

## REALLOCATION OF SOME DINOFLAGELLATE CYSTS FROM KUTCH, WESTERN INDIA

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### ABSTRACT

A revision, based on there-examination of the type and figured specimens of the dinoflagellate cyst assemblage described by Kar (1979) from the Oligocene sediments of Kutch, Western India, has been made. The revised dinocyst flora comprises of *Operculodinium centrocarpum*, *Tuberculodinium vancampoe*, *hemicystodinium* sp. cf. *congregatum*, ?*Sumatradinium* sp., *Cordosphaeridium* sp. and *Spiniferites ramosus* subsp. *granosus*. The new taxa proposed by Kar (1979) viz., *Polysphaeridium* (*Hystrichosphaeridium*) *microtriainum* (Klumpp) Kar, *Polysphaeridium cephalum* Kar and *Membranilarnacia delicata* Kar have been found to be junior synonyms of the known species and the names are therefore rejected. The holotype of *Fromea pachyderma* Kar possess a distinct trilete mark, it is a pteridophytic spore and not a dinocyst.

### INTRODUCTION

Recently Kar (1977, 1979) published two important papers on the palynostratigraphy of the Maniyara Fort Formation (Oligocene) in the district of Kutch, western India. The palynological assemblage consists of fungal and pteridophytic spores, gymnosperm and angiosperm pollen grains and microplankton (dinoflagellate cysts). The palynomorphs were recovered from the surface samples of different exposures viz., at the type locality of Ramania Stage (Lower Oligocene) of Biswas & Deshpande (1970), situated on the southern side of the eastern gate of the reservoir in the Sarangwara village; at the southern side of the village Sarangwara in the Barkhana nala cut (Upper Oligocene); and at the nala, besides the dilapidated fort of Maniyara (Upper Oligocene). The productive samples were only carbonaceous shales and shale partings.

The author, while going through the text of the paper (Kar, 1979), found some disagreement between the descriptions and the illustrations of the dinocysts. This led the author to re-examine the holotypes and other figured specimens referred to various dinoflagellate taxa. The re-examination of the figured specimens (Kar, 1979, pl. 1, figs. 63—75) has been made on Carl Zeiss Jena Amplival microscope. To support the observations some new photographs of the figured specimens (Kar, 1979) have been reproduced (see Pl. I—1-14).

The dinoflagellate taxa referred by Kar (1977) viz., *Polysphaeridium microtriainum*, *Polysphaeridium cephalum* and *Membranilarnacia delicata* possess no authorship. However, his subsequent publication (1979) clarified their status as new combination and new species. In the light of the present study the taxonomic position of these names (Kar, 1977) remains doubtful and unestablished, thus are not

included under the list of synonymy of various species referred in the following systematic palynology.

### SYSTEMATIC PALYNOLOGY

#### *Dinoflagellate cysts*

Genus *Operculodinium* WALL, 1967

*Operculodinium centrocarpum* (DEFLANDRE & COOKSON)  
WALL, 1967  
(Pl. I—2-5 & 11-12)

1979 *Polysphaeridium* (*Hystrichosphaeridium*) *microtriainum* (Klumpp) Kar; p. 33; pl. 4, figs. 63A-B & 64.

1979 *Membranilarnacia delicata* Kar, p. 35; pl. 4, fig. 70.

*Description*: Cyst body subspherical,  $44 \times 51 \mu\text{m}$  in size, endophragm and periphragm appressed. No parasutural features, surface covered with non-tabular processes measuring 6.2 to  $7.8 \mu\text{m}$  in length, capitate, distally closed, tips bear hooklets, base conical with minute striations; areas between processes granulate. Archaeopyle broadly triangular, precingular.

*Remarks*: The triangular shape of the archaeopyle in the present specimen suggests removal of precingular plate. *Polysphaeridium* possesses an apical archaeopyle.

Stover & Evitt (1978, p. 147) treated "C" *microtriaina* (Klumpp, 1953) Eisenack (1963) as a problematic species suggesting that it may be conspecific with forms subsequently described as *Hystrichosphaeridium pseudorecurvatum*.

The holotype of *Membranilarnacia delicata* Kar (pl. 4, fig. 70) does not possess any distal translucent membrane or apical archaeopyle. It has been transferred to *Operculodinium centrocarpum*. The former name should be rejected.

