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THE FOSSIL CONTENT OF THE UPPER TRIASSIC MOLTENO FORMATION, SOUTH AFRICA

by

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ABSTRACT

A concise summary of the fossil content of the Molteno Formation is given. The megaflora (foliage, fruit, seed, and stem impressions) comprises the most significant fossil group. With 74 assemblages sampled and 115 foliage taxa encountered the Molteno is, by a wide margin, the most productive (localities and diversity) megaplant bearing formation in South Africa. The palynomorphs and silicified wood remain unpublished and are not dealt with in this paper. The animal fossils are represented mainly by insects with 25 genera and 32 species having been described. At least as many taxa await attention in the available collection of 300 individuals from 16 of the megaplant assemblages. A few undescribed species of conchostraca from 5 localities and one species of fish from a single locality round off the animal content. Trace fossils are not considered.

Classified lists, taxa/assemblage tables, locality maps, pen sketches and photographic plates for the megaflora and insect fauna are presented.

INTRODUCTION

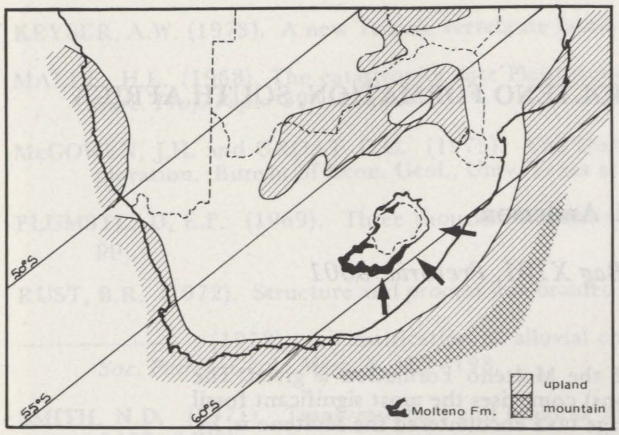
The present paper is essentially drawn, with a few additions (the insects in particular) and changes, from the section on the Molteno Formation in the book *Prodromus of South African megafloras : Devonian to L. Cretaceous* currently in press (Anderson and Anderson 1984). The repetition is justified by the nature and scope of this Haughton Memorial Volume – an attempt to bring together a series of papers giving a general overview of the 'Stormberg Series' (Molteno to Drakensberg formations).

We are in the process of preparing a series of volumes on the palaeoflora of the Molteno Formation. These are based primarily on our own collections begun in 1967 and now amounting to 15 500 catalogued slabs from 74 assemblages. The first volume has been published (Anderson and Anderson 1983a) and provides an interim synthesis of the megaflora to species level as well as a detailed taxonomic account of *Dicroidium*, the dominant most diverse element.

For further detail and clarification of aspects of the paper presented here the above mentioned volumes should be consulted.

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PALAEOENVIRONMENT & LITHOLOGY



Environment – Extensive drainage basin within the Gondwana interior, braided and meandering rivers flow N and NW from the Proto-Cape-Foldbelt. The Molteno Basin at around 55-60° S, lay in the track of the westerly wind belt. Warm temperate woodland and swampland, seasons marked, winter rainfall.

Source & cyclicity – Cyclic sedimentation reflects repeated uplift and denudation in the source area. Seven cycles are recognised along the southern outcrop where the formation attains its fullest development. Only the second cycle occurs basin-wide.

Lithology – Conglomerates (channel bed), variously bedded coarse to fine sandstones (point bar, levee, crevasse splay), siltstones and silty shales (quiet parts of the channel or abandoned channels), shales and minor coals (back swamp areas of flood plain). Sandy facies prominent.

Thickness – ±600 m in SE, thinning rapidly to N and NW.

PLANT FOSSILS

Preservation

Foliage, fruit, seed, stem impressions (megaplants) – Good impressions in buff to carbonaceous, fine grained sediments (mostly well bedded shales to finely laminated slates).

Cuticle – Preserved in 7 of 74 sampled assemblages, confined to more northerly outcrop of cycle 2, particularly good preservation in 1 assemblage (Lit 111 Dic/Hei).

Palynomorphs – Good assemblages isolated from the 7 cuticle yielding assemblages, a few additional megaflora locations, and several non-megaflora locations.

Silicified stems – rare in cross-bedded sandstones.

Megaplant collections

Institution	slabs	principal localities	principal collectors
PRE (Pretoria)	8600	47	And. & And. 1978-82
BPI (Johannesburg)	6900		And. & And. 1967-73
SAM (Cape Town)	500	15	Du Toit 1903-13
TMP (Pretoria)	300	1	Van Hoepen 1917
AMG (Grahamstown)	100	3	Kannemeyer pre 1889 Mountain ±1932
MML (Lesotho)	50	1	Ellenberger 1955-56
MMK (Kimberley)	50	5	various

superlocalities (10 km)	— 37
localities (1 km)	— 47
sublocalities (100 m)	— 51
supersites (10 m)	— 56
assemblages	— 74
catalogued slabs	— 15500
identifiable specimens	— 75000

These statistics reflect only our own 1967-82 collections. Where traceable earlier localities have been resampled. The Molteno megaflora synthesis (Tab.2) is based solely on these collections

Megaplant diversity

organ	genera	species*
stem	3	3
foliage	37	115
female/male	7	10
female	16	18
seed	7	11
male	12	16
natural taxa	37	115

* includes infra-specific taxa

Maximum natural taxa per asseblage — 62
Average natural taxa per assemblage — 10

Megaplant associations

Dicroidium (seed fern), *Heidiphyllum* (conifer), *Neocalamites* (sphenophyte), and *Sphenobaiera* (ginkgophyte) are, in that sequence, clearly the dominant Molteno genera. Some 25 associations, considering dominant species, occur. The most frequently recurring are:

(1) Neo car (13 times)	— monospecific association	(1 spp)
(2) Hei elo (12 ")	— low diversity "	(1-5 spp)
(3) Dic odo (10 ")	— med. " "	(5-20 spp)
(4) Dic/Hei (7 ")	— med. to high " "	(5-60 spp)
(5) Dic cra (4 ")	— med. diversity "	(5-20 spp)
(6) Bai spA (3 ")	— low " "	(1-5 spp)

Interpretation of associations:

Neocalamites – Monospecific bamboo-like thickets, shallow water in river channel and back swamp areas of flood plain.

Heidiphyllum – Monospecific to low diversity associations peripheral to swamps and low water in river channels. Heidiphyllum associations often pre-empt Neocalamites associations at a locality.

Sphenobaiera – Low diversity bush associations fringing lakes in the back swamp.

Dicroidium – More diverse forest and woodland associations, river bank (levee) and other elevated ground.

ANIMAL FOSSILS

Insects (Table 4 & Fig. 2)

Insects, primarily impressions of isolated wings, are the most frequently occurring animal fossils found.

		fam.	gen.	spp.	individ.
Ephemeroptera	(mayflies)	1	1	1	5
Meganisoptera	(protodragonflies)	1	1	1	2
Odonata	(dragonflies)	1	1	3	16
Plecoptera	(stoneflies)	1	1	1	1
Blattodea	(cockroaches)	2	3	5	110
? Mantodea	(mantids)	1	1	1	1
Orthoptera	(grasshoppers)	3	3	3	11
Homoptera	(bugs)	6	7	7	16
Megaloptera	(alderflies)	1	1	1	1
Mecoptera	(scorpionflies)	1	1	1	11
Trichoptera	(caddisflies)	-	-	-	7
Lepidoptera	(butterflies)	1	1	2	3
Coleoptera	(beetles)	3	4	6	61
Unidentified		-	-	-	56
		22	25	32	301

Collections – Insects have been collected from 16 of the 74 megaflora assemblages. They are unknown from elsewhere.

Diversity – The 22 families, 25 genera and 32 species noted include only described taxa. At least as many taxa remain, in the available collection, to be described. The 301 individuals include both described and undescribed identifiable material.

References – Zeuner 61, Riek '74,76a,b, Hubbard & Riek '77.

Associations – Insects have been gathered in reasonable numbers from only 4 megaflora assemblages. In 3 of these, Lit 111, Umk 111 and Maz 211, cockroaches and beetles clearly dominate in relatively low diversity insect associations; whilst in the 4th, bugs and dragonflies are perhaps most characteristic in a distinctly more diverse insect association.

Insect/megaflora relationships – The 2 insect associations occur with 2 of the broad megaflora associations:

The cockroach/beetle association occurs with diverse Dicroidium associations (abandoned channel).

The bug/dragonfly association occurs with a less diverse Sphenobaiera association (lake in back swamp).

Other animal fossils

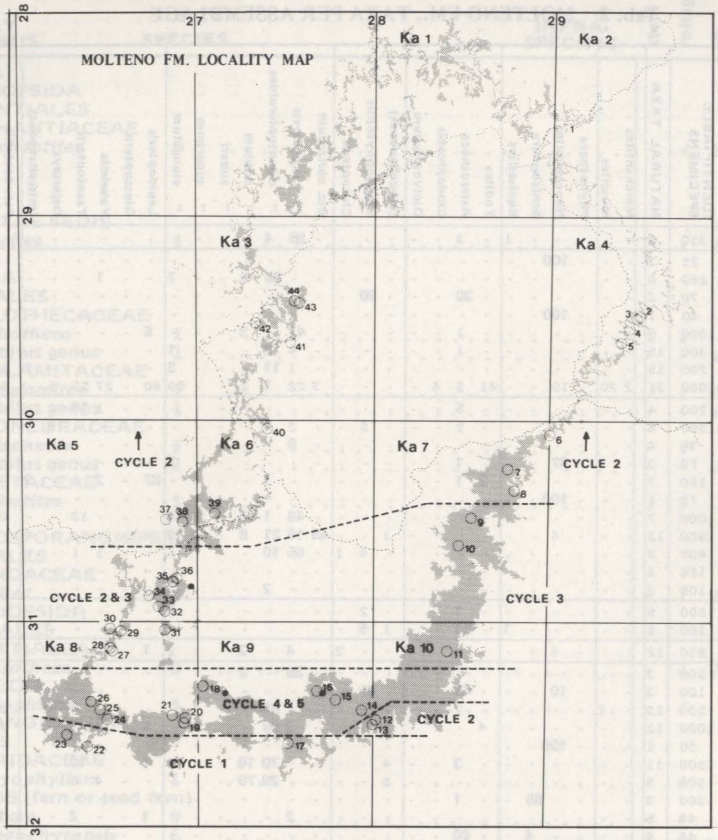
Conchostraca – Around 100 specimens representing a few species, from 5 megaplant localities (Maz 211, Lit 111, Umk 111, Hla 212, and Gre 111)

Fish – 3 specimens (impressions) of a single species, Semionotus capensis (see Jubb 1973), from 1 locality (Bir 111).

Tetrapods – Bone is not preserved in the Molteno Fm.

BIOSTRATIGRAPHIC AGE

Megaflora & palynoflora – L. Karnian (And. & And. 1983a).



