

- - -
// : // :

*

Archive of SID

(-)

() AOM (AOM () ())

() () *Ricciisporites tuberculatus* ()

Email: sajjadi@khayam.ut.ac.ir

(Assereto 1966)

(Kimyai 1975)

(Assereto 1966)

()

(Fürsich

(Rad 1986)

et al. 2005)

)

(

()

(Seyed-Emami et al. 2006, Seyed-Emami

)

(Javadi 2006)

,and Wilmsen 2007)

(

,(Fürsich et al. 2006)

(

)

()

)

(Shekarifard et al.

(

in press)

(

)

(

)

.....

Playford 1984)

%

%

(Shekarifard et al. 2006)

.(Shekarifard et al. 2007)

()

(Shekarifard et al. 2007)

AOM

AOM

()

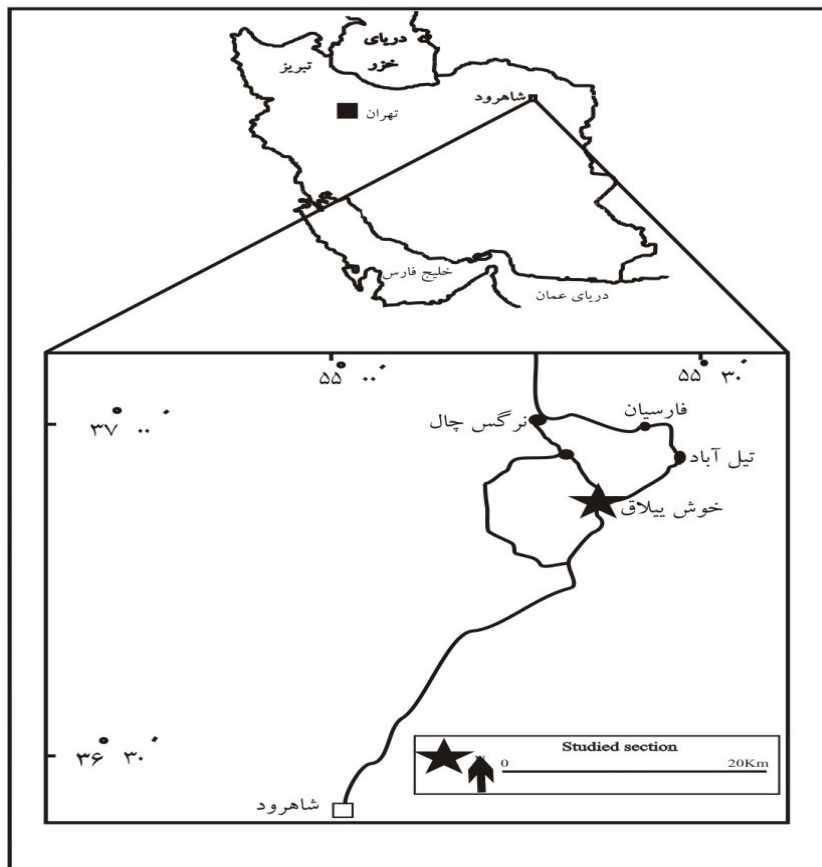
()

()

o / / / o / / /

()

(Phipps and



() ()
 (*spora dispersae*) ()

(Playford and Dettmann 1996)

(sporangium) ()
 (*in situ*)

(Balme 1995) :

.....

(Matoniaceae)

(Gleicheniaceae)

) ()

(

)

()

(

2

(Vakhrameev 1991; Van

Plates 1

Konijnenburg – Van Cittert 2002; Villar deseoane

1999, Tidwell and Ash 1994; Collinson 1996

(Lycopsida)

(Filicopsida)

(

(Bryopsida)

(Cycadopsida)

(Sphenopsida)

:(Lycopsida)

(Plates 1, 2) (Coniferopsida)

(Deng

2002)

Limbosporites

:(Bryopsida)

(Barrón et al. 2006)

- *Ricciisporites tuberculatus*

(-):

Filicophyta

(e.g. Lundblad 1954; Balme 1995; Lindström and

(Schizaeaceae)

(Batten

Erlström 2006)

(Dipteridaceae)

(Osmundaceae)

Ricciisporites

et al. 1994)

(Marattiaceae)

(Cyatheaceae)

(Dicksoniaceae)

) *Alisporites*
(Filatoff 1975; (Gleicheniaceae
Filatoff and Price 1988; Balme 1995; McKellar
1998)

:(Cycadopsida)

.()

Ricciisporites

% %

.(Fakhr 1975)

Chasmatosporites

Corollina

:(Coniferopsida)

(Tyson

1984; 1993; Mahmoud and Moawad 2000;

.Zavattieri et al. 2008) Fakhr

(Tyson 1984, 1993)

.(1975)

(;

(

:(Sphenopsida)

(

Equisetum

vitrinite inertinite

(

(

Calamospora

() AOM

Ricciisporites,

Gleicheniidites, Dictyophyllidites, Limbosporites

.....

(Zavattieri et al. 2008)

(Tyson 1984, 1993)

-

()

(Tyson 1993)

()

(Zavattieri et al. 2008)

(Zavattieri et al. 2008)

-

() anemophilous

(Tyson 1984)

(Tyson 1993)

%

(,)

()

(bryophyte/pteridophyte)

(Zavattieri et al. 2008)

(Plates 1, 2)

%

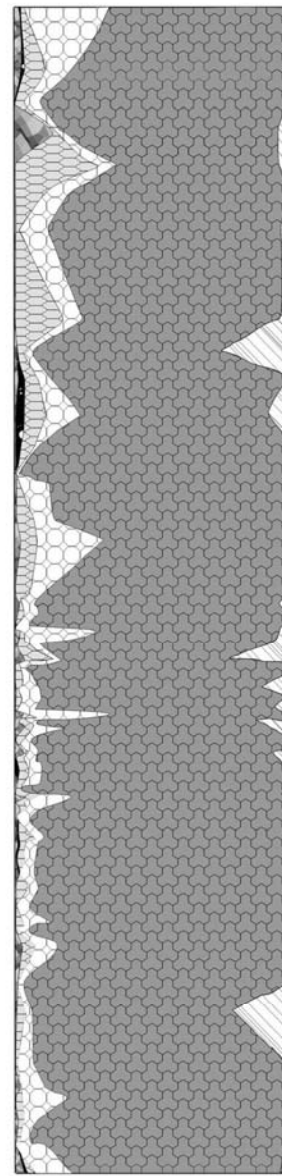
(Tyson 1993)

