# PALYNOLOGICAL EVIDENCE ON THE AGE OF CUDDALORE SANDSTONE*

B. S. VENKATACHALA

*Palynology Laboratory, Institute of Petroleum Exploration, O. N. G. C., Dehra Dun*

## ABSTRACT

Palynofloral assemblages recorded from Neyveli lignite are assessed. Records of fossil woods from the Cuddalore Sandstone are also reassessed. It is concluded that the Neyveli lignite, on the available evidence, is of Eocene age and therefore the Cuddalore Sandstone in this part of the basin are considered as of Eocene age.

## INTRODUCTION

The Cuddalore Sandstones, exposed in the western part of the Cauvery Basin, comprise gritty to pebbly and ferruginous sandstones. They are considered as continental in origin. The well known lignite deposits of Neyveli between Vridhachalam and Cuddalore occur within these sandstones. The average thickness of the major lignite seam varies from 15-25 m. The Cuddalore Sandstones are concluded to be of Mio-Pliocene age by various authors (RAMANATHAN & RAO, 1965, SASTRI & RAIVERMAN, 1968; RAMANUJAM, 1968 and others) though no positive fossil evidences have been put forward.

## FOSSIL WOOD AND OTHER FOSSILS FROM THE CUDDALORE SANDSTONES

The Cuddalore Sandstones were first described by VREDENBERG (1908). He however, did not comment on their age. EAMES (1950), discussing the age of Cuddalore Sandstones, believed them to overlie the Karaikal beds and thus of Pontian age. This age was concluded mainly on the basis of the occurrence of *Mesembrioxylon schmidianum*, a fossil wood occurring in Trivicary grits. The other fossil records that influenced EAMES (1950) are the occurrence of *Anadara granosa* from beds of Yellada Odai which FOOT (1883) has referred doubtfully to Cuddalore Sandstone. This fossil is of a common occurrence in the Indo-pacific region where it is known to range from Miocene to Recent. *Crocuta* spp. described by RAO (1932) from beds at Sendurai, which also have been referred doubtfully to the Cuddalore Sandstones, is the other record that influenced EAMES (1950). This mammalian fossil is a Pleistocene record. Even the evidence of *Mesembrioxylon schmidianum* towards the age of these sediments is not infallible.

SAHNI (1931) described in detail *Mesembrioxylon schmidianum* (Schleiden) and records that "the horizon is said to range from Eocene to Pliocene". From the foregoing it would appear that there is no positive indication of attributing a Mio-Pliocene age to the Cuddalore Sandstones on fossil evidences. RAMANUJAM (1968) reviewed the present status of fossil wood studies in the Cuddalore sandstone. He concludes on the basis of fossil wood evidences that the age of Cuddalore Sandstones is not older than Middle Miocene and

*Paper published with kind permission of the Additional Director, I.P.E., Oil & Natural Gas Commission. Views expressed are of the author and not necessarily of the organization.

that it could probably be upper Miocene or/and Lower Pliocene. The check list of woods recorded so far from the Cuddalore Series (RAMANUJAM, 1968) is extensive. A perusal of these records indicates that except for dipterocarpaceous woods the other fossils range from Upper Cretaceous to Recent or in some cases Eocene to Recent (CHESTERS, GNAUCK & HUGHES, 1971).

Thus, it is clear from the foregoing discussion that the Cuddalore sandstones can not be assigned to Miocene—Pliocene age on the basis of fossil wood evidences.

## PALYNOFLORA OF THE NEYVELI LIGNITE

A rich and varied palynofloral assemblage is described by RAMANUJAM (1966, 1967), NAVALE (1961) and THIERGART and FRANTZ (1962) from lignites occurring at Neyveli in South Arcot District. The papers of RAMANUJAM (1966, 1967) are elaborate systematic studies of the palynoflora. He lists the following families:

Schizaeaceae, Polypodiaceae, Araliaceae, Caesalpiniaceae, Caprifoliaceae, Ericaceae, Fagaceae, Poaceae (Graminae), Haloragaceae, Hippocrateaceae, Juglandaceae, Liliaceae, Mimosaceae, Myrsinaceae, Nymphaeaceae, Nyssaceae, Oleaceae, Palmae, Papilionaceae, Potamogetonaceae, Rubiaceae, Santalaceae, Sapotaceae, Sparganiaceae, Symplocaceae, Thymeliaceae and Ulmaceae. All the families listed above have either pollen or mega-fossil pre-Miocene fossil records. (See CHESTERS *et al.*, 1971, figs. 71-74).