Tab. 1 MOLTENO FM., MEGAPLANT LOCALITIES & ASSEMBLAGES

MAP REFERENCE (LOCALITIES)	SUPERLOC. (10 km) LOCALITY (1 km) SUBLOC. (100 m) SUPERSITE (10 m)	ASSEMBLAGE	SUPERLOCALITY	MAP REFERENCE (LOCALITIES)	SUPERLOC. (10 km) LOCALITY (1 km) SUBLOC. (100 m) SUPERSITE (10 m)	ASSEMBLAGE	SUPERLOCALITY
1	Lit 111	Dic/Hei	Little Switzerland	23	Aas 111	Hei elo	Aasvoëlberg
2	Hla 211	Dic 3spp	Hlatimbe Valley	24	Boe 111	Lep sto	Boesmanshoek Pass
"	" 212	Dic 3spp	" "	"	" "	Neo car	" "
"	" 213	Dic elo	" "	"	" "	Dic/Hei	" "
3	" 111	Neo car	" "	"	" 112	Dic cor	" "
4	Umk 111	Dic 2spp	Umkomaas Valley	25	Cyp 111	Dic cra	Cyphergat
5	San 111	Dic cra	Sani Pass	"	" "	Hei elo	"
6	Mng 111	Dic 2spp	Mngeni Valley	26	Mol 111	Bai spA	Molteno
7	Qac 111	Hei/Dic	Qachasnek	27	Kle 111	Neo car	Klein Hoek
8	Mat 111	Dic dub	Matatiele	"	" "	Hei elo	"
9	Ken 111	Dic cra	Kenegapoort	"	" "	Hei/Dic	"
10	Tin 111	Sch spA	Tina Bridge	28	" 211	Bai spA	"
"	" 121	Bai 2spp	" "	29	Kul 111	Bai spA	Kullfontein
"	" 131	Hei/Ast	" "	30	Kom 111	Bai/Dic	Kommandantskop
11	Wal 111	Dic odo	Waldeck	"	" "	Ast/Gin	"
12	Kon 222	Dic odo	Konings Kroon (K.Kr.)	31	Tel 111	Hei elo	Telemaghus Spruit
"	" 211,221	Ast 2spp	" " "	32	Vin 211	Neo car	Vineyard
"	" " "	Hei elo	" " "	33	" 111	Dic odo	"
13	" 111	Dic odo	" " (Rooipoort)	34	Ela 111	Dic odo	Elandspruit
"	" "	Neo car	" " "	"	" 112	Neo car	"
"	" "	Hei elo	" " "	"	" "	Hei/Neo	"
14	Kan 111	Hei elo	Kannaskop	"	" "	Dic/Hei	"
"	" "	Ast spA	"	35	Kra 211	Neo car	Kraai River (Plaatkop)
15	Nav 111	Neo car	Navar	36	" 111	Dic odo	" (Kraai R.)
"	" "	Dic odo	"	36a	" 311	Dic odo	" (Glenburn)
16a	Cal 211	Hei elo	Cala Road	37	Nuw 211	Hei elo	Nuwejaarspruit
16	" 111	Neo car	"	"	" "	Neo car	"
"	" "	Dic/Hei	"	"	" "	Dic 2spp	"
17	Ask 111	Neo car	Askeaton	38	" 111	♂ cone E	"
18a	Gre 121	Hei elo	Greenvale	"	" "	Dic zub	"
"	" 111	Bai spA	"	39	Win 111	Hei elo	Winnaarspruit
"	" "	Neo car	"	40	Qua 111	Dic odo	Qualasi Hill
18	Dor 111	Hei elo	Dordrecht	41	Mor 111	Dic zub	Morija
19	Bir 211	Bai 2spp	Birds River	"	" "	Dic odo	"
20	" 311	Hei/Bai	" "	42	Mak 111	Dic odo	Makoaneng
21	" 111	Bai 2spp	" "	43	Maz 111	Dic cra	Mazenod (Luka)
22	Bam 111	Dic dub	Bamboeshoek	44	" 211	Hei/Dic	" (Lechesa)

Notes (a) 37 superlocalities, 47 localities, 56 supersites, 74 assemblages (see also Tab. 2).
(b) Includes collections to Dec. 1982.
(c) Localities 16a, 18a & 36a (discovered in 1982) are indicated by full dots.
(d) Bai (*Baiera*) should read Sph (*Sphenobaiera*).
(e) Full explanatory notes on location ranks and assemblage codes in And. & And. '83a

Tab. 2 MOLTENO FM., TAXA PER ASSEMBLAGE

CYCLE	MAP REFERENCE	SUPERLOC. (10 km)	LOCALITY (1 km) SUBLOC. (100 m) SUPERSITE (10 m)	ASSEMBLAGE	CATALOGUED SLABS	IDENTIFIABLE SPECIMENS	NATURAL TAXA	Marchantites	Muscites	Phyllotheca	Neocalamites	Schizoneura	Equisetites	Todites	Asterotheca	Clodophlebis	Dictyophyllum	(miscellaneous)	Ginkgophytopsis	Chiropteris	Dic. coriaceum	" crassinervis	" odontopteroides	" dubium	" zuberi	" superbum	" elongatum	Lepidopteris	Glossopteris	Yabeiella	Taeniopteris	Dejerseya	(miscellaneous)	Pseudoctenis	Nilssoniopteris	Ginkgoites	Bai. spA	" tenuifolia	" schenki	" stormbergensis	Rissikia	Hei. elongatum	" spA
6	9	Ken	111	Dic cra	32	350	5	-	-	-	-	-	1	-	3	-	-	-	-	-	-	95	4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5	15	Nav	111	Neo car	14	25	1	-	-	-	100	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	"	"	"	Dic odo	60	250	6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	88	3	-	-	7	-	-	1	-	-	-	-	-	-	-	-	-	-	-	1	-
	16a	Cal	211	Hei elo	21	70	3	-	-	-	-	-	-	-	30	-	-	-	30	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	40	-
	16	"	111	Neo car	20	40	1	-	-	-	100	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	"	"	"	Dic/Hei	28	1000	9	-	-	-	-	-	-	-	1	-	-	-	-	-	-	47	-	3	-	-	5	-	-	-	-	-	-	-	-	-	-	-	-	-	2	-	44
	19	Bir	211	Bai 2 spp	184	300	16	-	-	-	-	-	-	-	1	-	-	-	-	-	-	4	3	-	-	1	-	-	-	-	-	-	-	-	3	35	15	46	3	-	3	-
	20	"	311	Hei/Bai	133	200	15	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	11	-	-	3	-	-	-	-	-	2	1	-	1	20	5	15	-	-	45	-
	21	"	111	Bai 2 spp	1094	10000	31	2	20	-	19	-	-	41	5	4	-	-	-	-	3	22	1	2	-	59	60	-	27	50	5	-	6	-	37	50	10	25	30	-	10	-
4-5	18	Dor	111	Hei elo	24	200	4	-	-	-	-	-	-	-	5	-	-	-	-	-	-	-	-	-	-	-	-	-	1	10	-	-	-	-	-	-	-	-	-	85	-
	18a	Gre	121	Hei elo	144	1500	6	-	-	-	1	-	-	-	2	-	-	-	5	-	-	2	-	-	-	-	-	-	-	-	19	-	-	-	-	-	-	-	-	80	-
	"	"	111	Bai spA	10	30	4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	5	-	-	-	-	-	-	-	-	-	-	-	-	10	75	-	-	-	10	-
	"	"	"	Neo car	63	70	3	-	-	-	97	-	-	-	1	-	-	-	-	-	-	-	-	-	-	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	24	Boe	111	Lep sto	81	150	7	-	-	-	-	-	-	2	1	-	-	-	-	-	-	-	1	-	-	-	87	-	2	-	2	-	-	-	-	-	-	-	-	-	5	-
	"	"	"	Neo car	34	70	1	-	-	-	100	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	"	"	"	Dic/Hei	59	1000	7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	49	1	3	-	-	4	-	-	-	13	-	-	6	-	-	-	-	-	-	-	42	-
	"	"	112	Dic cor	179	1500	12	-	-	-	4	-	-	-	-	-	-	3	-	-	49	19	21	8	-	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	12	14	-
	25	Cyp	111	Dic cra	38	400	9	-	-	-	-	-	-	-	-	-	-	-	4	1	-	65	10	-	-	-	-	-	1	1	-	-	-	-	-	-	-	-	-	12	12
	"	"	"	Hei elo	8	150	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	100	-
	26	Mol	111	Bai spA	63	100	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2	-	-	3	-	-	-	-	-	-	-	-	-	95	-	-	-	-	-
	14	Kan	111	Hei elo	42	500	5	-	-	-	-	-	-	-	1	-	-	-	2	-	-	-	-	-	-	1	-	-	-	1	-	-	-	-	-	-	-	-	-	97	-
	"	"	"	Ast spA	48	100	5	-	-	-	-	-	1	-	84	-	-	1	5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	10	-
3-4	31	Tel	111	Hei elo	203	800	12	-	-	-	6	-	-	-	8	-	-	-	-	2	-	4	-	2	-	-	2	1	-	-	2	-	-	-	-	1	-	-	-	-	89	-
3	30	Kom	111	Bai/Dic	72	500	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	38	-	2	-	-	-	-	-	-	-	-	-	-	-	-	-	60	-	-	-	-
	"	"	"	Ast/Gin	52	100	3	-	-	-	10	-	-	-	45	-	-	-	45	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	33	Vin	111	Dic odo	166	500	12	-	1	-	-	-	-	-	2	-	-	7	2	-	-	1	69	-	-	-	-	-	-	4	-	-	3	-	1	-	-	-	4	-	28	-
	34	Ela	111	Dic odo	235	1000	12	-	-	-	-	-	-	4	-	-	-	-	1	-	-	2	85	-	-	-	5	-	6	1	-	-	2	-	3	-	-	-	1	-	7	-
	35	Kra	211	Neo car	27	50	1	-	-	-	100	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	36	"	111	Dic odo	380	1500	11	-	-	-	-	-	-	-	3	-	-	4	-	-	-	-	70	16	-	-	1	-	-	10	-	-	-	-	-	-	-	-	2	-	-	-
	36a	"	311	Dic odo	103	500	5	-	-	-	-	-	-	-	-	-	-	8	-	-	-	-	29	70	-	-	-	-	-	4	6	-	-	-	-	-	-	-	-	-	-	-
	10	Tin	111	Sch spA	88	300	3	-	-	-	-	89	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	10	-
	"	"	121	Bai 2spp	29	40	8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2	-	-	-	-	1	-	-	2	-	-	1	-	-	40	-	52	-	1	1	-
	"	"	131	Hei/Ast	18	40	4	-	-	-	-	4	-	-	40	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	55	-
2-3	11	Wal	111	Dic odo	339	1000	12	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	88	3	-	-	1	-	13	3	-	-	2	-	3	-	-	-	3	-	-	-
f	12	Kon	222	Dic odo	275	1500	17	-	-	-	-	-	-	-	-	9	-	-	-	-	-	1	83	1	-	-	4	6	-	1	4	-	-	11	-	5	-	-	2	-	4	-	-
	"	"	211,221	Ast 2 spp	216	300	10	-	-	-	20	-	-	6	52	-	-	-	-	4	-	-	-	-	-	-	-	2	-	3	-	-	25	-	-	-	-	-	-	-	-	-
	"	"	"	Hei elo	22	100	2	-	-	-	-	-	-	-	-	-	-	-	-	-	5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	95	-
	13	"	111	Dic odo	195	800	21	-	-	-	-	-	-	-	12	-	-	-	-	-	-	3	68	3	-	2	10	8	-	1	8	-	-	5	-	5	-	-	1	-	2	-	7
	"	"	"	Neo car	12	40	2	-	-	-	90	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	10	-
	"	"	"	Hei elo	55	200	4	-	-	-	-	10	-	-	-	-	-	5	-	-	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	84	-
	27	Kle	111	Neo car	35	70	2	-	-	-	99	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-
	"	"	"	Hei elo	15	100	2	-	-	-	10	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	90	-
	"	"	"	Hei/Dic	188	1000	10	-	-	-	-	-	-	-	-	-	-	-	-	-	5	24	6	10	-	-	1	-	-	5	-	-	-	-	-	-	-	-	8	3	49	-
e	28	"	211	Bai spA	14	30	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	100	-	-	-	-	-
	29	Kul	111	Bai spA	10	20	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	99	-	-	-	-	-	-
d	32	Vin	211	Neo car	50	100	1	-	-	-	100	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	34	Ela	112	Neo car	25	50	2	-	-	-	80	-	-	20	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	"	"	"	Hei/Neo			2	-	-	-	40	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	60	-
	"	"	"	Dic/Hei	41	200	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	55	5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	40	-
	38	Nuw	111	Ó cone E	22	30	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	"	"	"	Dic zub	138	250	11	-	-	-	-	-	-	-	4	-	-	-	1	-	-	1	1	-	65	2	3	-	-	-	2	-	-	-	-	-	-	-	30	-	2	-
2	37	"	211	Hei elo	5	10	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	100	-
	"	"	"	Neo car	3	3	1	-	-	-	100	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	"	"	"	Dic 2 spp	119	300	8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	55	4	37	-	-	2	-	-	-	-	-	-	-	-	1	-	-	-	3	-	1	-
	39	Win	111	Hei elo	64	400	13	-	-	-	2	-	-	-	1	-	1	-	3	1	-	-	10	-	-	-	-	-	-	-	10	-	-	-	-	-	-	-	-	79	-
c	41	Mor	111	Dic zub	50	100	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4	-	95	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-
	"	"	"	Dic odo	214	800	8	1	-	-	-	-	-	-	-	-	1	-	-	-	-	-	78	-	-	-	20	-	-	-	2	-	20	-	-	-	-	-	-	1	-	-
	40	Qua	111	Dic odo	140	200	7	-	-	-	20	-	-	-	-	-	-	-	-	-	-	-	40	-	-	-	-	-	5	-	-	-	-	-	-	-	20	-	-	20	-
	42	Mak	111	Dic odo	146	500	7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	90	-	-	-	7	-	-	10	-	-	-	-	-	-	1	-	-	-	-
	43	Maz	111	Dic cra	462	1000	22	-	-	5	-	-	-	3	-	-	-	-	-	-	-	70	3	-	-	1	1	2	-	22	-	-	1	-	-	1	-	10	2	13	-	5	-
	44	"	211	Hei/Dic	919	2000	26	-	2	7	-	-	-	1	-	-	-	3	-	-	1	20	20	20	-	1	2	1	-	11	1	-	1	-	3	-	-	-	1	-	30	2
b	3	Hla	111	Neo car	14	50	2	-	-	-	99	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	2	"	211	Dic 3 spp	157	300	22	-	-	10	-	-	-	-	1	-	-	-	-	-	-	-	28	1	25	-	31	1	1	-	2	-	6	-	-	-	-	1	1	1	-	-
	"	"	212	Dic 3 spp	217	600	21	-	-	-	1	-	-	-	-	1	-	1	-	-	-	4	25	-	20	1	41	1	1	-	1	-	2	-	-	-	1	-	-	1	-	-
	"	"	213	Dic elo	897	2000	51	4	-	-	1	1	-	-	3	16	-	3	11	2	2	6	24	2	4	2	49	1	8	16	1	-	10	29	-	-	16	1	15	6	2	1	-
	4	Umk	111	Dic 2 spp	3081	13000	62	23	36	2	-	2	-	-	1	6	-	70	53	2	2	13	28	3	-	1	22	1	5	20	79	-	-	1	-	-	8	1	12	3	5	8	21
	5	San	111	Dic cra	303	2000	19	-	1	-	2	-	-	-	-	-	-	3	3	-	-	61	5	5	-	2	17	1	-	2	2	-	-	1	-	8	-	-	-	-	-	5	-
	6	Mng	111	Dic 2 spp	68	300	10	-	-	-	-	-	-	-	-	-	-	-	-	-	-	46	47	-	-	-	-	-	-	2	-	-	-	-	2	-	-	4	2	2	6	-
	7	Qac	111	Hei/Dic	112	1000	6	-	-	-	-	-	-	-	-	-	2	-	-	-	-	6	44	-	-	-	-	-	-	-	-	-	-	-	-	-	-	8	-	50	-
	8	Mat	111	Dic dub	1000	8000	27	-	-	-	12	-	2	-	1	-	-	4	2	-	-	10	15	50	19	-	5	1	-	2	2	-	-	9	-	25	-	-	-	14	-	4	-
a	1	Lit	111	Dic/Hei	1967	10000	53	2	14	-	15	-	-	-	-	-	-	9	49	1	20	5	29	7	2	3	8	1	27	6	79	20	1	54	17	48	-	-	1	31	40	23	-
1-2	23	Aas	111	Hei elo	61	300	9	-	-	-	1	-	-	-	20	-	-	-	2	-	-	3	2	6	-	-	-	-	-	-	3	-	-	-	-	-	-	-	-	-	77	-
1	17	Ask	111	Neo car	161	600	7	-	-	-	50	-	-	9	-	-	-	-	-	-	-	-	-	18	-	-	2	20	-	-	-	-	-	-	-	-	4	-	8	-	-	-
	22	Bam	111	Dic dub	53	150	6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	97	-	-	1	1	-	-	-	-	-	-	-	-	-	-	-	-	1	1	-
					±15500																																					