Woody debris	Phytoclasts	Marine palynomorph	Transparent Aom	Opaque Aom	Pollen Grains	Spore	Sample No.
2.715	79.705	0.7	13.43	2.93	1.46	2.06	1
1.611	88.48	-	9.66	0.009	-	0.24	2
0.5	95.32	-	2.04	2.14	-	-	3
0.69	92.7	0.18	3.5	2.08	-	0.85	4
0.31	81.78	-	14.99	2.92	-	-	5
0.21	88.95	0.18	8.59	0.85	0.06	1.16	6
2.15	91.76	-	5.18	0.91	-	-	7
20.53	73.40	0.4	2.23	3.24	0.1	0.1	8
-	97.45	-	2.16	0.25	0.5	0.2	9
2.68	81.71	0.4	8.18	4.63	0.5	1.9	10
0.5	96.63	-	1.6	1.17	0.1	-	11
2.1	85.93	-	8.85	3.12	-	-	12
0.37	94.3	-	4.98	-	-	0.35	13
0.73	90.51	-	3.9	4.6	0.13	0.13	14
1.75	91.66	-	4.72	0.27	1.1	0.5	15
0.62	91.97	0.2	3.71	3.10	0.4	-	16
1.5	90.22	0.63	4.9	1.7	0.42	0.63	17
2.48	86.85	0.6	3.79	5.81	0.37	0.1	18
0.85	93.33	0.4	4.78	-	0.14	0.5	19
0.2	89.62	-	5.74	2.66	1.68	0.1	20
0.307	85.103	0.1	10.98	3.41	-	0.1	21
2.82	76.73	-	12.18	5.23	1.46	1.58	22
0.01	99.39	-	0.3	0.3	-	-	23
0.14	90.29	0.3	5.7	2.73	0.34	0.5	24
-	-	-	-	-	-	-	25
2.38	87.52	1.5	5.16	3.44	-	-	26
5.48	86.80	-	4.44	3.28	-	-	27
1.67	90.18	1.43	3.24	0.8	1.63	1.02	28
1.63	91.62	0.5	5.23	0.52	-	0.5	29
0.45	95.32	-	1.9	2.33	-	-	30
12.17	68.95	0.2	10.63	4.51	1.18	2.36	31
0.31	92.51	0.07	3.42	3.02	0.07	0.6	32
2.446	73.194	0.2	20.83	0.83	-	2.5	33

.....

Woody debris	Phytoclasts	Marine palynomorph	Transparent Aom	Opaque Aom	Pollen Grains	Spore	Sample No.
1.87	61.33	0.4	28.52	1.8	1.69	4.39	34
6.42	86.69	-	6.89	-	-	-	35
0.15	90.23	-	7.01	2.27	0.09	0.28	36
10.31	80.68	-	7.38	1.13	-	0.5	37
0.29	92.60	-	4.22	2.89	-	-	38
-	95.15	0.1	3.08	2.06	-	-	39
0.08	97.09	-	1.38	1.45	-	-	40
2.37	64.05	0.34	18.56	11.28	1.19	2.21	41
4.37	87.82	0.24	4.7	2.07	-	0.8	42
2.97	66.85	-	26.54	1.97	0.25	1.42	43
1.69	93.89	-	4	0.42	-	-	44
1.02	90.14	-	5.41	2.46	0.24	0.73	45
3.93	88.84	-	4.5	0.97	-	1.76	46
0.37	89.28	-	7.85	2.5	-	-	47
0.4	86.90	-	6.9	5.8	-	-	48
1.16	66.62	0.1	24.08	5.74	1.10	1.2	49
-	87.78	-	7.37	6.22	-	0.6	50
19.15	86.19	-	10.56	1.7	-	0.4	51
-	98.58	0.05	0.86	0.4	-	0.3	52
0.23	90.77	2.74	1.37	4.71	0.09	0.09	53
7.62	68.52	3.04	12.56	7.7	0.06	0.5	54
6.07	85.09	2.87	5.62	4.96	0.26	0.78	55
25.05	69.04	-	2.6	2.7	0.61	-	56
2.47	72.95	-	6.96	17.62	-	-	57
-	-	-	-	-	-	-	58
1.44	85.13	-	10.55	1.19	0.5	1.19	59
0.01	80	-	8.88	11.11	-	-	60
3.86	59.61	-	7.69	28.84	-	-	61
3.87	79.69	-	2.34	0.02	0.16	13.92	62
0.01	90.82	-	5.24	3.93	-	-	63
0.65	77.16	0.6	10.49	8.02	1.85	1.24	64
-	-	-	-	-	-	-	65
1.39	62.52	0.67	32.94	0.84	0.84	0.8	66
2.51	64.67	-	30.84	-	0.49	1.49	67

Time Unit	Rock Unit	Thickness (meter)	Sample No	Lithology	
Jurassic	Farsan Fm.	1280.3	67		
	Middle (Dogger)	1150.3	65		
Early (Liassic)	Shemshak Formation	887.8	60		
		922	57		
		890.3	54		
		797.9	50		
		574.1	47		
		537	42		
		510.2	37		
		238.8	31		
		121.6	28		
		68.4	24		
Late Triassic	Rhaetian	Elika Fm.	8		
			4		

