DEPARTMENT OF MINES
SOUTH AUSTRALIA

REAPPRAISAL OF SOME PALYNOMORPHS OF SUPPOSED PROTEACEOUS AFFINITY

III THE GENUS *PROTEACIDITES* Cookson *ex* Couper

by

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CONTENTS

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ANTHONY R.H. MARTIN AND WAYNE K. HARRIS

Martin, A.R.H., & Harris, W.K: Reappraisal of some palynomorphs of supposed proteaceous affinity. III The genus *Proteacidites* Cookson ex Couper.

The upper Cretaceous and Tertiary palynomorph *Proteacidites* Cookson ex Couper 1953, is shown to be morphologically inhomogeneous. Two new genera, *Postatriotriorites* and *Cranwellipollis* are proposed, to receive certain species excluded from *Proteacidites* and *Proteacidites* is emended. The propriety of ascribing all species of *Proteacidites* (and the two new genera) to the family Proteaceae is briefly discussed. The natural affinity of many dispersed pollen remains in doubt.

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Introduction

The palynomorph genus *Proteacidites* Cookson ex Couper 1953 (type *P.adenanthoides* Cookson 1950) was defined as "free, isopolar or subisopolar, triorate, occasionally diorate. Grain triangular to sub-triangular, sides concave to convex between ora in polar view. Exine clearly differentiated into nexinous and sexinous layers. Sexine baculate, clavate or tuberculate, forming a very variable pitted-reticulate, reticulate or pseudoreticulate sculpture in surface view". Couper (1953) comments: "This genus is proposed for the reception of fossil pollen of proteaceous affinities which cannot be more accurately placed." In this way was perpetuated a situation in which a plexus of forms with very little morphological coherence was given a common generic name because of "affinity".

In Part I of this series, the issue has been discussed of the propriety of accepting the occurrence of *Proteacidites* and other "proteaceous" palynomorph genera as evidence of the family Proteaceae (Martin 1972) the conclusion being reached that identity with the family should not be taken for granted. Such acceptance runs the risk of falling into the same error as was committed many years ago when, on the basis of leaf form, (at that time very insecure), genera such as *Quercus L.*and *Salix L.* were identified world-wide in Tertiary sediments.

A first step towards a more critical approach to the problem would be the clearer definition of the genus *Proteacidites*. The comparison of *Proteacidites hakeoides* Couper with the alliance of species clustered round *P.adenanthoides* and the realisation that the diagnostic value of the structure of the aperture had been hitherto neglected (Martin 1972) led to the authors' belief that the, by now, cumbersome genus might reasonably be subdivided on the basis of apertural morphology into better define morphographic genera. It then eventuated that both present authors had been thinking along closely parallel lines and a joint paper was decided on.

Three main types of structure can be isolated; these are shown in Fig. 1 and 2. These types may be described as the *P.adenanthoides* type (cf. Fig. 1a) the *P.reticuloscabratus* type and the *P.palisadus* type (Fig. 1c). The re-examination of the great majority of the species defined by Cookson (1950) and of many of the New Zealand species defined by Couper(1960) and those defined by Harris (1965,1972) and Stover & Partridge (1973), convinces us that subdivision is feasible. Grain shape and exine sculpture alone, on the other hand are unrealiable bases for generic diagnoses. Two new genera are here proposed and *Proteacidites* is emended.

PROTEACIDITES Cookson *ex* Couper 1953 *emend.*

Type species - *P.adenanthoides* Cookson, Aust.J.Sci.Res.B3(2), 1950, 172-3, Pl.2, fig.21.

Emended diagnosis - Pollen grains triporate; triquetrous, semi-lobate, subangular or semi-angular in polar view; oblatoid or ± psilate, with obvious columellae, simpli- to pluri-columellate*; angulaperturate; pores sometimes facing obliquely into

proximal hemisphere, circular or nearly so, not annulate and without postatria; ektexine marginally incurved over more or less protruding or more rarely truncate aperture; endexine thick or tapering into aperture, smooth internally or if slightly irregular then foveolate in a narrow zone round the pore. Size of grain small to rather large or large.