Notes (a) 37 superlocalities, 47 localities, 56 supersites, 74 assemblages (see also Tab. 1).

(b) Includes collections to Dec. 1982.

(c) The localities and assemblages are included as far as possible in stratigraphic sequence and bracketed according to sedimentary cycle.

(d) Most genera and the more significant species are listed (foliage taxa only). Genera not listed individually are combined under miscellaneous.

(e) Bai (*Baiera*) should read Sph (*Sphenobaiera*).

(f) Full explanatory notes on location ranks and assemblage codes in And. & And. '83a.

(g) Identifiable specimens (excl. seeds) — round figure estimates.

(h) Natural taxa — organ taxa combined into natural taxa where possible.

(i) **44** — bold figures are % counts.
70 — mild figures are actual numbers of specimens where the taxon makes up less than 1 % of the assemblage.

Tab. 3 MOLTENO FM.
MEGAFLORA, CLASSIFIED LIST.

DIVISION / CLASS / ORDER / FAMILY / GENUS	SPECIES	INFRA-SPECIFIC	stem	foliage	♂	♀	seed	♂
HEPATOPHYTA								
MARCHANTIOPSIDA								
MARCHANTIALES								
MARCHANTIACEAE								
Marchantites	3		-	✓	?	-	-	-
BRYOPHYTA								
BRYOPSIDA								
BRYALES								
INCERTAE SEDIS								
Muscites	1		-	✓	✓	-	-	-
SPHENOPHYTA								
SPHENOPSIDA								
EQUISETALES								
PHYLLOTHECACEAE								
Phyllotheca	1		✓	✓	-	-	-	-
strobilus genus	1		-	-	✓	-	-	-
APOCALAMITACEAE								
Neocalamites	1		✓	✓	-	-	-	-
strobilus genus	1		-	-	✓	-	-	-
SCHIZONEURACEAE								
Schizoneura	1		-	✓	-	-	-	-
strobilus genus	1		-	-	✓	-	-	-
EQUISETACEAE								
Equisetites	1		✓	✓	-	-	-	-
FILICOPHYTA								
PROTOLEPTOSPORANGIOPSIDA								
OSMUNDALES								
OSMUNDACEAE								
Todites	3		-	✓	✓	-	-	-
EUSPORANGIOPSIDA								
MARATTIALES								
MARATTIACEAE								
Asterotheca	6		-	✓	✓	-	-	-
INCERTAE SEDIS								
Cladophlebis	5		-	✓	-	-	-	-
LEPTOSPORANGIOPSIDA								
FILICALES								
DIPTERIDACEAE								
Dictyophyllum	1		-	✓	-	-	-	-
INCERTAE SEDIS (fern or seed fern)								
9 genera	9		-	✓	-	-	-	-
Ginkgophytopsis	6		-	✓	-	-	-	-
Chiropteris	2		-	✓	-	-	-	-
GYMNOSPERMOPHYTA								
PTERIDOSPERMOPSIDA								
CORYSTOSPERMALES								
CORYSTOSPERMACEAE								
Dicroidium coriaceum (Johnst. 1887) Townr. 1957		2	-	✓	-	-	-	-
" *crassinervis* (Gein. 1876) And. & And. 1982		5	-	✓	-	-	-	-
" *odontopteroides* (Morris 1845) Gothan 1912		5	-	✓	-	-	-	-
" *dubium* (Feistm. 1878) Gothan 1912		4	-	✓	-	-	-	-
" *zuberi* (Szajn. 1888) Archang. 1968		1	-	✓	-	-	-	-
" *superbum* (Shirley 1898(Townr. 1957		4	-	✓	-	-	-	-
" *elongatum* (Carruth. 1872) Archang. 1968		7	-	✓	-	-	-	-
Umkomasia	4		-	-	-	✓	-	-
seed genus	3		-	-	-	-	✓	-
Pteruchus	4		-	-	-	-	-	✓
PELTASPERMALES								
PELTASPERMACEAE								
Lepidopteris	2	2	-	✓	-	-	-	-
Peltaspermum	1		-	-	-	✓	-	-
seed genus	1		-	-	-	-	✓	-
Antevsia	1		-	-	-	-	-	✓
GLOSSOPTERIDALES								
GLOSSOPTERIDACEAE								
Glossopteris	3		-	✓	-	-	-	-
INCERTAE SEDIS								
Yabeiella	2		-	✓	-	-	-	-
Fraxinopsis	2		-	-	-	✓	-	-
Taeniopteris	6		-	✓	-	-	-	-
Dejerseya	1	4	-	✓	-	-	-	-
♀ cone genus	1		-	-	-	✓	-	-
4 genera	4		-	✓	-	-	-	-
CYCADOPSIDA								
CYCADALES								
Pseudoctenis	7		-	✓	-	-	-	-
Nilssoniopteris	1		-	✓	-	-	-	-
CONIFEROPSIDA								
GINKGOALES								
GINKGOACEAE								
Ginkgoites	7	2	-	✓	-	-	-	-
Sphenobaiera spA			-	✓	-	-	-	-
" *tenuifolia* Johnston 1887			-	✓	-	-	-	-
" *schenki* Feistmantel 1889			-	✓	-	-	-	-
" *stormbergensis* Seward 1903			-	✓	-	-	-	-
♀ cone genus	1		-	-	-	✓	-	-
Feruglioa	2		-	-	-	-	✓	-
Stachyopitys	2		-	-	-	-	-	✓
CONIFERALES								
PODOCARPACEAE								
Rissikia	3		-	✓	-	-	-	-
♀ cone genus	1		-	-	-	✓	-	-
♂ cone genus	1		-	-	-	-	-	✓
CYCADOCARPIDIACEAE								
Heidiphyllum elongatum (Morris 1845) Retall. 1981			-	✓	-	-	-	-
Telemaghus elongatus H. And. 1978			-	-	-	✓	-	-
Dordrechtites elongatus H. And. 1978			-	-	-	-	-	✓
Heidiphyllum spA			-	-	✓	-	-	-
INCERTAE SEDIS (fertile structures)								
♀ cone, 9 genera	9		-	-	-	✓	-	-
seed, 4 genera	4		-	-	-	-	✓	-
♂ cone, 7 genera	7		-	-	-	-	-	✓

Notes (a) The foliage taxa named are those listed in Tab. 2. Other taxa are included anonymously.