*O. centrocarpum* is a long ranging species. It ranges from Upper Cretaceous to Recent (Eaton, 1976).

*Operculodinium* sp.

1979 *Polysphaeridium cephalum* Kar; p. 34, pl. 4, fig. 67.

*Description* : Cyst subspherical, 50  $\mu\text{m}$  in diameter, distorted, periphragm covered with short, 4-5  $\mu\text{m}$  long processes, distally capitate, base circular, distance between processes coarsely granulate. Archaeopyle precingular.

Genus *Tuberculodinium* WALL, 1967

*Tuberculodinium vancampoae* (ROSSIGNOL) WALL, 1967  
emend. WALL AND DALE, 1971

(Pl. I—1)

1979 *Membranilarnacia* sp., in Kar; p. 35, pl. 4, fig. 72.

*Remarks* : The specimen is characterised by the presence of numerous short, stout, tuberculate projections all over the body in apical-antapical view. Archaeopyle is antapical and polygonal. Paratabulation is indistinct.

This specimen does not possess any character of *Membranilarnacia*, viz., an apical archaeopyle and processes with cylindrical or columnar shafts.

*Geologic and geographic distribution* : Pleistocene-Recent Israel (Rossignol, 1962 & 1964) ; Quaternary, Venezuela (Wall, 1967) ; Post-Miocene, Florida Hatteras Slope (Drugg, 1970) ; Middle to Late Miocene, Grand Banks, Atlantic Continental Margin (Williams & Brideaux, 1975) ; Late Miocene, Eastern Canada (Williams, 1975) and Miocene, Kerala Coast, South India (unpublished K. P. J.) Middle to Late Oligocene, Offshore Eastern Canada (Williams & Bujak, 1977).

Genus *Hemicystodinium* WAL, 1967

*Hemicystodinium* sp. cf. *H. congregatum* STOVER, 1977

(Pl. I—10)

1979 *Polysphaeridium* (*Hystrichosphaeridium*) *microtriainum* (Klump) Kar; p. 33, pl. 4, fig. 65.

*Description* : Cyst spherical, endophragm and periphragm appressed, latter bears processes arranged in poor delimited groups. Processes hollow, tapered, distally open. Archaeopyle not distinctly marked.

*Remarks* : The archaeopyle in the single specimen is not very clearly marked, otherwise in process arrangement and shape, it compares best with *H. congregatum*.

Stover (1977) has reported *H. congregatum* from Middle Oligocene, *Globorotalia opima* zone, of Blake Plateau.

*Hemicystodinium* sp.

(Pl. I—6)

1979 *Membranilarnacia delicata* Kar; p. 35, pl. 4, fig. 71.

*Remarks* : The cyst is broken along the periphery, and is characterised by the presence of hemispherical shape with numerous spines having weakly striated base. Archaeopyle is not seen. Parallel alignment of spines in the equatorial region reflects the position of paracingulum.

Above features support *Hemicystodinium* affinity rather than *Membranilarnacia* which has distal membrane joining the tabular processes and an apical archaeopyle. Due to lack of many specimens no definite specific assignment has been attempted.

Genus *Sumatradinium* LENTIN & WILLIAMS, 1976  
*?Sumatradinium* sp.

(Pl. I—8)

1979 *Polysphaeridium cephalum* Kar; p. 34, pl. 4, fig. 66a-b.

*Description* : Cyst subcircular, 62  $\times$  56  $\mu\text{m}$  in size ; surface finely granulate and covered with numerous, short (4.6  $\mu\text{m}$  long), nontabular processes ; processes pointed distally. Archaeopyle? intercalary, angular, broadly triangular, probably six sided, operculum free.

*Discussion* : The broadly triangular shape might have been the result of distortion in apical-antapical flattening, it appears to be hexagonal representing an intercalary plate. In any case it does not reflect an apical archaeopyle, to be referred to *Polysphaeridium*. For the time being it has been transferred to *?Sumatradinium*. It resembles best with *S. hispidum* (Drugg) Lentin & Williams (1975) in having numerous short, distally pointed spines. The intercalary archaeopyle position remains a probability.

Genus *Cordosphaeridium* EISENACK EMEND.  
Davey, 1969

*Cordosphaeridium* sp.

(Pl. I—7)

1979 *Homotryblium* sp. in Kar; p. 35, pl. 4, fig. 73.

