandstone, light red-pink	68	16	16		50	7	10	32				1				
274/75	fine grained conglomerate, dark gray	96	1	3	1	60	10	2	23		+		2	2			+
"Permoskythsandstein"																	
275/75	sandstone, red	91		9	1	83	6	3	+								2
35/71	sandstone, red	85	8	7	2	90	4	1	+	1							2
233/74	sandstone, red	89	5	6		74	18	7	+		1						

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