(b) Organ taxa taken to be associated are bracketed.

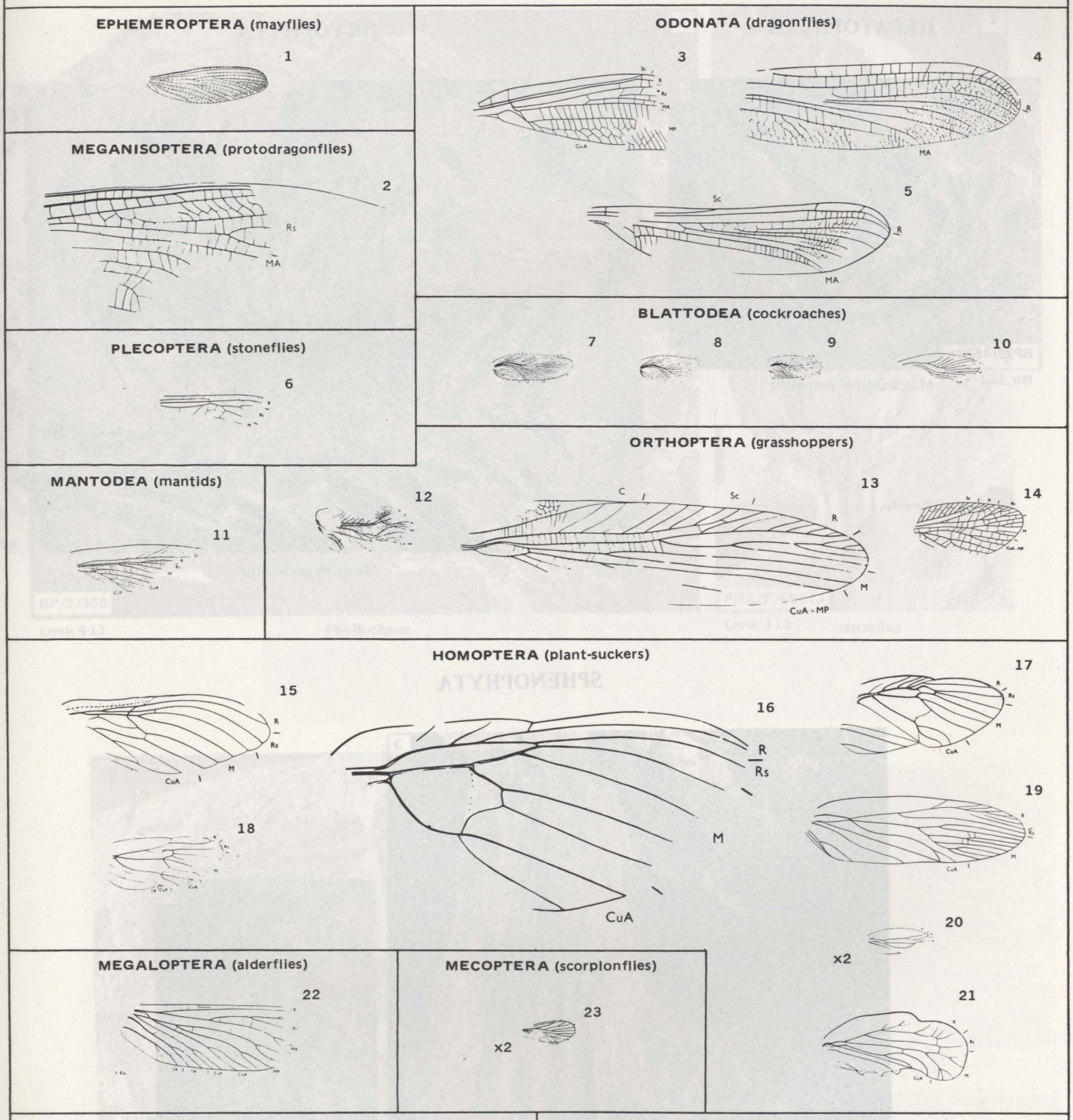
Tab. 4 MOLTENO FM.
INSECT FAUNA
CLASSIFIED LIST

ORDER / SUBORDER / FAMILY / GENUS & SPECIES	Lit 111 Dic/Hei	Hla 212 Dic 3 spp	" 213 Dic elo	Umk 111 Dic 2 spp	Mat 111 Dic dub	Tin 111 Sch spA	Kon 211 Ast 2 spp	" 111 Dic odo	Ask 111 Neo car	Gre 111 Neo car	Bir 111 Bai 2 spp	Cyp 111 Dic cra	Kle 111 Hei/Dic	Win 111 Hei elo	Qua 111 Dic odo	Maz 211 Hei/Dic
EPHEMEROPTERA (mayflies)																
LITOPHLEBIIDAE																
Litophlebia optata Riek 76 (Hub. & Riek 77)	-	-	-	-	-	-	-	-	-	-	4	-	-	-	-	-
abdomen	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-
MEGANISOPTERA (protodragonflies)																
PARALOGIDAE																
Triassologus biseriatus Riek 76	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-
Unidentified																
unidentified taxon	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-
ODONATA (dragonflies)																
PROTOZYGOPTERA																
TRIASSONEURIDAE																
Triassoneura andersoni Riek 76	-	-	-	-	1	-	-	-	-	-	1	-	-	-	-	-
" *heidiae* Riek 76	-	-	-	-	1	-	-	-	-	-	7	-	-	-	-	1
" *regularis* Riek 76	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-
" unidentified spp	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2
Unidentified																
larva	-	-	-	2	-	-	-	-	-	-	-	-	-	-	-	-
PLECOPTERA (stoneflies)																
? GRIPOPTERYGIDAE																
Euxenoperla clara Riek 76	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-
BLATTODEA (cockroaches)																
POROBLATTINIDAE																
Triassoblatta natalensis Zeuner 61	-	-	-	19	-	-	-	-	-	-	-	-	-	-	-	-
" *robusta* Riek 74	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-
" *simplex* Riek 76	-	-	-	-	-	-	-	-	-	-	6	-	-	-	-	-
" unidentified spp	6	2	3	-	-	-	-	-	-	-	-	-	-	1	1	69
MESOBLATTINIDAE																
Samaroblatta parvula Riek 76	-	-	-	-	-	-	-	-	-	-	2	-	-	-	-	-
Samaroblattella revelata Riek 76	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-
Unidentified																
abdomen	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-
? MANTODEA (mantids)																
MESORTHOPTERIDAE																
Mesorthopteron similis Riek 74	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-
ORTHOPTERA (grasshoppers)																
HAGLIDAE																
Hagla contorta Riek 74	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	1
PROPARAGRYLLACRIDIDAE																
Dordrechtia robusta Riek 76	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-
GEINITZIIDAE																
Fletchitzia picturata Riek 76	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-
Miscellaneous																
unidentified taxa	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	6
HEMIPTERA (plant-bugs)																
HOMOPTERA (plant-suckers)																
MESOGEREONIDAE																
Triassogereon distinctum Riek 76	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-
DUNSTANIIDAE																
Fletcheriana magna Riek 76	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-
Dunstania petrophila Riek 76	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-
CICADOPROSBOLIDAE																
Prosbolomorpha clara Riek 74	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-
Leptoprosbole lepida Riek 76	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-
SCYTINOPTERIDAE																
Scytinoptera distorta Riek 76	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-
DYSMORPHOPTILIDAE																
Tennentsia protuberans Riek 74	-	-	-	-	-	-	-	-	-	-	3	1	-	-	-	-
PROTOPSYLLIDIIDAE																
nymph	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-
Miscellaneous																
unidentified taxa	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	5
MEGALOPTERA (alderflies)																
EUCHAULIODIDAE																
Euchauliodes distinctus Riek 74	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-
MECOPTERA (scorpionflies)																
MESOPANORPODIDAE																
Afristella delicatula Riek 74	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-
Miscellaneous																
unidentified taxa	1	-	-	1	-	-	-	-	-	-	-	-	-	-	5	3
TRICHOPTERA (caddisflies)																
Miscellaneous																
unidentified taxa	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	6
LEPIDOPTERA (butterflies)																
PARATRICHOPTERA																
MESOSETIDAE																
Mesoses optata Riek 76	-	-	-	-	-	-	-	-	-	-	2	-	-	-	-	-
" *magna* Riek 76	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-
COLEOPTERA (beetles)																
CUPEDIDAE																
Moltenocupes townrowi Zeuner 61	-	1	-	9	-	-	1	-	-	-	-	-	-	-	-	1
PERMOSYNIDAE																
Ademosyne speciosa Riek 74	-	-	-	2	-	-	-	-	-	-	-	-	-	-	-	-
" *prisca* Riek 74	-	-	-	4	-	-	-	-	-	-	-	-	-	-	-	2
" *reducta* Riek 76	1	-	-	1	-	-	-	-	-	-	3	-	1	-	-	-
" unidentified spp	2	-	-	2	-	-	-	-	-	-	-	-	-	-	-	2
Umkomaasia depressa Zeuner 61	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-
? SILPHIDAE																
Pseudosilphites natalensis Zeuner 61	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-
Miscellaneous																
undescribed taxa	5	-	2	16	-	-	-	-	-	1	-	-	-	-	1	3
Miscellaneous																
± complete insects	2	-	-	6	-	-	-	-	-	-	-	-	-	-	-	1
abdomens	-	-	-	9	-	-	-	-	-	-	-	-	-	-	-	5
abdominal and thorax fregments	-	-	-	9	-	-	-	-	-	-	-	-	-	-	-	-
wings	-	-	1	15	-	-	-	-	-	-	4	-	-	-	-	3
	18	3	7	97	2	1	1	1	1	1	50	1	1	1	7	110

Notes (a) Includes collections (301 individuals) to Dec. 1982.
(b) Undescribed material placed according to Toms 1982 (pers. comm.).
(c) See further notes in text and illustrations in Fig. 2.