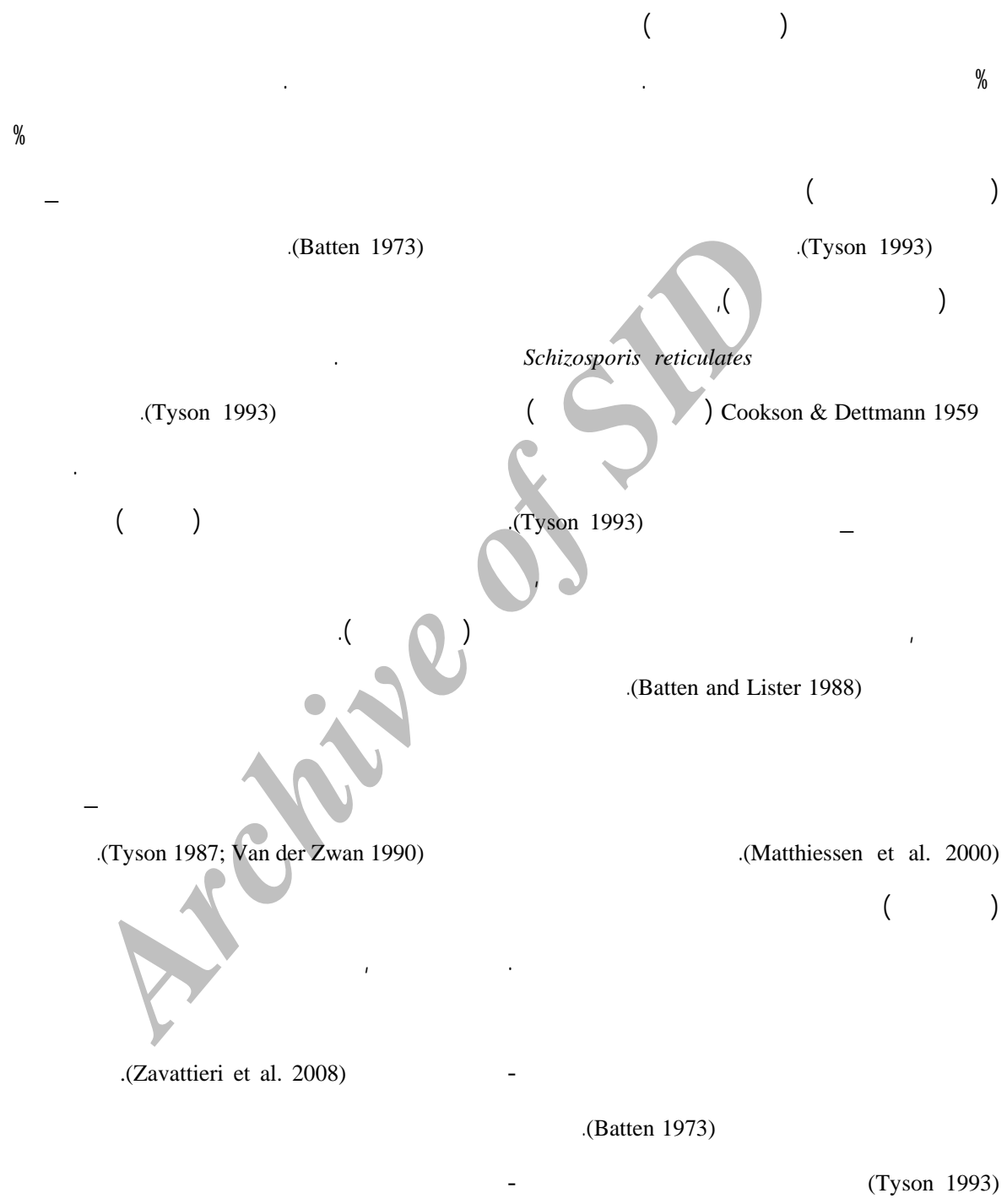


LEGEND

- Laterite
- Silty Shale
- Argillaceous Sandstone
- Sandstone
- Conglomerate
- Limestone
- Shale
- Coal
- Unconformity
- Marine Palynomorph
- Miospores
- Woody debris
- Phytoclast
- Dark Aom
- Transparent Aom



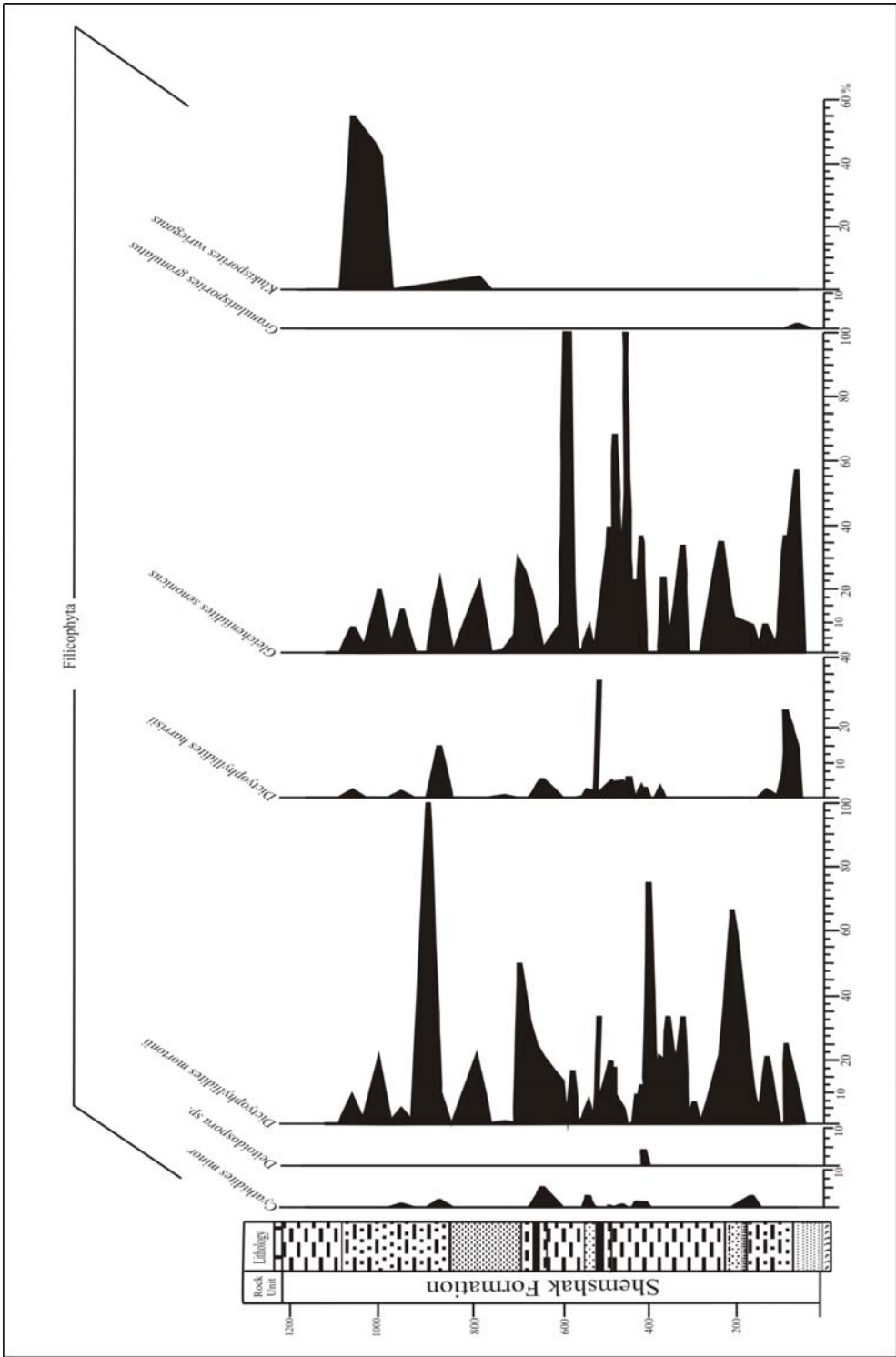
.....