* *Columella*. The term "baculum", used by Erdtman, 1966, to mean structures both above and below the tectum (=tegillum) is confusing. We follow Faegri & Iversen who use "columella" (a little column) for supporting rods below the tectum. However, Faegri & Iversen have no term in their system corresponding to unibaculate and duplibaculate. The corresponding terms simpli-columellate and pluri-columellate, proposed here, repair this deficiency.

Content - Included in the genus are: *P.alveolatus* Stover 1973; *P.confragosus* Harris 1972; *P.crassus* Cookson 1950; *P.franktonensis* Couper 1960; *P.fromensis* Harris 1972; *P.grandis* Cookson 1950; *P.hakeoides* Couper 1960; P.isopogoniformis Couper 1960; *P.incurvatus* Cookson 1950; *P.leightonii* Stover 1973; *P.ornatus* Harris 1965; *P.pachypolus* Cookson & Pike 1954; *P.polymorphus* Couper 1953; *P.protrudens* Sah & Kar 1970; *P.pseudomoides* Stover 1973; *P.recavus* Partridge 1973; *P.rectomarginis* Cookson 1950; *P.reflexus* Partridge 1973; *P.retiformis* Couper 1960; *P.similis* Harris 1965: *P.stipplatus* Partridge 1973; *P.symphyonemoides* Cookson 1950; *P.tenuiexinus* Stover 1973; *P.truncatus* Cookson 1950; *P.wilkatanaensis* Harris 1972; probably *P.obscurus* Cookson 1950, (the exine of which appears unusual in that the ectexine strips off easily except in a narrow zone round the pore) and the unnamed species from the Comaum bore,

mentioned in connection with the pore structure of *P.hakeoides* (Martin, 1972).

Affinity - Some of these grains have been closely compared with members of the family Proteaceae, especially the tribes Proteeae and Persoonieae of sub-family Proteoideae. Resemblances have been indicated in several cases by allusion in the specific epithet (e.g. *Symphyonema* R.Br, *Isopogon* R.Br. ex Knight, *Adenanthos* Labill.) The pore structure of *P.recto-marginis* though unusual, is closely like that of some Western Australian species of *Petrophile* R.Br.ex Knight. However, one should not conclude that all these species are true Proteaceae.

The botanical relationships of others is doubtful and not known to be matched in any existing family.

POSTATRIOTRIORITES gen.nov.

Type species - Postatriotriorites reticuloscabratus (Harris) comb.nov., Palaeontographica, 115B (4-6) 1965: p.93,Pl.28, figs. 20,21.

Diagnosis -Pollen grains triporate; semilobate, sub-angular or semi-angular in polar view: oblate or oblatoid, isopolar in equatorial view; exine scabrate, rugulate or reticulate, simplicolumellate or pluricolumellate,

muri narrower or wider than lumina, sometimes also gemmate or spinulose; angulaperturate, pore with post-atrium which is often internally foveolate or striate (with radiating costae pori), pores frequently also annulate.

Content. - The species provisionally included in the genus are:

Postatriotriorites (al.*Proteacidites*) *annularis* comb.nov. (Cookson 1950, p.170, Pl.1,fig.15) *P.*(al.*Proteacidites*) *asper* comb.nov. (Samoilovich, *in* Samoilovich et al. 1961, p.174, Pl. 54 fig.1)

P.(al.*Proteacidites*) *asperatus* comb.nov. (McIntyre 1968, p.194, figs. 51-53).