Fig. 2

MOLTENO INSECTS



1 Litophlebia optata
2 Triassologus biseriatus
3 Triassoneura andersoni
4 " heidiae
5 " regularis
6 Euxenoperla clara
7 Triassoblatta natalensis
8 " robusta
9 Samaroblatta parvula
10 Samaroblattella revelata
11 Mesorthopteron similis
12 Hagla contorta
13 Dordrechtia robusta
14 Fletchitzia picturata
15 Triassogereon distinctum
16 Fletcheriana magna
17 Dunstania petrophila
18 Prosbolomorpha clara
19 Leptoprosbole lepida
20 Scytinoptera distorta
21 Tennentsia protuberans
22 Euchauliodes distinctus
23 Afristella delicatula
24 Mesoses optata
25 " magna
26 Moltenocupes townrowi
27 Ademosyne speciosa
28 " prisca

all x1, except figs 20,23

Notes (a) Sketches mainly from Riek '74,'76 a,b
(b) Most described taxa (see Tab. 4) included.

all x1,
except where indicated

MOLTENO FM., PHOTOGRAPHIC CATALOGUE

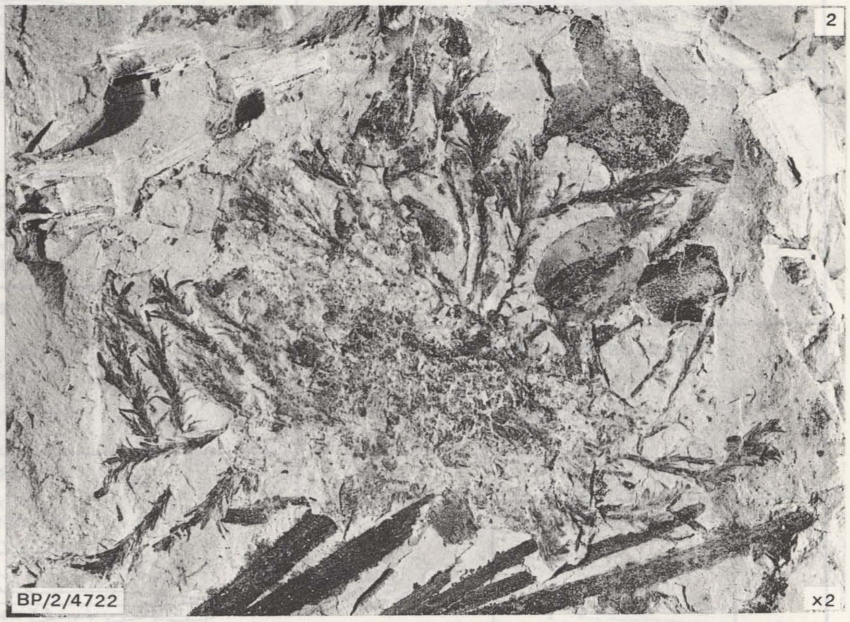
Typical examples of the genera & species listed in Tab. 2 & 3 are illustrated