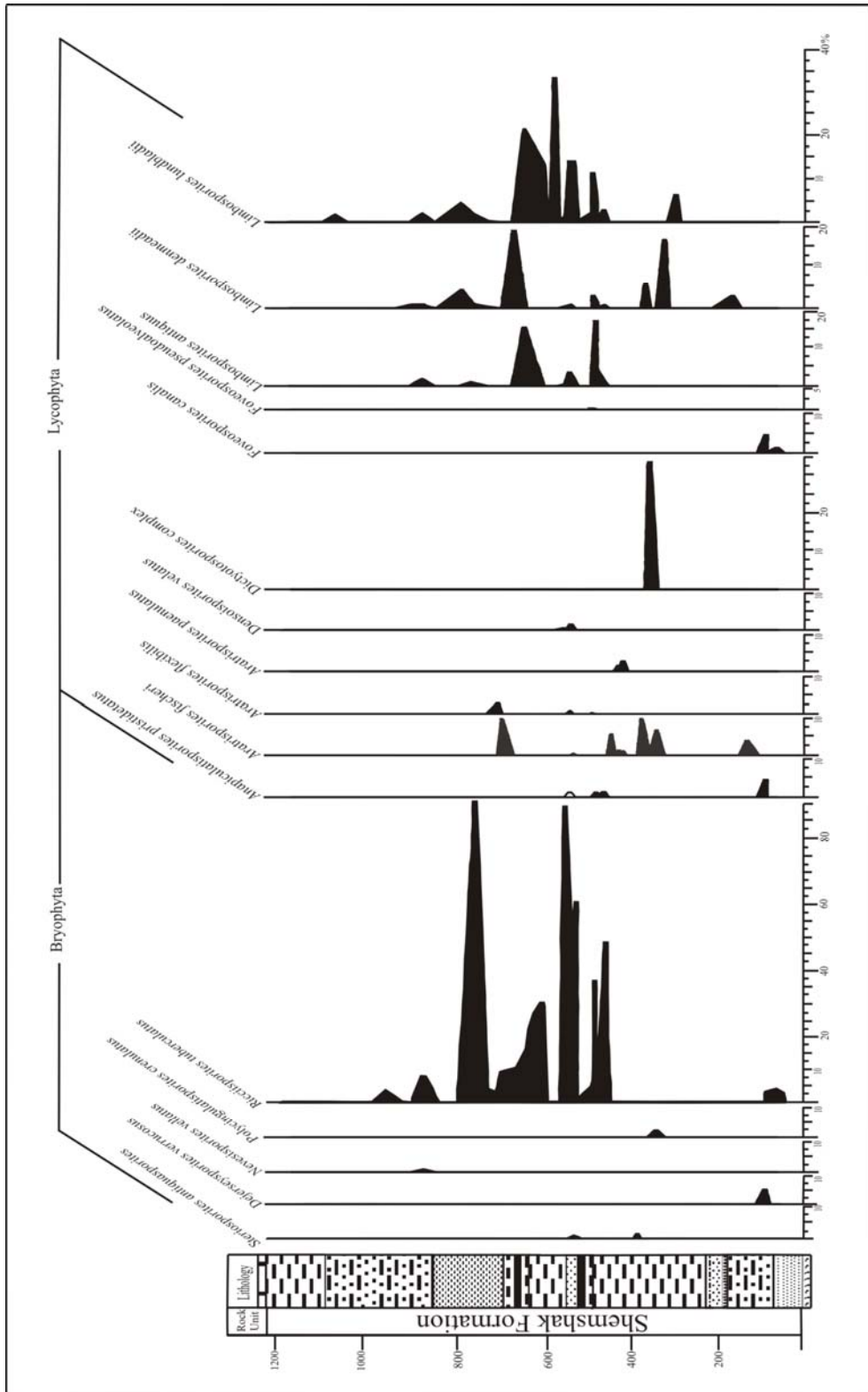


Archive of SID

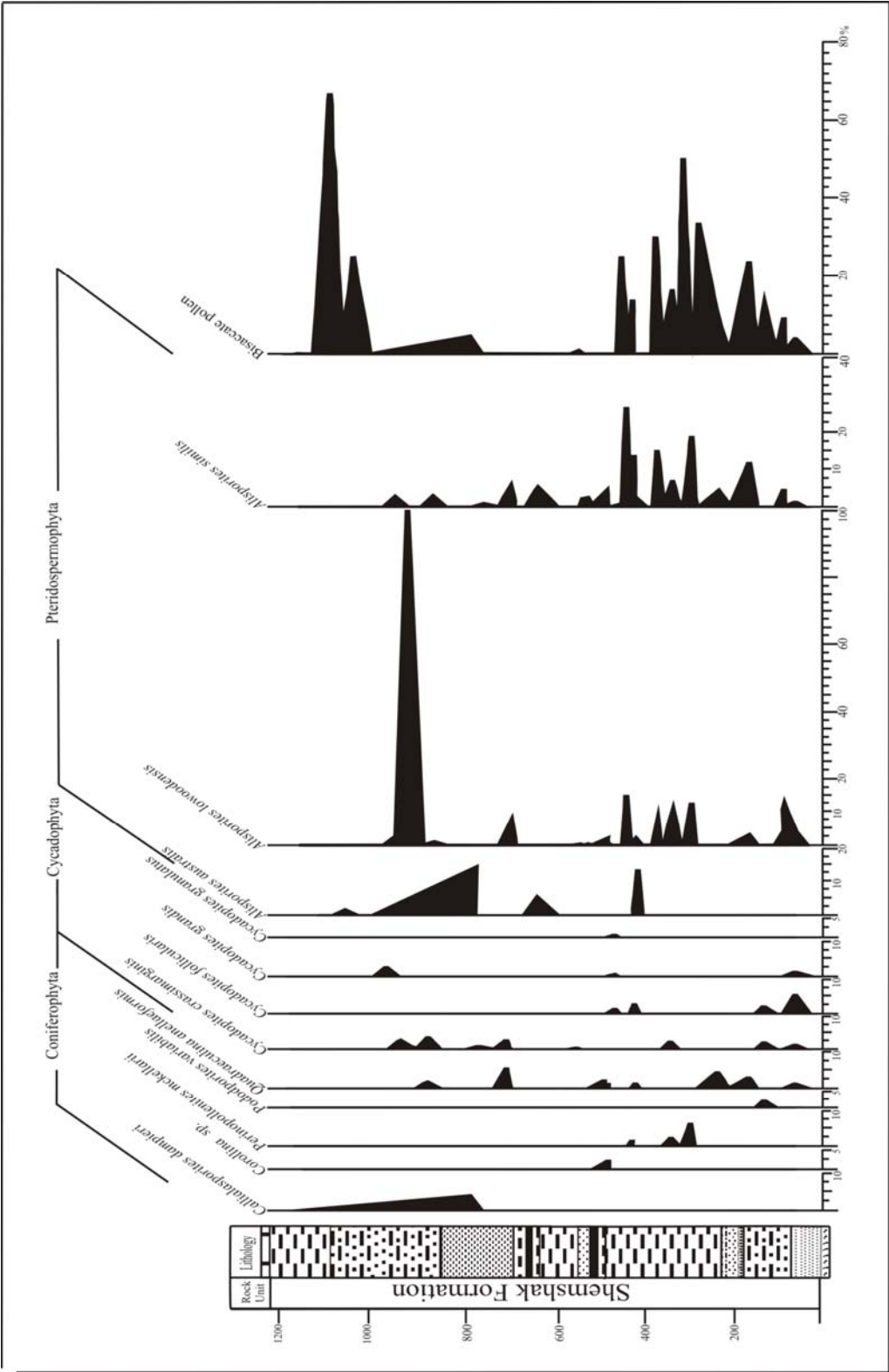
(Van der Zwan 1990; .
Tyson 1995)
) AOM
Ricciisporites () AOM ()
(Schulz 1967) *tuberculatus* %
(Lindström and Erlström 2006) —
Cerebropollenites macrovrrucosus (Tyson 1987, 1989, 1993)
(Schulz 2006) 1967; Lindström and Erlström
Klukisporites variegatus
(Achilles et al. 1984)
(Ashraf 1977)
(Filatoff 1975; McKellar (Tyson
(Couper — 1998) 1987; Van der Zwan 1990; Boulter and Riddick
— 1958; Lam and Porter 1977) () .1986)
(Vigran and Thusu 1975) (*Corollina Ricciisporites*)
()