P. (al.*Proteacidites*) *auratus* comb.nov. (Srivastava 1969, p.1574, Pl.1, fig. 12)

P. (al.*Proteacidites*) *beddoesii* comb.nov. (Stover, in Stover & Partridge 1973, p.pl.10)

P.(al.*Proteacidites*) *concretus* comb.nov. (Harris 1972, p.58, figs. 48,49)

P. (al.*Proteacidites*) *dehaanii* comb.nov. (Germeraad et al. 1968, p.312, Pl.9 figs 3,4)

P. (al. *Proteacidites*) *latrobensis* comb.nov. (Harris 1966, p.332)

P. (al.*Proteacidites*) *magnus* comb.nov. (Samoilovich 1961, p.175, P154, fig.3)

P. (al.*Proteacidites*) *minimus* comb.nov. (Couper 1954, p.479, text fig. 1 & Fig. 1.)

P. (al.*Proteacidites*) *parvus* comb.nov. (Cookson 1950, p.175, Pl.3, fig. 29).

P.(al.*Proteacidites*) *scaboratus* comb.nov. (Couper 1960,p.52, Pl.5 fig.22,23).

P. (al.*Proteacidites*) *tripartitus* comb.nov. (Harris 1972, p.56, figs. 23-25).

P. (al.*Proteacidites) tuberculiformis* comb.nov. (Harris 1965, p.92, Pl.29 fig.5)

P.(al.*Proteacidites) tumidiporus* comb.nov. (Samoilovich 1961, p.170, Pl.51 fig.3, Pl.52 fig.1.).

Affinity:- The relationships of many of these grains appears to be to certain genera of Proteaceae in the tribes Macadamieae, Embothrieae, Grevilleeae, and Oriteeae, to the pollen of which they bear a resemblance, eg. *P.annularis, P. reticuloscabratus* (see Martin, 1972, Pl. ,fig.2 *Macadamia* F.v M.). However, various genera of Icacinaceae, Sapindaceae, and isolated genera of other families have sculptured pollen which is triporate and has a quasivestibular structure such as an atrium or postatrium. *P.dehaanii* could quite easily be a species of *Allophylus* L. *P.asper, P.magnus* and *P.tumidiporus* are accepted hesitantly, as their apertures appear generally "notched", a feature unusual for Proteaceae, and absent in other species of *Postatriotriopites*.

CRANWELLIPOLLIS gen.nov.

Synonomy - 1953 Proteacidites Cookson *ex* Couper (in part)

Type species: Cranwellipollis palisadus (Couper 1953) comb. nov. Paleont. Bull., Wellington, 22, pp.42-43, Pl.5, fig. 54; also Couper 1960: *ibid* 32 p.49, pl.5, fig.17.

Diagnosis: Pollen grains triporate: sub-angular or semi-angular in polar view, sub-oblate, oblate or oblatoid in equatorial view, isopolar or paraisopolar; exine scabrate, verrucose, pilate, spinulose or baculate; columellate; angulaperturate, amb smoothly rounded at pore, not protruding; pores more or less circular, without annulus or postatrium, endexine and ektexine uniform in thickness to

pore margin, endexine thicker than ektexine.

Content - *Cranwellipollis* (al. *Proteacidites) subpalisadus* comb.nov. (Couper 1953, p.43, Pl.5 fig. 55)

*C. (*al.*Proteacidites) spiniferus* comb.nov. (McIntyre 1968, p.195, figs. 62-63)

*C.(*al.*Proteacidites) tortuosus* comb.nov. (Harris 1972, p.57, figs. 28,29 figs. 12-14)

*C. (*al. *Proteacidites) tuberculatus* comb.nov. (Cookson 1950, p.170, figs. 12-14)

Affinity: The relationship of these grains is doubtful. Scabrate and other types of ornamental exine occur in triporate, non-atriate grains in a number of non-proteaceous genera. There is a possibility that *C.palisadus* and *C.subpalisadus* lack a tectum whereas *C.tuberculatus* has a definite tectum; the presence or absence of this feature could be reasonable grounds for subdividing the genus further. With the possible exception of *Franklandia* R.Br. non-tectate pollen grains are unknown in Proteaceae. *C.palisadus* and *C.subpalisadus* bear at least a superficial resemblance, however, to *Placospermum* C.T. White et Francis and some species of *Persoonia* Sm. in the Tribe Persoonieae of Proteaceae while *C.spiniferus* resembles *Oreocallis* R.Br. in the Tribe Embothrieae.