HEPATOPHYTA



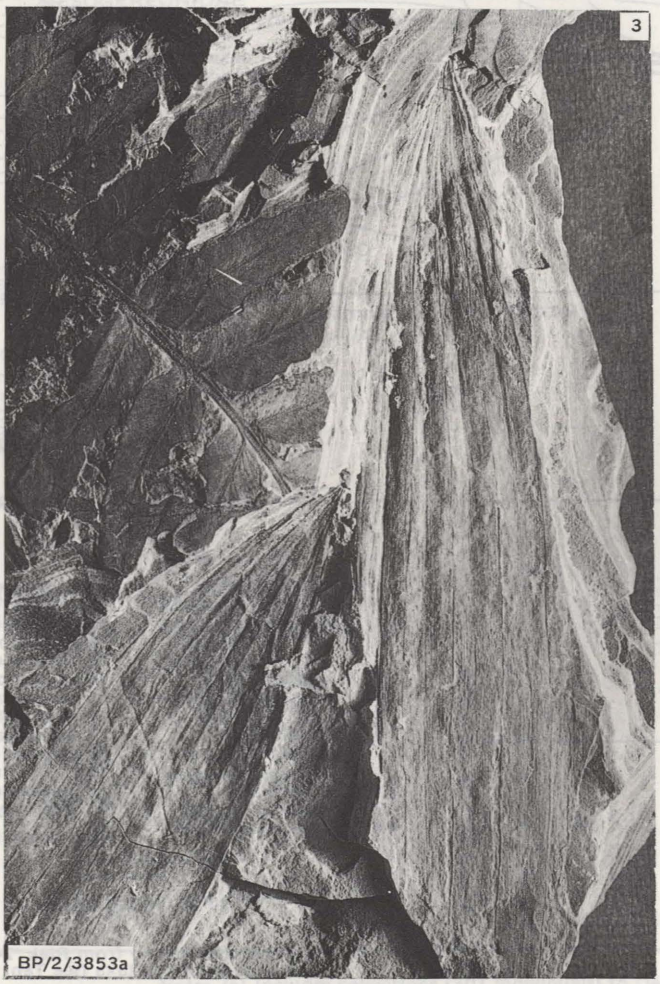
Bir 111 **Marchantites tennantii**

BRYOPHYTA



Bir 111 **Muscites guescelini**

SPHENOPHYTA

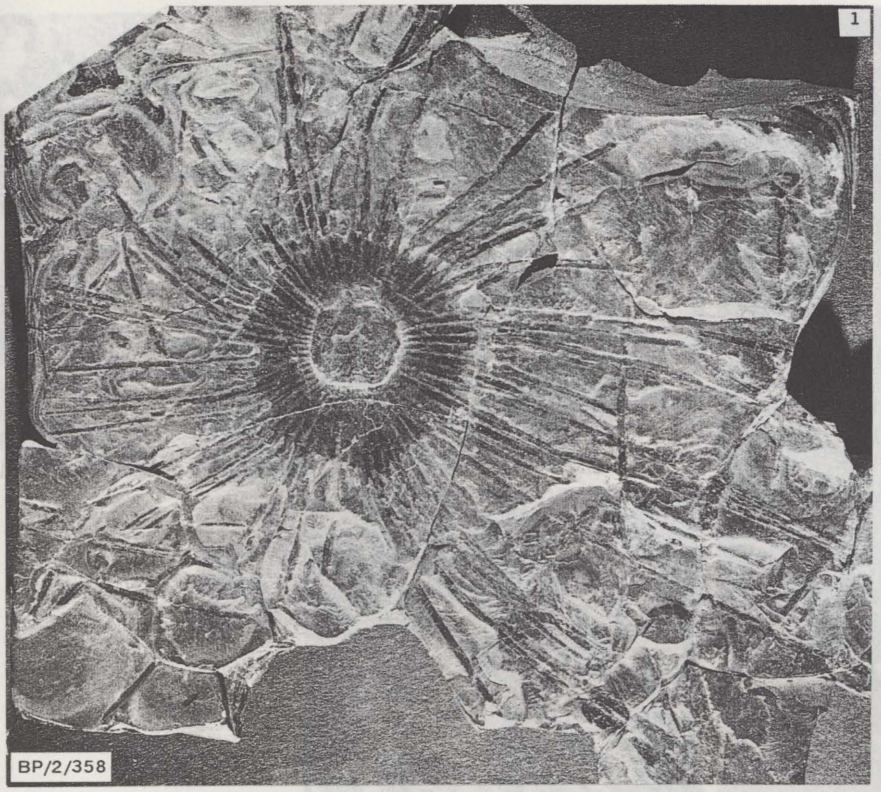


Kan 111 **Schizoneura spA**

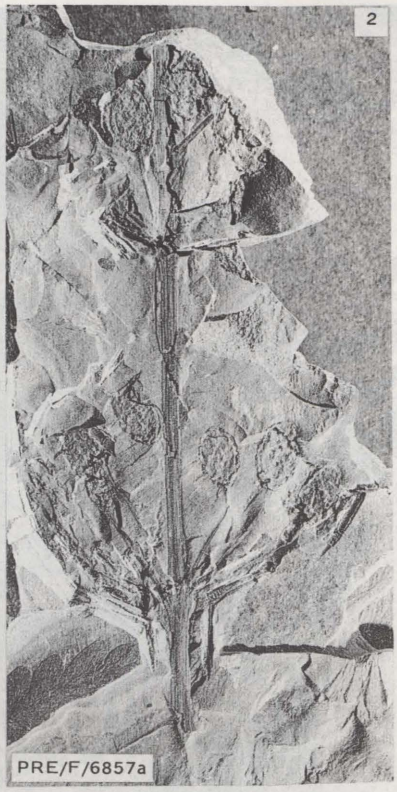


SAM 11652 **strobilus**
Tin 111

SPHENOPHYTA



Umk 111 **Phyllotheca**



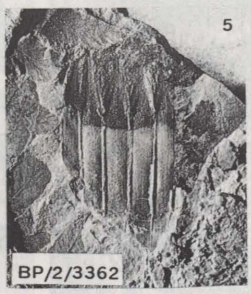
Umk 111 **strobilus**



Boe 111 **Neocalamites carrerei**

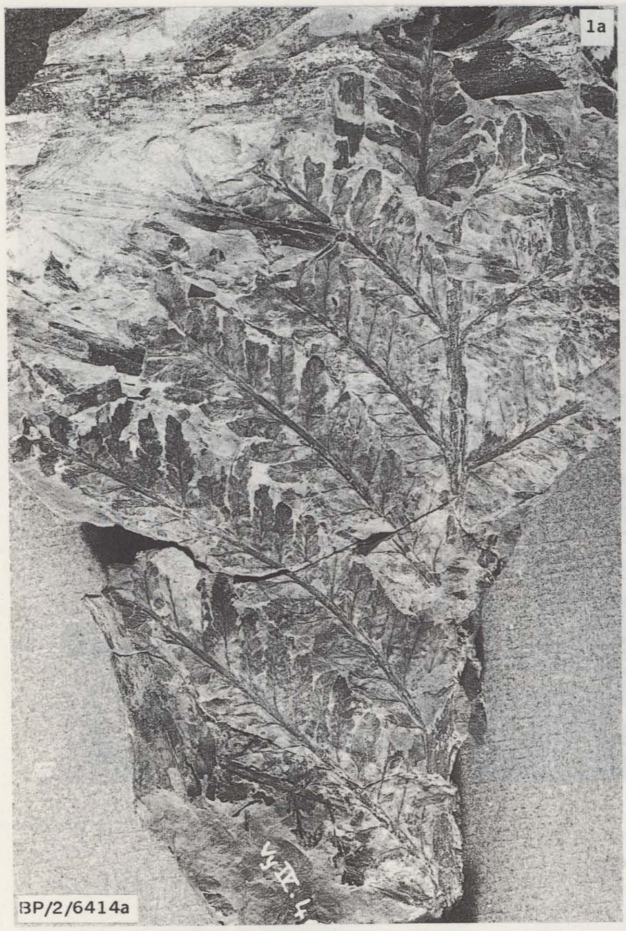


Kra 211
strobilus

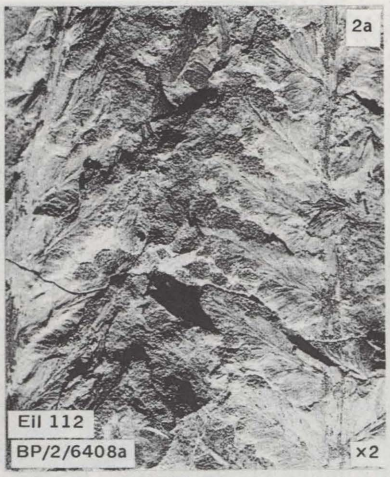


Kan 111 **Equisetites**

FILICOPHYTA



Todites













Asterotheca

FILICOPHYTA

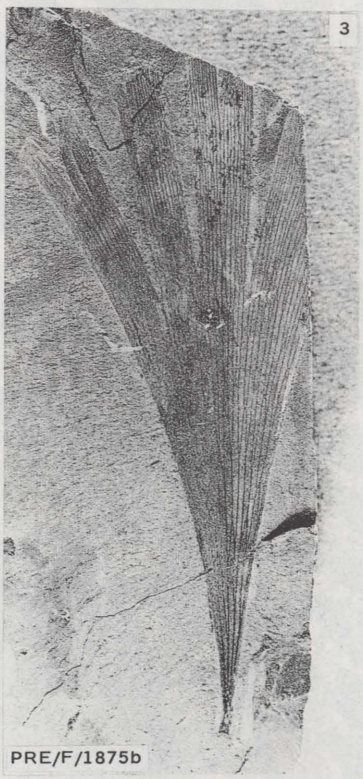


Umk 111 **Cladophlebis**

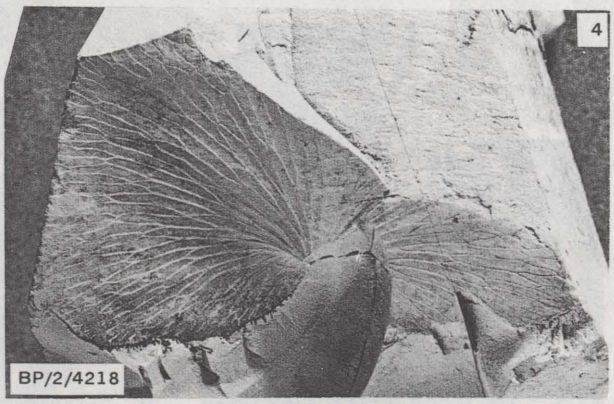


Mor 111 **Dictyophyllum ellenbergi**

INCERTAE SEDIS

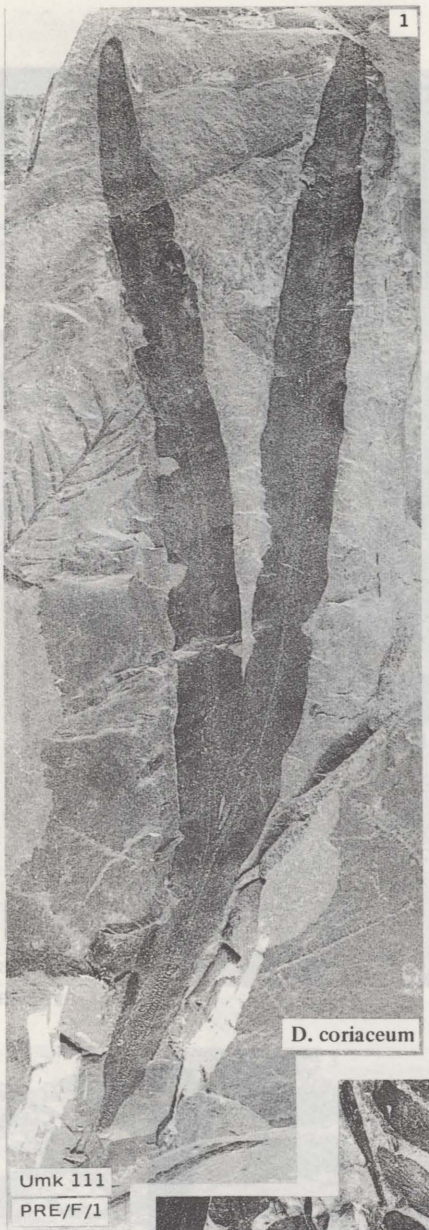


Mat 111 **Ginkgophytopsis lacerata**

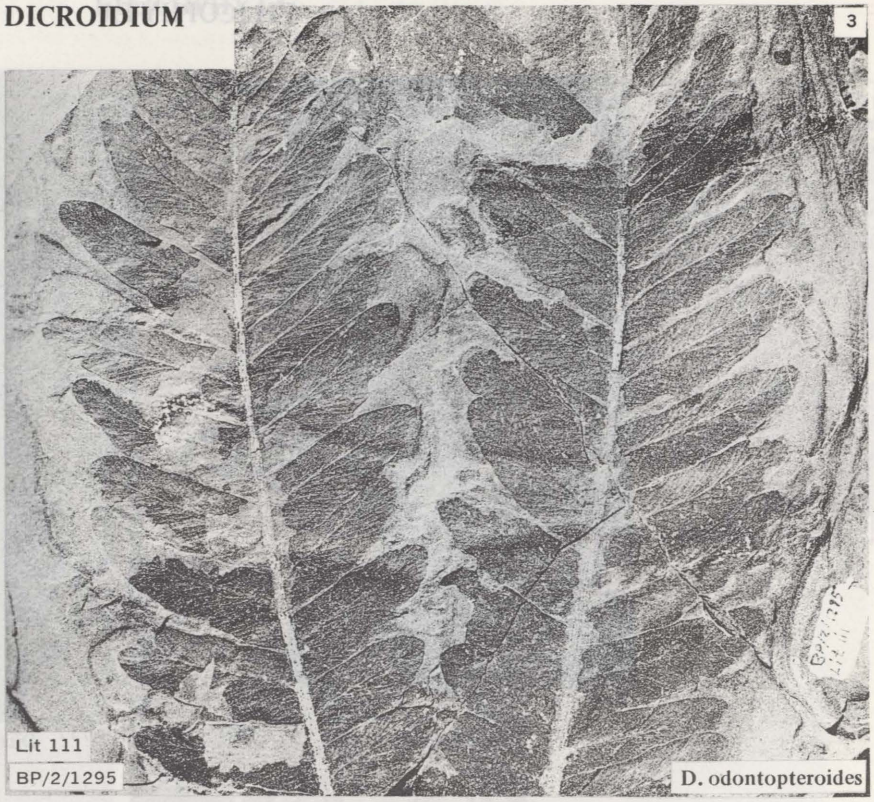


Kon 211 **Chiropteris zeilleri**

DICROIDIUM


1
D. coriaceum
Umk 111
PRE/F/1


2
San 111
BP/2/2397
D. crassinervis


3
Lit 111
BP/2/1295
D. odontopteroides


4
Mat 111
PRE/F/1782
D. dubium

DICROIDIUM



1

Mat 111
PRE/F/1802

D. zuberi



2

Umk 111
PRE/F/87a

D. superbum



3

Umk 111
PRE/F/53

D. elongatum

DICROIDIUM FRUIT



Umk 111



Maz 211



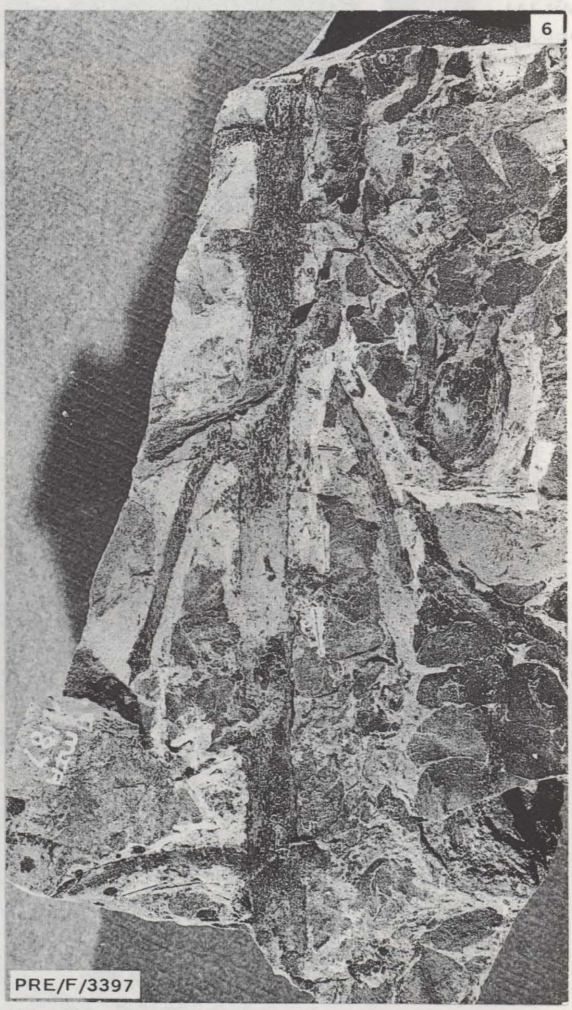
Mat 111



Kon 222



Mat 111



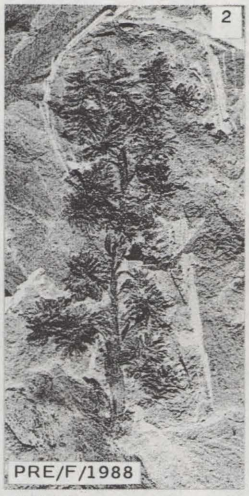
Mor 111

Umkomasia

DICROIDIUM FRUIT



Mor 111



Mat 111





Mat 111



Mat 111

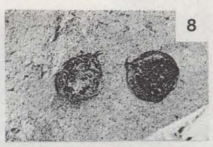
Pteruchus



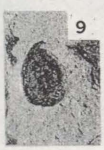
BP/2/1157
Umk 111



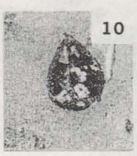
Umk 111



Mat 111



Mat 111



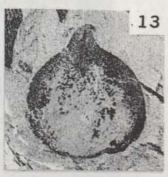
Mat 111



Lit 111



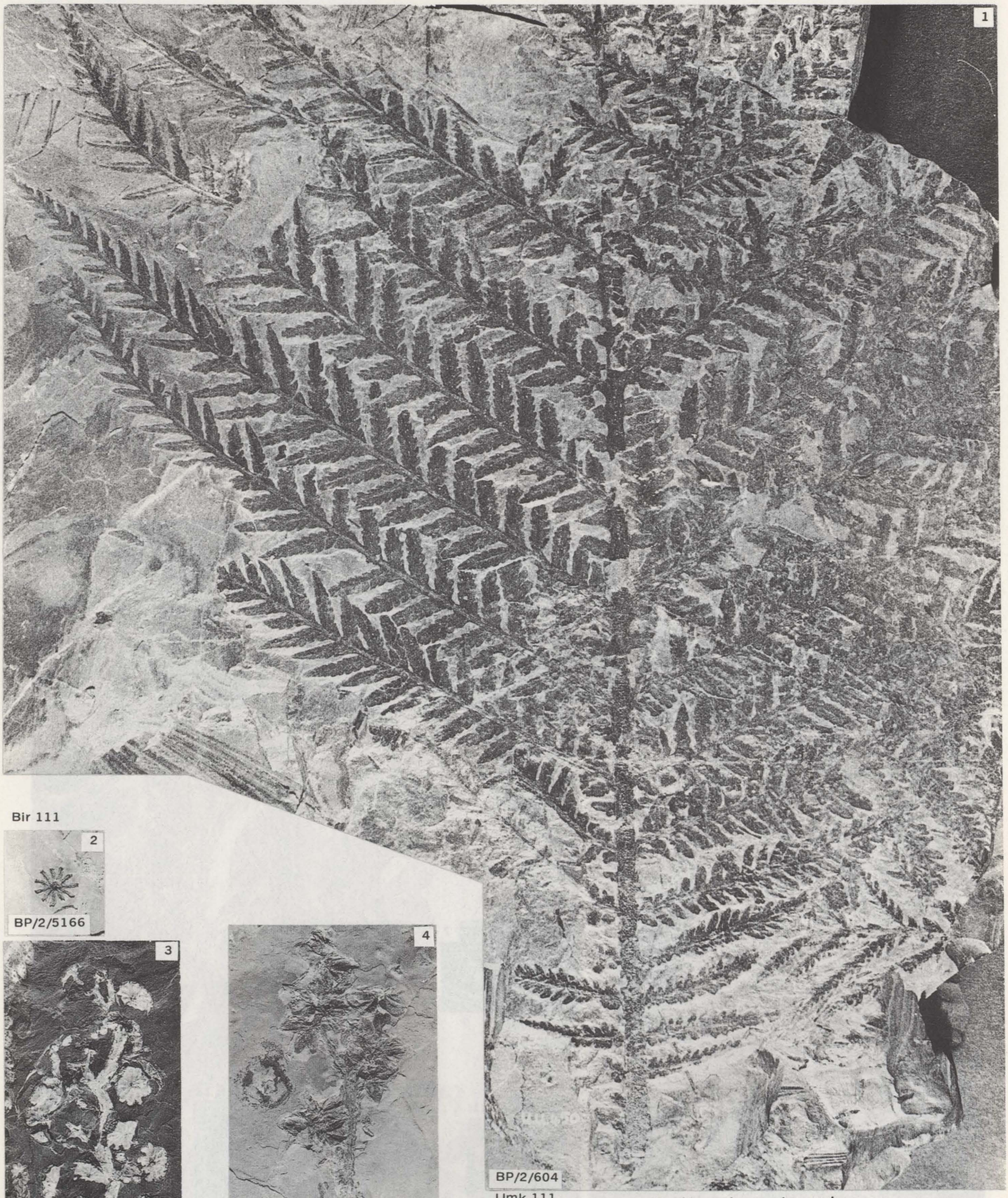