*Description* : Cyst subspherical, endophragm and periphragm appressed between processes. Processes intratabular, about 30 or more in number, cord like, loosely fibrous, solid, some branched, broader at base, distally gradually narrow and open, at the tip fibres diverge in paint brush-like fashion. Paratabulation indeterminate. Archaeopyle shape and position not distinctly observed due to bad preservation (broken specimen) but appears to be large and triangular.

*Remarks* : Cyst having cord like fibrous processes and a probable triangular archaeopyle (precingular) suggests its assignment to *Cordosphaeridium*.

Genus *Spiniferites* (Mantell) Sarjeant, 1970

*Spiniferites ramosus* subsp. *granosus* (Davey & Williams)  
Lentin & Williams, 1973

(Pl. I—9)

1979 *Spiniferites ramosus* cf. var. *multibrevis* (Davey & Williams) Sarjeant, 1970, in Kar, p. 34, pl. 4, fig. 69.

*Remarks* : The surface of the central body is coarsely granulate. The other features are similar to *S. ramosus*.

*Forma-A*

1979 *Polysphaeridium* sp., in Kar, p. 34, pl. 4, fig. 68.

*Remarks* : The specimen does not show any feature of a dinocyst. It is characterised by frequent folds and ornamented surface only. It is not a dinocyst.

*Pteridophytic spore Type-1*

(Pl. I—13-14)

1979 *Fromea pachyderma* Kar, P. 35, pl. 4, fig. 75.

*Remarks* : The specimen photographed and illustrated by Kar (1979, p. 35, pl. 4, fig. 75) is a broken one and possesses subspherical shape with thick exine and distinct trilete mark. The broken irregular outline of the spore, has been probably misinterpreted by Kar (1979, p. 35) as an apical archaeopyle. It is a pteridophytic spore and not a dinocyst. The name *Fromea pachyderma* Kar (1979) should be rejected.

#### DISCUSSION

The quantitative and qualitative re-evaluation of the dinocyst assemblage described by Kar (1979) revealed paucity of dinocysts in the palynological assemblages. The analysis is based on the re-examination of fifty-one slides (B.S.I.P. Museum Nos. 5072 to 5123) representing the productive lithologies of the three sections. The qualitative analysis indicates common presence of *Operculodinium centrocarpum* and total absence of *Cleistosphaeridium* or *Homotryblum* in all the samples. The other constituents of the dinocyst assemblage, viz., *Tuberculodinium vancampoae*, *Hemicystodinium* sp. cf. *congregatum*, ?*Sumatradinium* sp., *Cordosphaeridium* sp. and *Spiniferites ramosus* subsp. *granosus*, sporadically occur in different samples.

It won't be out of the place here to point out that the two cenozones viz., "*Polysphaeridium microtriainum*" and *Aplanosporites robustus*, erected at two different localities, exhibit similar microfloral assemblage except for the presence of a new fungal form *Aplanosporites*. The appearance of fungal form might be a very localized feature.

The lithologic sequence of these two cenozones, when compared from the palynostratigraphic zonation table and description of lithology in defining cenozones (Kar, 1979 ; Table-1 ; p. 39), appears to be exactly similar having limestone with thin shale bands. But from the description of the section (Kar, 1979 ; p. 19) it seems that the productive shale partings, in the Maniyara Fort Section, occur with calcareous marls overlying the coral limestone, the base of which is full of *Nummulites*. This needs careful attention because the Lower Oligocene section in the vicinity of the village Ramania also contains limestone with thin partings of grey-slightly carbonaceous shales full of *Nummulites*. The lower and upper contacts of the section are not known. This may possibly suggest extension of a single cenozoone representing Lower Oligocene though the microflora has no age supporting element.

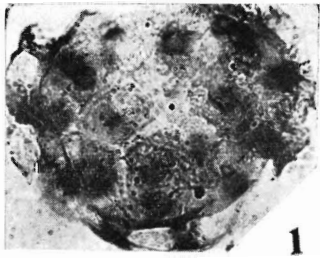
The lithologic and microfloristic characters of the *Trisyncolpites* Cenozoone are distinct from the other two Cenozones. The spores and pollen suddenly appear and dominate with only 2% representation of microplankton. This might also represent the development of a regressive phase or some sort of interfingering of continental and marine facies.