Excluded species and species insufficiently known

Species described as *Proteacidites* but which have not been seen by us or for which insufficient evidence exists to warrant ascription to any of the above genera are listed below.

Proteacidites thalmannii Anderson 1960. This form has short colpi and must therefore be excluded from *Proteacidites*.

Proteacidites retusus Anderson 1960. This is described as possessing an endannulus and vestibule (text fig. 1b). It appears closer in affinity to brevicolpate forms described elsewhere as *Labrocolpoidites* (Martin 1972) or to *Symplocoipollenites* Potonie, 1951.

Proteacidites crassiporus Samoilovich 1961 appears to have the same pore structure as the genus *Oculopollis* Thomson & Pflug.

Proteacidites egerensis Nagy 1963. The species was founded on a single (corroded?) specimen and requires more study.

Proteacidites isopogonoides Stel'mak 1960 is compared by its author, to *P.truncatus* Cookson. The description and illustration alone do not permit one to judge.

Proteacidites bakkeri Thiergart, Frantz, & Raukopf 1962. Description and illustration inadequate; requires further study.

Proteacidites amolosexinus Dettman & Playford 1968. The description of the exine suggests that a form somewhat like *Cranwellipollis* is involved. The more or less everted pore does not fit this genus however. Pending an examination of the species, we prefer not to make any alteration in its attribution.

Proteacidites africanus Sah 1967. The type specimen has demi-colpoids on one face and is closely comparable to *Cardio-sperm* L.

Proteacidites terrazum Rouse 1962, appears to be close to *P.retusus* and *P.thalmannii*. Its author states that it was first referred to *Symplocos*, and the precise reasons for its reappraisal as *Proteacidites* are not clear.

The presence of annuli, transverse costae and very short colpoids must exclude it from *Proteacidites* and place it close to *Labrocolpoidites*.

Proteacidites longispinosus Jardin & Magloire 1963. The form and ornamentation do not recall the family Proteaceae very closely. The authors suggest morphological affinity to *Triorites spinosus* Couper 1954, and seem to imply a taxonomic affinity with Solanaceae of Tilicaeae.

Proteadicites tienabarensis Jardine & Magliore 1963. The notched appearance of the rather indistinct but protruding pore, seems to distinguish this form from *Proteacidites*, *Postatriotriorites*, *Cranwellipollis* or *Labrocolpoidites*, though it is something like *P.amolosexinus*, and some other Upper Cretaceous forms. Its attribution to *Proteacidites*, like that of these latter species, should be very provisional.

Discussion

Many of the described palynomorphs included in *Postatriotrioites*, *Cranwellipollis* and *Proteadicites* are undoubtedly true Proteaceae. It has been shown above that *Proteacidites* may be subdivided so as to correspond better

with real pollen morphological differences between the taxa, but it is not possible to define these so as to exclude palynomorphs from sources other than Proteaceae. Nor is it desirable to do so; the only criterion for definition of a palynomorph species ought to be its own morphology. Hence there must always be some doubt whether a given taxon represents a particular natural family of plants. Where an element of geographical unlikelihood is involved, where macro-fossils of the family have never been convincingly substantiated, and in strata as old as the Cretaceous, in which very few angiospermous fossils can be identified to family level, this doubt should be kept well in mind.

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Explanation to figures

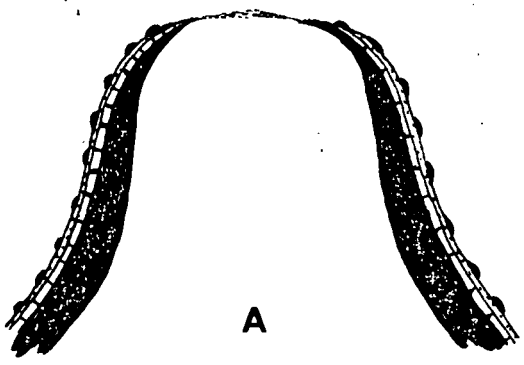
Fig.1 Aperture types in Proteacidites & its allies (scale diagrammatic).