Mat 111



Mat 111

seed

PELTASPERMALES



Lepidopteris stormbergensis

Bir 111

Kon 222

Peltaspermum

Bir 111

Antevsia



BP/2/5210

Bir 111

GYMNOSPERMOPHYTA



Umk 111

Glossopteris verticillata



Kon 222

Yabeiella crassa



BP/2/5305

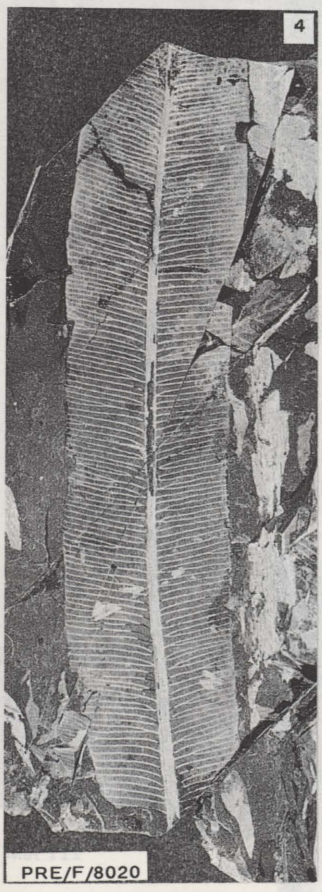
Bir 111

Fraxinopsis

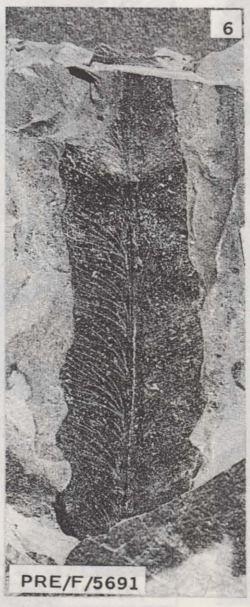


Lit 111

Dejerseya lobata



Kra 111 **Taeniopteris**



Lit 111



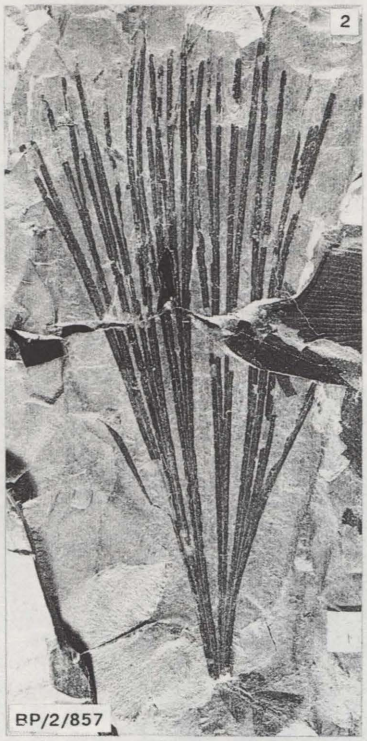
Lit 111

♀ cone

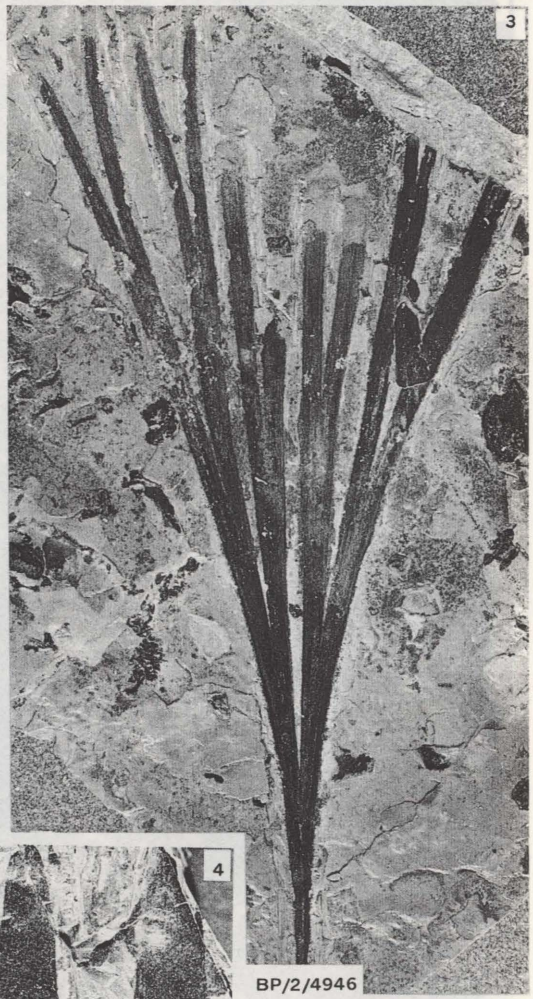
GINKGOALES



BP/2/5024
Bir 111 **Sphenobaiera spA**



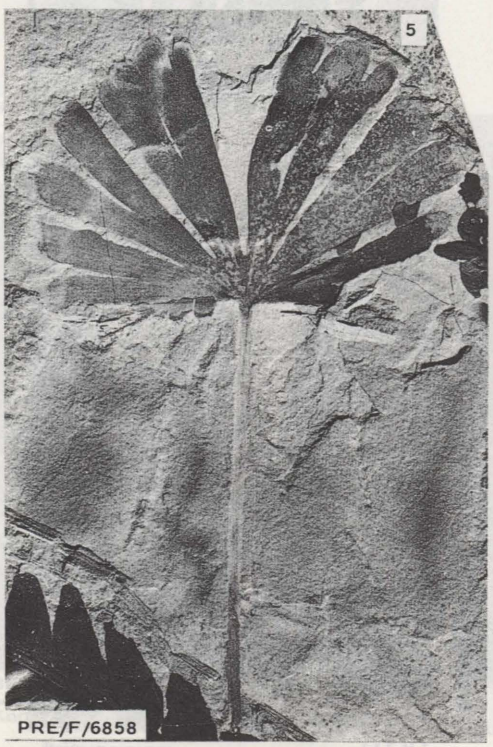
BP/2/857
Umk 111 **Sphenobaiera tenuifolia**



BP/2/4946
Bir 111 **Sphenobaiera schenki**



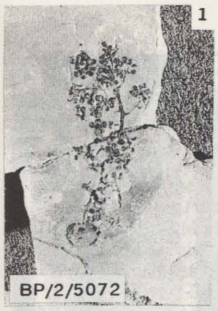
BP/2/1885
Lit 111 **Sphenobaiera stormbergensis**

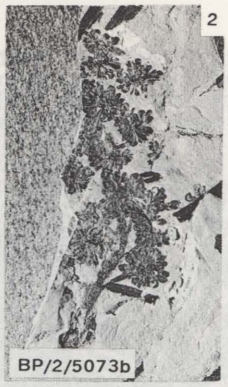


PRE/F/6858
Wal 111 **Ginkgoites digitata**

SPHENOBAIERA FRUIT

Stachyopitys


1
BP/2/5072
Bir 111


2
BP/2/5073b
Bir 111


3
BP/2/5335
Bir 111
Feruglioa

♀ cone


4
PRE/F/9535b
Wal 111


5
PRE/F/9538a
Wal 111


6
PRE/F/9536
Wal 111


7
PRE/F/9436a
Wal 111

Stachyopitys


8
PRE/F/9250b
Mat 111

Stachyopitys


10
PRE/F/9174a
Mat 111


9
BP/2/3115
Mat 111

Stachyopitys


11
PRE/F/2010
Mat 111

♀ cone


12
PRE/F/2045
Mat 111
Feruglioa

♀ cone


13
PRE/F/9776
Tin 121

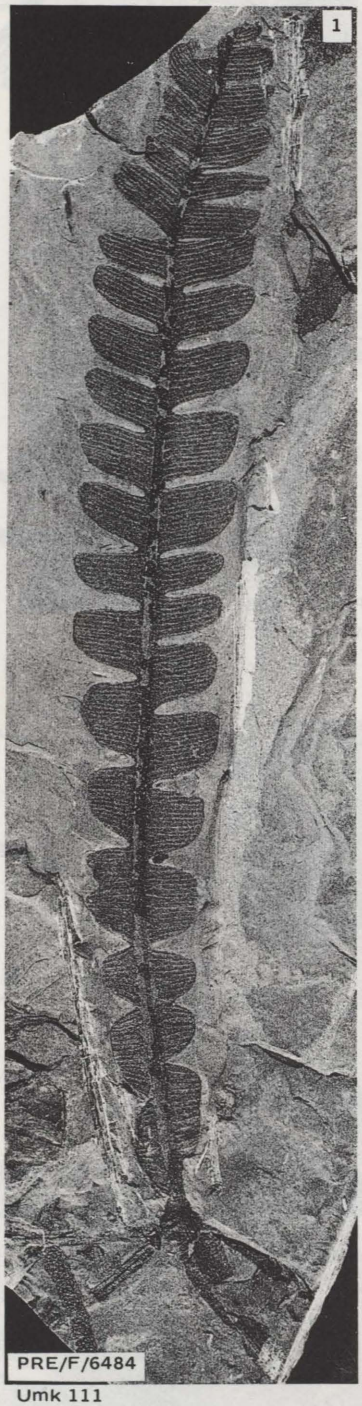

PRE/F/9542
14
Tin 121


15
PRE/F/9778
Tin 121

Feruglioa

CYCADALES

CONIFERALES



Umk 111



Lit 111 **Nilssoniopteris**

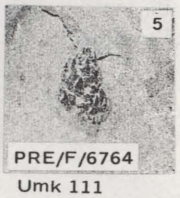


Hla 213 **Rissikia media**



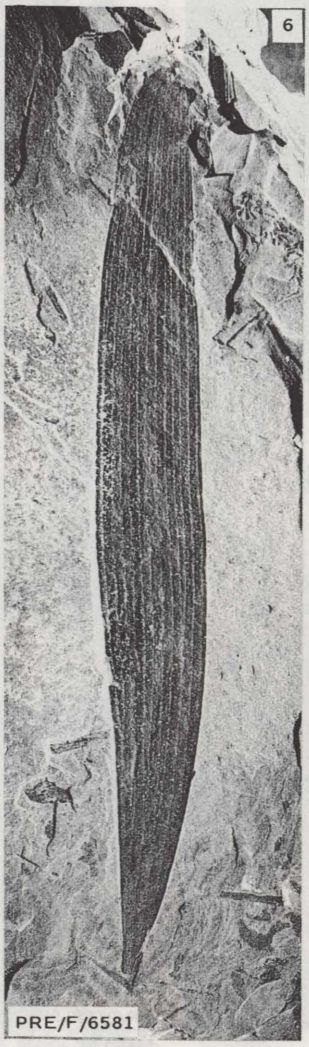
Umk 111

♀ cone



Umk 111

♂ cone



Umk 111

Heidiphyllum elongatum



BP/2/5277a

Bir 111

Dordrechtites elongatus

Mat 111





Tel 111

Telemachus elongatus

MOLTENO FM.