.....





.....



,Filicophyta

Lycophyta ,Bryophyta

Coniferophyta

Cycadophyta

Sphenophyta

Ricciisporites

Archive of SID

.....

- Barrón, E.; Gómez, J.J.; Goy, A., and Pieren, A.P. 2006, The Triassic – Jurassic boundary in Asturias (northern Spain): Palynological characterisation and facies: *Review of Palaeobotany and Palynology*, v.138, p. 187- 208.
- Boulter, M. C., and A. Riddick, 1986, Classification and analysis of palynodebris from the Palaeocene sediments of the Forties Field: *Sedimentology* v.33, p. 871- 876.
- Brenner, G. J. 1963, The spores and pollen of the Potomac Group of Maryland: Maryland Department of Geology, Mines and Water Resources, Bulletin v.27, 215 p.
- Collinson, M. E. 1996, What use are fossil ferns- "20 years on: with a review of the fossil history of extant pteridophyte families and genera. In: J. M. Camus, M. Gibby, and R. J. Johns (Eds.), *Pteridology in Perspective: Royal Botanical Gardens, Kew*, p. 349- 394.
- Cookson, I. C., and M. E. Dettmann, 1959, Microfloras in bore cores from Alberton West, Victoria: *Proceedings of the Royal Society of Victoria* v.71, p. 31- 38.
- Couper, R. A. 1958, British Mesozoic microspores and pollen grains, a systematic and stratigraphic study: *Palaeontographica*, Abt. B, v.103, p.75- 179.
- Deng, S. 2002, Ecology of the Early Cretaceous ferns of northeast China: *Review of Palaeobotany & Palynology* v.119, p. 93- 112.
- Dettmann, M. E. 1963, Upper Mesozoic microfloras from south-eastern Australia: *Proceedings of the Royal Society of Victoria* v.77, p. 1- 148.
- deJersey, H. J., and M. Hamilton, 1967, Triassic spores and pollen grains from the Moolayember Formation: Geological Survey of Queensland, Publication N. 336, 61 p.
- Achilles, H., H. Kaiser, H. J Schweitzer, and A. Hushmand, 1984, Die Rato-Jurassischen floren des Iran und Afganistans. 7. Die mikroflora der Obertriadisch-Jurassischen Ablagerungen des Alborz-Gebirges (Nord-Iran): *Palaeontographica*. Abt. B 194, p. 14- 95.
- Ashraf, A. R. 1977, Die Rato-Jurassischen Floren des Iran und Afghanistan. 3. Die Mikroflora des Ratischen bis Unterkretazischen Ablagerungen Nordafghanistan: *Palaeontographica* Abt. B 161, p. 1-97.
- Assereto, R. 1966, The Jurassic Shemshak Formation in central Elburz (Iran). *Rivista Italiana di Paleontologia e Stratigrafia*, v.72(4), p. 1133- 1182.
- Balme, B. E. 1957, Spores and pollen grains from the Mesozoic of Western Australia: Commonwealth Scientific and Industrial Research Organization, Australia, Coal Research Section T.C. 25, 48 p.
- Balme, B. E. 1995, Fossil in situ spores and pollen grains: an annotated catalogue: *Review of Palaeobotany and Palynology* v.87 (2-4), p. 81- 323.
- Batten, D. J. 1973, Palynology of Early Cretaceous soil beds and associated strata: *Palaeontology*, v.16 (2), p. 399- 424.
- Batten, D. J., and Lister, J.K. 1988, Evidence of freshwater dinoflagellates and other algae in the English Wealden (Early Cretaceous): *Cretaceous Research* 9, p. 171- 179.
- Batten, D. J., Koppelhus, E. and Nielsen, L.H. 1994, Uppermost Triassic to Middle Jurassic palynofacies and palynomiscellanea in the Danish Basin and Fennoscandian Broder Zone: *Cahiers de Micropaléontologie, Nouvelle Série* 9, p. 21- 45.