Another important observation which can be made is the presence of *Tuberculodinium vancampoae* in the Barkhana nala section alone. This dinoflagellate species has its oldest record in Middle-Upper Oligocene and is common in Miocene sediments. Recently Costa & Downie (1978) established *T. vancampoae* zone for the Early Miocene sediments of NE Atlantic. Later Costa & Müller (1978) correlated it with standard early Miocene Nannoplankton zones, NNI to NN4 of Martini (1971).

In view of the above findings and to maintain the biostratigraphic potential of dinocysts, it is very necessary to carefully check the dinoflagellate flora and the stratigraphic setup of the area.

#### REFERENCES

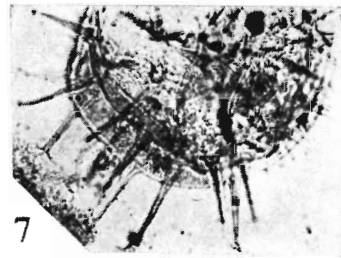
- BISWAS, S. K. AND DESHPANDE, S. V. 1970. Geological and tectonic maps of Kutch. *Bull. Oil Nat. Gas Comm.* **7**(2) : 115-116.
- EATON, G. L. 1976. Dinoflagellate cysts from the Bracklesham beds (Eocene) of the Isle of Wight, southern England. *Bull. Brit. Mus. Geol. (Nat. Hist.)*, **26** (6) : 230-332.
- COSTA, L. I. AND DOWNIE, C. 1978. Cenozoic dinocyst stratigraphy of Sites 403-406 (Rockall Plateau) IPOD, Leg 48. In Montandert, L., Roberts, D. et al., *Initial Reports of Deep Sea Drilling Project*, **48**.
- COSTA, L. I. AND MÜLLER, C. 1978. Correlation of Cenozoic dinoflagellate and Nannoplankton zones from the NE Atlantic and NW Europe. *Newsl. Stratigr.* **7** (2) : 65-72.
- DRUGG, W. S. 1970. Some new genera, species and combinations of phytoplankton from the Lower Tertiary of Gulf coast, U.S.A. *Proc. North Am. Paleont. Conv.* Sept. 1969, Part **G** : 809-843.
- KAR, R. K. 1977. Palynostratigraphy of Maniyara Fort Formation (Oligocene) in the District of Kutch, Western India. *Geophytology*, **7** (1) : 121-122.
- KAR, R. K. 1979. Palynological fossils from the Oligocene sediments and their biostratigraphy in the district of Kutch, Western India. *Palaeobotanist*, **26** (1) : 16-49.
- Martini, E. 1971. Standard Tertiary & Quaternary calcareous nannoplankton zonation. In II planktonic conference Rome 1970 (Ed. G. Farinacci) *Technoscienza*, **2** : 739-785, Rome.
- ROSSIGNOL, M. 1962. Analyse pollinique de sediments marine Quaternaires en Israel II sediments Pleistocenes. *Pollen Spores*, **4** : 121-148.
- ROSSIGNOL, M. 1964. Hystrichospheres du Quaternaire en Mediterranee Orientale, dans les sediments Pleistocenes et les boues marines actuelles. *Rev. micropalaeontol.* **7** : 83-99.
- STOVER, L. E. 1977. Oligocene and Early Miocene dinoflagellates from Atlantic core hole 5/5B, Blake Plateau. *Am. Assoc. Stratigraphic Palynologista Inc. contribution Series*, **5A** : 66-90.
- STOVER, L. E. AND EVITT, W. R. 1978. Analyses of Pre-Pleistocene organic walled dinoflagellates. *Stanford Univ. Publs. geol. Sci.* **15** : 1-300.