MEGAPLANT REFERENCES

ANDERSON, H.M., 1974. A brief review of the flora of the Molteno Formation (Triassic), South Africa. *Palaeont. afr.*, 17, 1-10.

ANDERSON, H.M., 1976. A review of the Bryophyta from the Upper Triassic Molteno Formation, Karoo Basin, South Africa, *Palaeont. afr.*, 19, 21-30.

ANDERSON H.M., 1978. *Podozamites* and associated cones and scales from the Upper Triassic Molteno Formation, Karoo Basin, South Africa, *Palaeont. afr.*, 21, 57-77.

ANDERSON, H.M. & ANDERSON, J.M., 1970. A preliminary review of the biostratigraphy of the uppermost Permian, Triassic and lowermost Jurassic of Gondwanaland. *Palaeont. afr.*, 13, 1-22, Charts 1-22.

ANDERSON, J M. & ANDERSON, H.M., 1983a. *Palaeoflora of Southern Africa. Molteno Formation (Triassic). Vol 1: Part 1, Introduction. Part 2, Dicroidium*. Rotterdam, A.A. Balkema, 228 pp.

ANDERSON, J.M. & ANDERSON, H.M., 1983b. Vascular plants from the Devonian to Lower Cretaceous in southern Africa. *Bothalia*, 14(3,4) 337-344.

ANDERSON, J.M. & ANDERSON, H.M., 1984 (in press). *Prodromus of South African megafloras : Devonian to L. Cretaceous.* Rotterdam, A.A. Balkema, 400 pp.

BALDONI, A.M., 1980a. Revisión de las especies del género *Xylopteris* (Corystospermaceae) en el Triásico de Argentina, Australia y Sud Africa. *Ameghiniana*, 17(2), 135-155.

BALDONI, A.M., 1980b. *Baiera africana*, una nueva especie de ginkgoal del Triásico de Sudáfrica. *Ameghiniana*, 17(2), 156-162.

CARRUTHERS, W., 1871. Note on fossil plants from Dordrecht. In: Stow, S.W. On some points of South African geology of Queenstown. *Q. Jl. geol. Soc. Lond.*, 27, 525.

DU TOIT, A.L., 1927. The fossil flora of the Upper Karroo beds. *Ann. S. Afr. Mus.*, 22(2), 289-420.

DU TOIT, A.L., 1932. Some fossil plants from the Karroo System of South Africa. *Ann. S. Afr. Mus.*, 28(4), 369-393.

FABRE, J. & GREBER, C., 1960. Presence d'un *Dictyophyllum* dans la flore Molteno du Basutoland. (Afrique Australe). *Bull. Soc. geol. Fr., Ser.* 7, 2, 178-182.

FEISTMANTEL, O., 1889. Ubersichtliche Darstellung der geologisch-palaeontologischen Verhältnisse Süd-Afrikas. Th 1: Die Karroo-Formation und die dieselbe unterlagernden Schichten. *Abh. K. Bohm. Ges. Wiss. Prague*, 7(3), 1-89.

PLUMSTEAD, E.P., 1969. Three thousand million years of plant life in Africa. Du Toit memorial lecture number 11. *Trans geol. Soc. S. Afr.*, 72 (Annex.), 1-72.

SEWARD, A.C., 1903. Fossil floras of Cape Colony. *Ann. S. Afr. Mus.*, 4(1), 1-122.

SEWARD, A.C., 1904. On collections of Natal fossil plants. II: From the Drakensberg range in west Natal. *Report of the Geological survey of Natal and Zululand*, 2, 101-104.

SEWARD, A.C., 1908. On a collection of fossil plants from South Africa. *Q. Jl. geol. Soc. Lond.*, 64(253), 83-108.

SEWARD, A.C., 1911. A new genus of fossil plants from the Stormberg Series of Cape Colony. *Geol. Mag.*, 7, 298-299.

SHAW, J., 1887. On fossil plants from Indwe and Cyphergat coal beds. *Trans. S. Afr. phil. Soc.*, 4(1), 44-45.

STOCKLEY, G.M., 1947. *Report on the geology of Basutoland.* Maseru, Basutoland. 114 pp.

THOMAS, H.H., 1931. The early evolution of the angiosperms. *Ann. Bot.*, 45, 647-672.

THOMAS, H.H., 1933. On some pteridospermous plants from the Mesozoic rocks of South Africa. *Phil. Trans. R. Soc. Ser. B. Biological sciences*, 222, 193-265.

THOMAS, H.H., 1952. A Glossopteris with whorled leaves. *Palaeobotanist*, 1, 435-438.

THOMAS, H.H., 1955. Mesozoic pteridosperms. *Phytomorphology*, 5, 177-185.

THOMAS, H.H., 1958. *Lidgettonia*, a new type of fertile *Glossopteris*. *Bull. Br. Mus. nat. Hist., Geology*, 3, 179-189.

TOWNROW, J.A., 1956. The genus *Lepidopteris* and its southern hemisphere species. *Avh. norske Vidensk Akad. Oslo Mat. –Naturv. Klasse.*, 2, 1-28.

TOWNROW, J.A., 1957. On *Dicroidium* probably a pteridospermous leaf, and other leaves now removed from the genus. *Trans. geol. Soc. S. Afr.*, 60, 1-36.

TOWNROW, J.A., 1959. Two Triassic bryophytes from South Africa. *Jl. S. Afr. Bot.*, 25, 1-22.

TOWNROW, J.A., 1960. The Peltaspermaceae. a pteridosperm family of Permian and Triassic age. *Palaeontology*, 3(3), 333-361.

TOWNROW, J.A., 1962. On *Pteruchus* a microsporophyll of the Corystospermaceae. *Bull. Br. Mus. nat. Hist., Geology*, 6(2), 289-320.

TOWNROW, J.A., 1967. On *Rissikia* and *Mataia* podocarpaceous conifers from the lower Mesozoic of southern lands. *Pap. Proc. R. Soc. Tasm.*, 101, 103-136.

VAN EEDEN, O.R., 1937. The geology of the country around Bethlehem and Kestell with special reference to oil indications. *Mem. geol. Surv. S. Afr.*, 33, 1-60.

Annotations to megaplant references

Carruthers 1871 – The earliest report of megaplants in the Molteno Fm. A brief note on a few fragmentary specimens, referred to the genera *Danaeopsis* and *sphenopteris*, from Dordrecht.

Shaw 1887 – Brief mention of a few taxa, *Pecopteris (Dicroidium), Cycadites* and *Sphenopteris*, from the coal deposits at Indwe and Cyphergat.

Feistmantel 1889 – The first descriptions with illustrations of Molteno megaplants – 6 genera and 7 species from Indwe and Cyphergat. The material was sent to Feistmantel by Schenk who spent 3 years working on Karoo strata in South Africa.

Seward 1903,04,08,11 – Descriptions of a number of taxa from some 15 to 20 localities. The material was forwarded to him by the Cape Geological Survey.

Du Toit 1927,32 – The earlier work is an extensive monograph in which he describes 25 genera (1 new) and 48 species (10 new) from 13 localities. It provides the only earlier comprehensive account of the Molteno palaeoflora and is based largely on his own collections. The later work deals with Karoo floras of different ages. It includes the description of 2 genera and 2 species from 2 Molteno localities.

Thomas 1931,33,52,55,58 – Concerned primarily with *Dicroidium* and its fructifications. The works are based on collections (housed in the British Museum of Natural History) made by himself and Hoeg (Norway) in 1929 from the well known Umkomaas locality.

Van Eeden 1937 – Illustrated some excellent cuticular fragments from a new locality near Kestell.

Stockley 1947 – In a report on the geology of Lesotho he notes a number of new Molteno plant localities and mentions the more evident taxa.

Townrow 1956,57,59,60,62,67 – This series of papers deals with particular genera (*Lepidopteris, Dicroidium*, Bryophyta, *Rissikia)* and their fructifications from the Umkomaas locality. The earlier work was based on the material of Thomas & Hoeg and the latter on his own collections made in 1956.

Fabre & Greber 1960 – Described a new species of the Dipteridacean fern *Dictyophyllum* from the Morija locality in Lesotho.

Plumstead 1969 – In a monograph on the succession of fossil floras in South Africa she gives a brief summary of the Molteno megaflora.

And. & And. 1970 – In a general synthesis of the biostratigraphy of the Gondwana Triassic an updated checklist of the Molteno flora and a preliminary pictographic taxonomic revision of *Dicroidium* are presented.

Anderson, H., 1974,76,78 – The earlier paper gives an overview of the Molteno flora. The latter papers describe the bryophyta and the conifer *Podozamites* with its associated cones.

Baldoni 1980a,b – Taxonomic treatment of a few specimens of *Xylopteris (Dicroidium)* and *Baiera* from the Umkomaas locality. Collections in Buenos Aires.

And. & And. 1983a,b, 84 – Works initiating a monograph series on the 'Palaeoflora of Southern Africa'. Included is the 1st of 6 planned volumes on the Molteno palaeoflora, and a volume covering the succession of fossil floras in South Africa.

ANIMAL REFERENCES

HUBBARD, M.D. & RIEK, E.F., 1977. New name for a Triassic mayfly from South Africa (Ephemeroptera). *Psyche*, 83(3-4), 260-61.

JUBB, R.A., 1973. Brief synthesis of present information on the geographical and stratigraphical distribution of fossil fish within the Stormberg Stage, South Africa. *Palaeont. afr.*, 16, 17-23.

RIEK, E.F., 1974. Upper Triassic insects from the Molteno 'Formation', South Africa. *Palaeont. afr.*, 17, 19-31.

RIEK, E.F., 1976a. An unusual mayfly (Insecta: Ephemeroptera) from the Triassic of South Africa. *Palaeont. afr.*, 19, 149-151.

RIEK, E.F., 1976b. A new collection of insects from the Upper Triassic of South Africa. *Ann. Natal Mus.*, 22(3), 791-820.

TOMS, R.B., 1982 (pers. comm.). Interim identifications of Molteno Fm. insects. Univ. Witwatersrand, Jhb., Zoo Dept.

ZEUNER, F.E., 1961. A Triassic insect fauna from the Molteno Beds of S. Africa. *Trans. XI Int. Congr. Ent.*, Vienna, 1, 304-6.