- area, Alburz, NE, Iran: Nuova Pagina 1. Abstract v. 112. (3), 1 p.
- Kimyai, A. 1975, Jurassic palynological assemblages from the Shahrud region, Iran: *Geoscience and Man*, v.11, p. 117- 121.
- Lam, K., and R. Porter, 1977, The distribution of palynomorphs in the Jurassic rocks of the Brora Outlier, NE Scotland: *Geological Society of London*, v.134, p. 45- 55.
- Lindström, S., and M. Erlström, 2006, The late Rhaetian transgression in southern Sweden: Regional (and global) recognition and relation to the Triassic – Jurassic boundary: *Palaeogeography, Palaeoclimatology and Palaeoecology*, v.241, p. 339- 372.
- Lundblad, B. 1954, Contributions to the geological history of the Hepaticae. Fossil Marchantiales from the Rhaeto-Liassic coal mines of Skromberga (Prov. of Scania): Sweden. *Svensk Botanisk Tidskrift*. v.48 (2), p. 381-417.
- Mahmoud, M. S., and A. R. M. M. Moawad, 2000, Jurassic-Cretaceous (Bathonian to Cenomanian) palynology and stratigraphy of the West Tiba-1 borehole, northwestern Desert, Egypt: *Journal of African Earth Sciences*, v.30 (2), p. 401- 416.
- Matthiessen, J., M. Kunz-Pirrung, and P. J. Mudie, 2000, Freshwater chlorophycean algae in recent marine sediments of the Beaufort, Laptev and Kara Seas (Arctic Ocean) as indicators of river runoff: *International Journal of Earth Sciences* v.89, p. 470- 485.
- McKellar, J. L. 1974, Jurassic miospores from the upper Evergreen Formation, Hutton Sandstone, and basal Injune Creek Group, north-eastern Surat Basin: *Geological Survey of Queensland*, publication n. 361, 89 p.
- de Jersey, N. J., and J. I. Raine, 1990, Triassic and earliest Jurassic miospores from the Murihiku Supergroup, New Zealand: *New Zealand Geological Survey, Paleontological Bulletin* v.62, 164 p.
- Döring, H., W. Krutzsch, D. H. Mai, and E. Schuls, 1963, Retitriletes. – In: Krutzsch, W. (Ed.): *Atlas der mittel – und jungtertiären dispersen Sporen – und Pollen – sowie der Mikroplanktonformen des nördlichen Mitteleuropas. Lieferung II*, p. 8-18.
- Fakhr, M.S. 1975, Contribution a L'étude de la Flore Rheto- Liasique de la Formation de Shemshak de Lebourz Iran. These, de Doctorat d'état ES-Sciences Naturelles, Uni. Pierre et Marie Curie Paris VI; Publication du Laboratoire de Paleobotanique de l'Universite Paris VI 2, 421 p.
- Filatoff, J. 1975, Jurassic palynology of the Perth Basin, Western Australia: *Palaeontographica*, Abt. B 154, p. 1- 113.
- Filatoff, J. and P. L. Price, 1988, A Pteridacean spore lineage in the Australian Mesozoic: *Memoir of the Association of Australasian Paleontologists* v.5, p. 89- 124.
- Fürsich, F. T., M. Wilmsen, K. Seyed-Emami, F. Cecca, and M. Majidifard, 2005, The upper Shemshak Formation (Toarcian-Aalenian) of the Eastern Alborz (Iran): Biota and palaeoenvironments during a transgressive-regressive cycle, *Facies*, v. 51, p. 365- 384.
- Fürsich F.T., M. Wilmsen, and K. Seyed-Emami 2006, Ichnology of Lower Jurassic beach deposits in the Shemshak Formation at Shahmirzad, southeastern Alborz Mountains, Iran: *Facies*, v.52, p. 599- 610.
- Javadi, F. 2006, Plant Fossil remains from the Rhaetian of Shemshak Formation, Narges-chal

at Tazareh, eastern Alburz: *Journal of Asian Earth Sciences* v.28, p. 259- 275.

-Seyed-Emami K., and M. Wilmsen, 2007, Late Triassic ammonoids from the lower Shemshak Group at Rezaabad, south-southwest of Damghan, northern Central Iran: *Beringeria*, v.37, p. 175-180.

-Shekarifard, A., F. Baudin, J. Schynder, and K. Seyed-Emami (in press), Characterization of organic matter in the fine-grained siliciclastic sediments of the Shemshak Group (Upper-Triassic to Middle Jurassic) in the Alburz Range, northern Iran. In: M. F. Brunet, M. Wilmsen and J. W. Granath, (Eds.), *South Caspian to Central Iran Basins: Geological Society London, Special Publication*, 312 p.

-Shekarifard, A., K. Seyed-Emami, and F. Baudin, 2006, Organic geochemistry and petrography of the Shemshak Formation in the eastern Alburz, northern Iran: *The 24th Symposium on Geosciences, Geological Survey of Iran*, p. 27. Tehran, Iran [abstract].

-Shekarifard, A., K. Seyed-Emami, and F. Boudin, 2007, Hydrocarbon potentials of organic black shales of the Shemshak Formation in eastern and central Alburz, northern Iran: *The 25th Symposium on Earth Sciences, Geological Survey of Iran*, p. 410 [abstract].

-Shekarifard, A., K. Seyed-Emami, F. Baudin, and J. Schnyder, 2007, Organic matter characterization and source rock evaluation of fine-grained siliciclastic sediments from the Shemshak Group, Alburz Range, northern Iran: *International Symposium on Middle East Basins Evolution*, p. 12. Paris [abstract].

-McKellar, J. 1998, Late early to Late Jurassic Palynology, biostratigraphy and palaeogeography of the Roma Shelf Area, northwestern Surat Basin, Queensland, Australia. Ph.D. thesis, University of Queensland, Australia.

-Nilsson, T. 1958, Über das Vorkommen eines mesozoischen Sapropelgesteins in Schonen: *Lunds Universitets Arsskrift* 2, 54, 112 p.

-Phipps, D., and G. Playford, 1984, Laboratory techniques for extraction of Palynomorphs from sediments: *Department of Geology, University of Queensland, Papers*, v.11 (1), p. 1- 23.

-Playford, G., and M. E. Dettmann, 1965, Rhaeto-Liassic plant microfossils from the Leigh Creek Coal Measures, South Australia, *Senckenbergiana Lethaea*.v.46 (2-3), p. 127- 181.

-Playford, G., and M. E. Dettmann, 1996, "Spores". In: Jansonius, J. & McGregor, D.C. (Eds.): *Palynology: principles and applications: American Association of Stratigraphic Palynologists Foundation*, v.1, p. 227- 260.

-Rad, F. K. 1986, A Jurassic delta in eastern Alburz, NE Iran: *Journal of Petroleum Geology*, v.9(3) p. 281- 294.