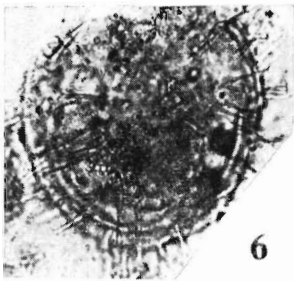
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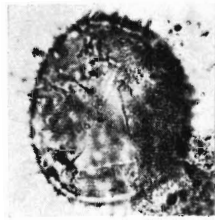
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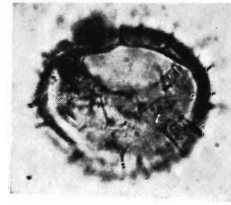
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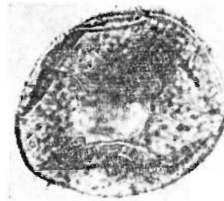
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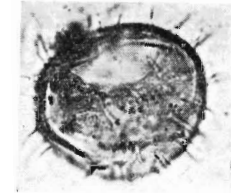
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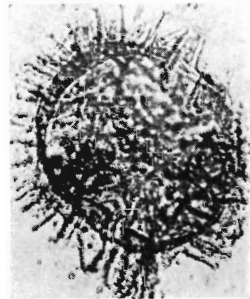
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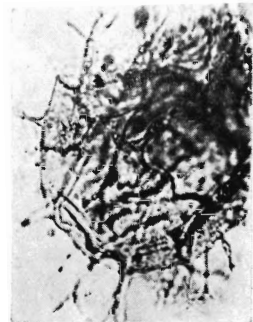
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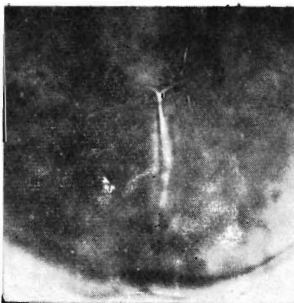
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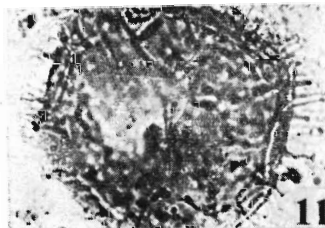
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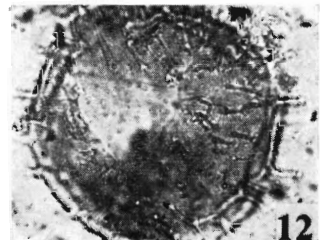
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- WALL, D. 1967. Fossil microplankton in deep sea cores from the Caribbean Sea. *Palaeontology*, **10** (1) : 95-123.
- WILLIAMS, G. L. 1975. Dinoflagellate and spore stratigraphy of the Mesozoic-Cenozoic, offshore eastern Canada. *Geol. Surv. Can. paper* 74-30. **2** : 107-161.
- WILLIAMS, G. L. AND BRIDEAUX, W. W. 1975. Palynologic analysis of Upper Mesozoic and Cenozoic rocks of the Grand Banks Atlantic continental Margin. *Bull. Geol. Surv. Canada*. **236** : 1-160.
- WILLIAMS, G. L. AND BUJAK, J. P. 1977. Cenozoic Palynostratigraphy of offshore Eastern Canada. *Amr. Assoc. Strat. Palynol. Contr. Ser.* 5A, **1** : 14-47.

## EXPLANATION OF PLATE

## PLATE I

1. *Tuberculodinium vancampoae* (Rossignol) Wall, emend. Wall & Dale, 1971; Slide no. 5087-2 (coordinates : 104.6 × 17.7); × 500.
- 2-3. *Operculodinium centrocarpum* (Deflandre & Cookson) Wall, 1967; same specimen in two different foci; Slide no. 5116-2 (coordinates : 117.7 × 11.8) × 500.
- 4-5. *Operculodinium centrocarpum* (Deflandre & Cookson) Wall, 1967; same specimen in two different foci (apical view); Slide no. 5117-1 (coordinates : 124 × 5); × 500.
6. *Hemicystodinium* sp.; Slide no. 5121-6 (coordinates : 135 × 18.5); × 500.
7. *Cordosphaeridium* sp.; Slide no. 5122-5 (coordinates : 128.6 × 14); × 500.
8. ?*Sumatradinium* sp.; Slide no. 5118-1 (coordinates : 123 × 17); × 500.
9. *Spiniferites ramosus* subsp. *granosus* (Davey & Williams) Lentin & Williams, 1973; Slide no. 5086-8 (coordinates : 135.6 × 16.4); × 500.
10. *Hemicystodinium* sp. cf. *H. congregatum* Stover, 1977; Slide no. 5116-5 (coordinates : 133 × 14.6); × 500.
- 11-12. *Operculodinium centrocarpum* (Deflandre & Cookson) Wall, 1967; same specimen in two different foci; Slide no. 5120-2 (coordinates : 138 × 12.8); × 500.
- 13-14. Pteridophytic spore Type-1; Slide no. 5077-3 (coordinates : 122.5 × 14.8); × 500. 14, magnified portion of the same specimen showing trilete mark; × 1000.