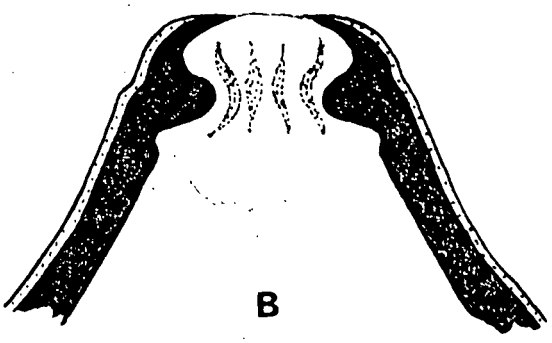
A. Proteacidites type as in P.incurvatus. B.Postatriotriorites type as in P.annularis C. P.concretus. D. P.latrobensis. E. Construction of pore of Proteaceae with post-atrium (e.g. Hickensbeachia), and of Postriotriorites. F. Cranwellipollis type.

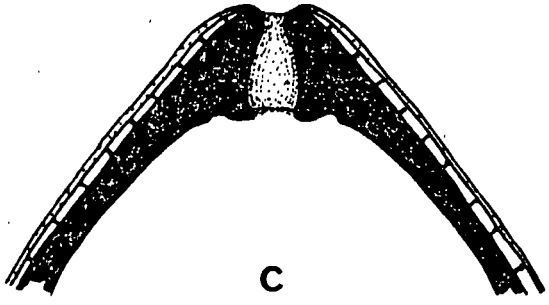
Fig.2 Proteacidites kopiensis x 1000. B. Proteacidites incurvatus x 1000, Nomarski differential interference contrast.

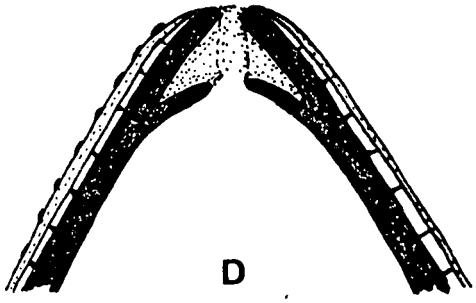
Fig.3 A and B. Postatriotriorites annularis x 1000. B. in Nomarski differential interference contrast. C and D. Postatriotriorites latrobensis x 1000. D. in Normarski differential interference contrast. E. Postatriotriorites reticuloscabratus x 7500. F. Postatriotriorites concretus x 750.

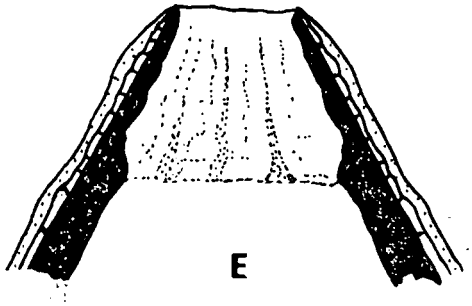
Fig.4 A. Cranwellipollis sp. x 750. B. Cranwellipollis tortuosus x 750.











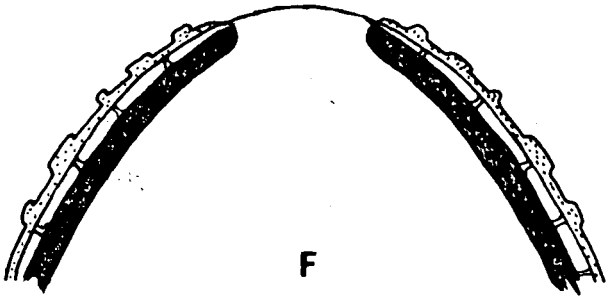


FIG. 1.