-Schulz, E. 1967, Sporenpaläontologische Untersuchungen rätoliassischer Schichten im Zentralteil des Germanischen Beckens: *Palaontologische Abhandlungen. B*, v.2 (3), p. 545- 633.

-Seyed-Emami, K., F. T. Fürsich, M. Wilmsen, M. R. Majidifard, F. Cecca, and A. Shekarifard, 2006, Stratigraphy and ammonite fauna of the upper Shemshak Formation (Toarcian-Aalenian)

Field, offshore mid Norway: Review of Palaeobotany and Palynology v.62, p. 157- 186.

-Van Konijnenburg-Van Cittert, J. H. A., 2002, Ecology of some Late Triassic to Early Cretaceous ferns in Eurasia: Review of Palaeobotany and Palynology, v.119, p. 113- 124.

-Vigran, J. O., B. Thusu, 1975, Illustrations and identifications of the Jurassic palynomorphs of Norway: Royal Norwegian Council for Scientific and Industrial Research, Continental Shelf Division, Publication v.65, 55 p.

-Villar de Seoane, L. 1999, Estudio comparado de *Cyathea cyathifolia* comb: Nov. del Cretacico inferior de patagonia, Argentina. Rev. Esp. Paleontol. v.14, p. 157- 163.

-Zavattieri, A.M., U. Rosenfeld., and W. Volkheimer, 2008, Palynofacies analysis and sedimentary environments of Early Jurassic coastal sediments at the southern border of the Neuquen Basin, Argentina: Journal of South American Earth Sciences. v. 25, p. 227- 245.

-Skarby, A. 1964, Revision of *Gleicheniidites senonicus* Ross: Acta Universitatis Stockholmiensis, Stockholm Contributions in Geology v.11, p. 59- 77.

-Tidwell, W. D., and S. R. Ash, 1994, A review of selected Triassic to Early Cretaceous ferns: Journal of Plant Research v.107, p. 417- 442.

-Tyson, R. V. 1984, Palynofacies investigations of Callovian (Middle Jurassic) sediments from DSDP Site 534, Blake-Bahama Basin, Western Central Atlantic: Marine and Petroleum Geology v.1, p. 3- 13.

-Tyson, R. V. 1987, The genesis and palynofacies characteristics of marine petroleum source rocks. In: Brooks, J., Fleet, A.J. (Eds.), Marine Petroleum Source Rocks, Geological Society Special Publication v.26, p. 47- 67.

-Tyson, R. V. 1989, Late Jurassic palynofacies trends, Piper and Kimmeridgian Clay Formation, UK onshore and offshore. In: D.J. Batten and M.C. Keen (Eds.), Northwest European Micropalaeontology and Palynology, British Micropalaeontological Society Series, Ellis Horwood, Chichester, p. 135- 172.

-Tyson, R. V. 1993, Palynofacies analysis. In: D. G. Jenkins (Ed.), Applied Micropalaeontology, Kluwer Academic Publishers, Dordrecht, p. 269.

Tyson, R. V. 1995, Sedimentary organic matter: Organic facies, and palynofacies. Chapman and Hall, London, 615 p.

-Vakhrameev, V. A. 1991, Jurassic and Cretaceous Floras and Climates of the Earth: Cambridge University Press, Cambridge, 318 p.

-Van der Zwan, C. J. 1990, Palynostratigraphy and palynofacies reconstruction of the Upper Jurassic to lowermost Cretaceous of the Dragen