	DEPARTMENT OF MINES – SOUTH AUSTRALIA	Scale: Diag.
Compiled: W.K.H.	APERTURE TYPES IN *Proteacidites* & ITS ALLIES	Date: 4 · 6 · 73
Drn. W.K.H. | Ckd.		Drg. No. S 10340

300–6.72 C5552

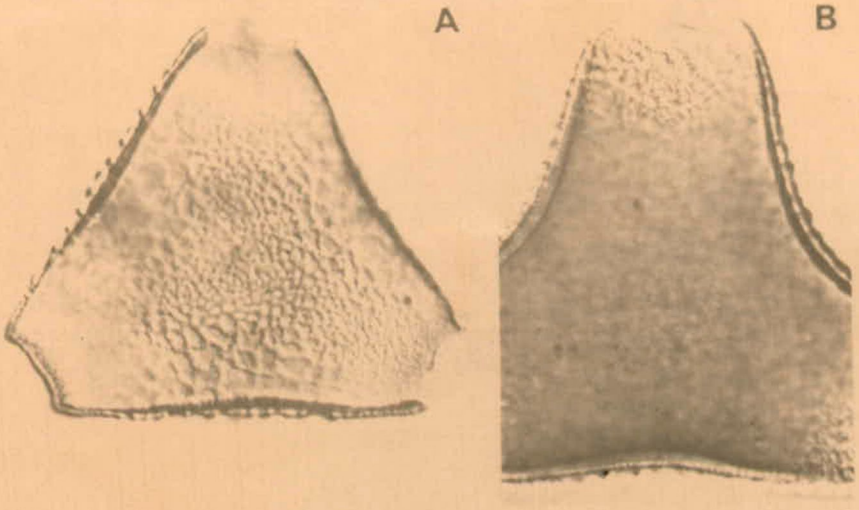


FIG. 2

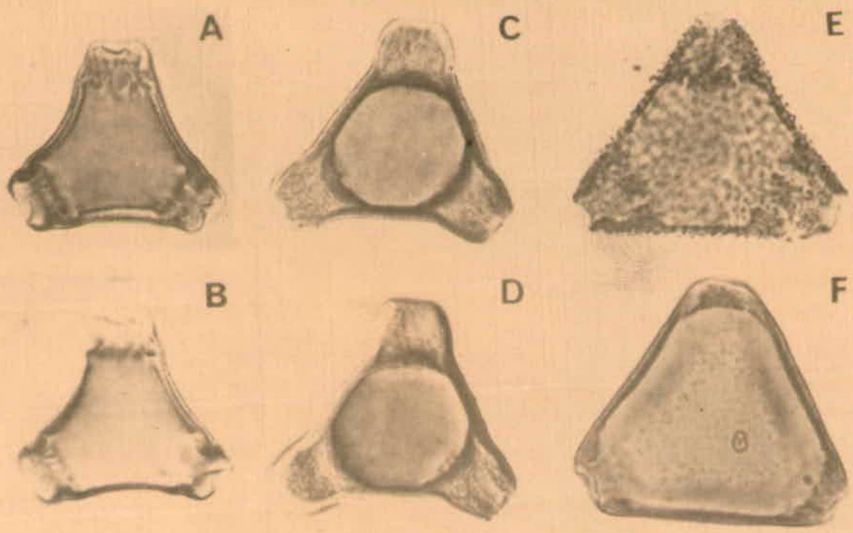


FIG. 3

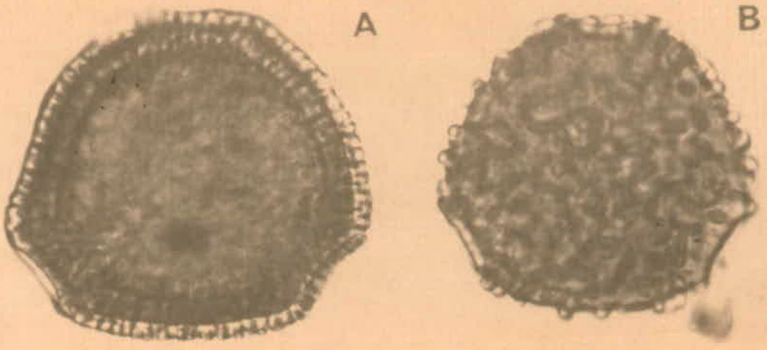


FIG. 4