Plate 1

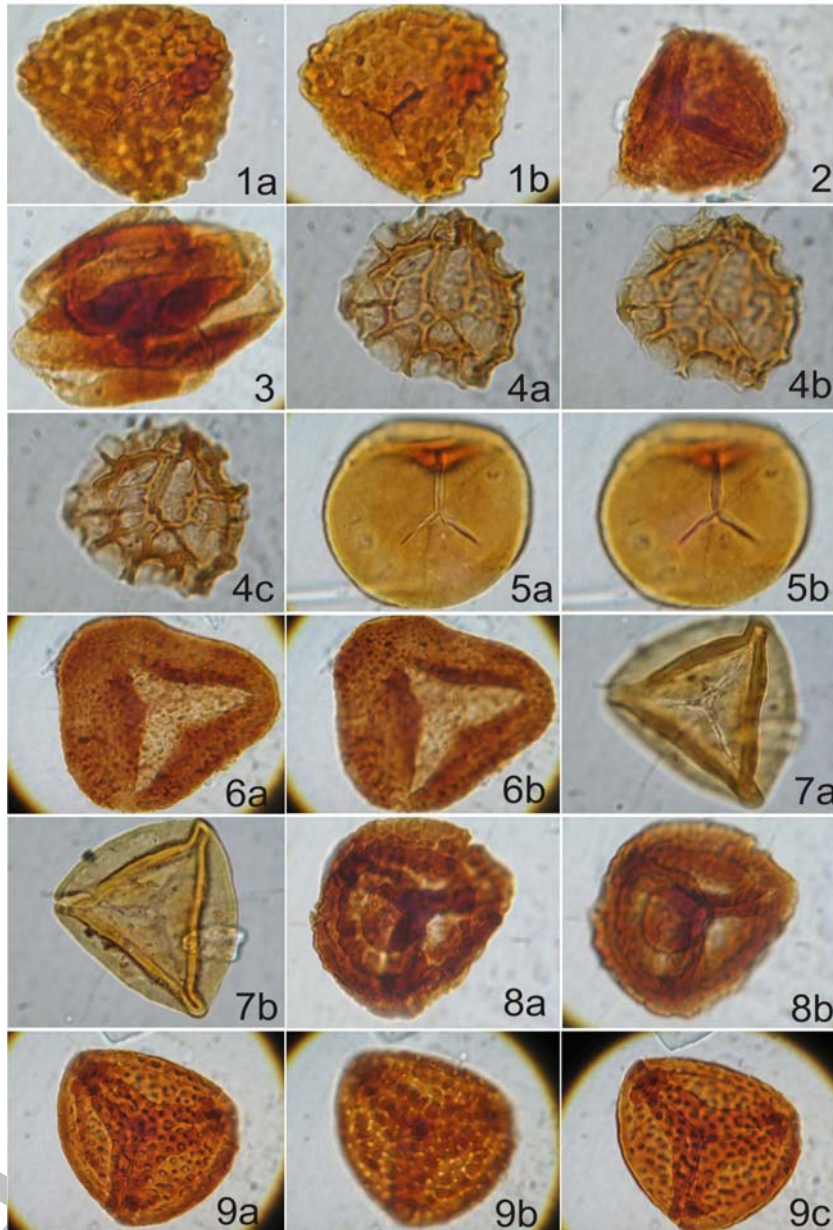


Plate 1

Fig. 1: *Klukisporites variegatus* Couper, 1958, 1a, Proximal focus x1000. 1b, Distal focus x1000, slide 66/1. Fig. 2: *Foveosporites pseudoalveolatus* (Couper) McKellar, 1998, Proximal focus x1000, slide 34/1. Fig. 3: *Ricciisporites tuberculatus* Lundblad, 1954, Proximal focus x600, slide 34/1. Fig. 4: *Retitriletes clavatooides* (Couper) Döring, Krutzsch, Mai & Schulz, 1963, 4a, 4c, Distal foci x1000, 4b, Proximal focus x1000, slide 41/2. Fig. 5: *Todisporites major* Couper, 1958, 5a, Proximal focus x1000. 5b, Distal focus x1000, slide 66/2. Fig. 6: *Concavissimisporites punctatus* (Delcourt & Sprumont) Brenner, 1963, 6a, Proximal focus x1000. 6b, Distal focus x1000, slide 26/1. Fig. 7: *Dictyophyllidites mortonii* (de Jersey) Playford & Dettmann, 1965, 7a, Proximal focus x1000. 7b, Distal focus x1000, slide 66/2. Fig. 8: *Polycingulatisporites crenulatus* Playford & Dettmann emend. McKellar, 1974, 8a, Distal focus x1000. 8b, Proximal focus x1000, slide 16/1. Fig. 9: *Foveosporites canalis* Balme, 1957, 9a, Proximal focus x1000. 9b, Median focus x1000. 9c, Distal focus x1000, slide 1/1.

Plate2

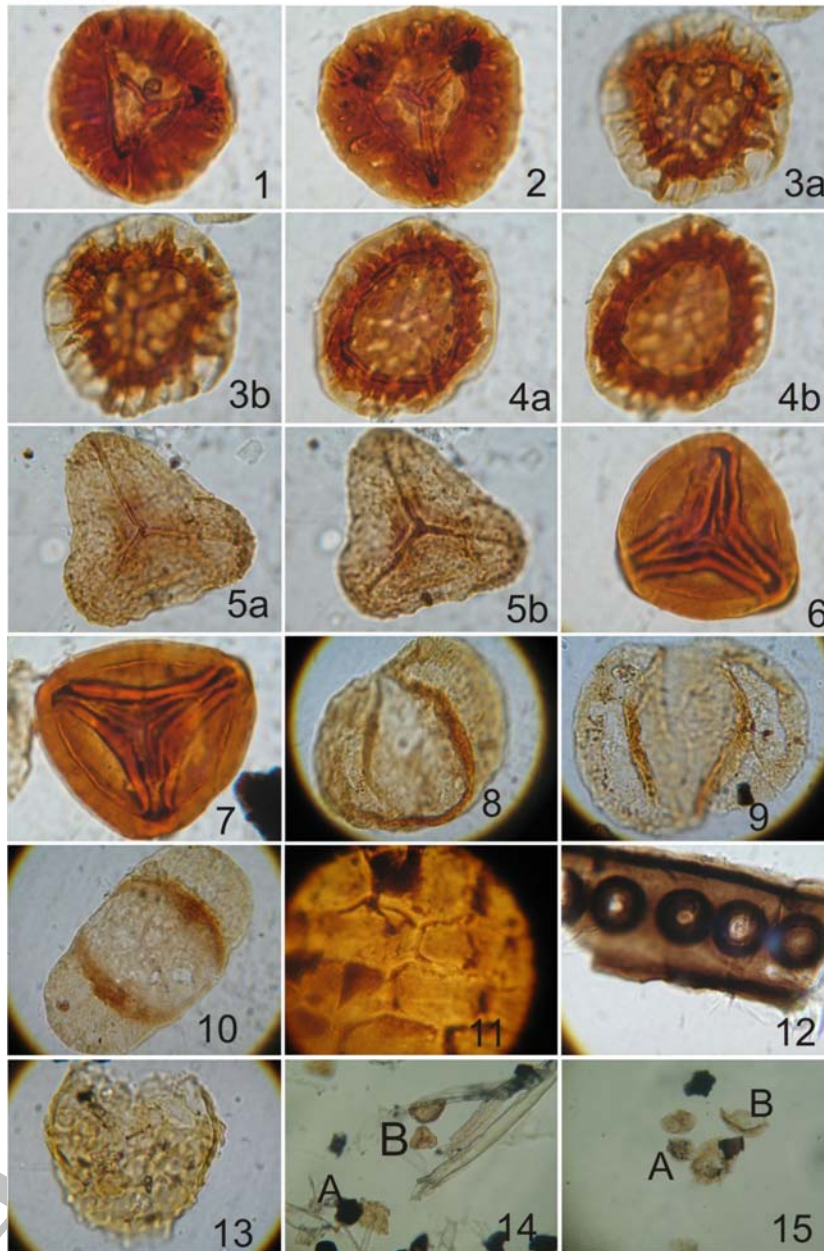


Plate 2

Figs. 1, 2: *Limbosporites denmeadii* (de Jersey) de Jersey & Raine, 1990: Proximal foci x1000, slide 34/1. Fig. 3: *Limbosporites lundbladii* Nilsson, 1958, 3a, Proximal focus x1000. 3b, Distal focus x1000, slide 34/1. Fig. 4: *Limbosporites antiquus* (de Jersey, 1964) de Jersey & Raine, 1990, 4a, Proximal focus x1000. 4b, Distal focus x1000, slide 34/1. Fig. 5: *Trachysporites infirmus* (Balme) McKellar, 1998, 5a, Proximal focus x1000. 5b, Distal focus x1000, slide 26/1. Figs. 6, 7: *Gleicheniidites senonicus* Ross emend. Skarby, 1964, Proximal foci x1000, slide 34/2. Figs. 8, 9: *Sulcosaccispora lata* de Jersey & Hamilton 1967, x1000, slide 41/1, 59/1 respectively. Fig. 10: *Alisporites similis* (Balme) Dettmann, 1963, x1000, slide 11/1. Fig. 11: Woody debris, x1000, slide 13/1. Fig. 12: Plant tissue x1000, slide 54/1. Fig. 13: Dinoflagellate cyst, x1000, slide 66/1. Fig. 14: (A) Phytoclasts, (B) Palynomorph, x160, slide 31/1. Fig. 15: opaque (A) and transparent (B) Aom, x160, slide 34/1.