GHOSH, SRIVASTAVA and SEN (1963), observe that pollen with more number of colpi appears to increase in frequency in the older horizons, i.e., pre-Miocene, a conclusion refuted by RAMANUJAM (1966, p. 193). Extensive studies (VENKATACHALA, 1973) made on the palynofloras of Tertiary sediments of Assam, Cauvery, Kutch and Cambay basins in India generally substantiate the observations of GHOSH *et al.* (1963). Eocene sediments can easily be distinguished by such a variety of polycolpate pollen that are rare or absent in younger sediments. The fact that polycolpate pollen are abundant in the Neyveli lignites raised a doubt in the author's mind as to its correct assignment to Mio-Pliocene age. Typical Neogene genera viz., *Abietineaepollenites*, *Magnastriatites*, *Verrucatosporites*, *Lacrimapollis*, *Tricollareporites*, *Malvacearumpollis*, *Oudhkusumites*, *Cauveripollis*, *Tiliaepollenites*, *Maculoporites*, *Coneopollis* and *Bombacacidites* (VENKATACHALA, 1973; VENKATACHALA & RAWAT, 1973) are not recorded in the Neyveli lignites by RAMANUJAM (1966) and other authors. The other characteristic assemblages that are recorded in the Neyveli lignite are those that are common to both Eocene and Miocene sediments. *Disulcites*, *Proxapertites* (described by RAMANUJAM, 1966, as *Longapertites cuddalorense*), *Stephanocolpites*, *Polycolpites*, *Paleocaesalpiniaceapites* and *Symplocoipollenites* in particular are Eocene genera that do not occur in the subsurface Miocene sediments of the Cauvery Basin (VENKATACHALA, 1973).

The absence of typical Neogene genera and the presence of forms that are generally common to both Eocene and Miocene sediments, as enumerated above, led the author to remark that either the Neyveli lignite, hitherto dated as Mio-Pliocene in age, represents a restricted flora of the region or its dating is questionable. (VENKATACHALA, 1972, 1973) The palynological assemblage (Pl. 1) of the lignite beds associated with sandstones, hitherto considered correlatable to the Cuddalore Sandstones of the Cauvery Basin is as follows:

*Palmaepollenites baculatus* Venkatachala & Rawat 1972
*Palmaepollenites* sp.
*Liliacidites* sp.
*Mauritiidites densispinus* Venkatachala & Rawat 1972
*Spinizonocolpites echinatus* Muller 1968

*Proxapertites operculatus* V. d. Hammen 1956
*P. hammenii* Venkatachala & Rawat 1972
*Dicolpopollis kalewensis* Potonié 1960
*Psilodiporites hammenii* Verma & Rawat 1963
*Tricolpites minor* Sah 1967
*T. brevicolpus* Couper 1960
*T. microreticulatus* Bolesky, Boltenhagen & Potonič 1965
*T.* sp. *cf. T. densiornatus* Venkatachla & Rawat 1972
*Retitricolpites florentinus* Guzman 1967
*Zonocostites ramonae* Germeraad, Happing & Muller 1968
*Z.* sp.
*Rhoipites conatus* Venkatachala & Rawat 1972
*R. striotoreticulatus* Sah 1967
*Favitricolporites ornatus* Sah 1967
*F.* sp. a and b.
*Margocolporites sitholeyi* Ramanujam 1966
*M. sahnii* Ramanujam 1966
*Proteacidites dehaanii* Germeraad, Hopping & Muller 1968
*P.* cf. *P. retusus* Anderson 1960
*?Cricotriporites* sp.
*Anacolosidites trilobatus* Venkatachala & Rawat 1972
*Myricaceoipollenites dubius* Venkatachala & Rawat 1972
*Myricipites harrisii* (Coup.) Venkatachala & Rawat 1973
*Iugopollis tetraporites* Venkatachala & Rawat 1972
*Cupanieidites cauveriensis* Venkatachala & Rawat 1972
*C. flaccidiformis* Venkatachala & Rawat 1972
*C.* sp.
*Marginipollis kutchensis* (Venk. & Kar) Venkatachala & Rawat 1972
*Tetracolpites* sp.
*Polycolpites pedaliaceoides* Sah 1967
*Polycolpites* sp.
*Retistephanocolpites coromandalinsis* Venkatachala & Rawat 1972
*Stephanocolpites globatus* Venkatachalə & Kar 1968
*S.* sp. a & b.
*Stephanoporites* sp.
*Schizosporis rugulatus* Cookson & Dettmann 1959
*Circulisporites* sp.

The above assemblage is fairly comparable to that recovered from the Eocene sequence of the Cauvery Basin (VENKATACHALA & RAWAT, 1972). Thus, it is logical to infer that the lower age limit of the Neyveli lignites and the associated sandstones may extend to Eocene.

ACKNOWLEDGEMENTS

The author is thankful to Sri V. V. Sastri, Additional Director, I.P.E., ONGC., for advice and permission to publish this paper, to Sri L. L. Bhandari, Joint Director for constant encouragement and useful discussion. Sincere thanks are also expressed to Sri R. N. Sinha for going through the manuscript and Sri K. D. Sharma and Sri M. S. Rawat for laboratory help.

## REFERENCES


CHESTERS, K. I. M., GNAUCK, F. R. & HUGHES, N. F. (1967). Angiospermae. in: W. B. Harland (Ed.) *The Fossil Record.* Geol. Soc. London: 169-288.

EAMES, F. E. (1950). On the age of certain Upper Tertiary beds of Peninsular India and Ceylon. *Geol. Mag.* **87**(4): 233-253.

FOOT, R. B. (1883). On the geology of the Madura and Tinnevelly districts. *Mem. geol. Surv. India.* **20:** 1-103.

GHOSH, A. K., SRIVASTAVA, S. K. & SEN, J. (1963). Polycolpate grains in Pre-Miocene Horizons of India. *Proc. natn. Inst. Sci. India.* **23B:** 511-519.

NAVALE, G. K. B. (1961). Pollen and spores from Neyveli lignite, South India. *Palaeobotanist.* **10:** 87-90.

RAMANATHAN, S. & RAO, V. R. (1965). Geology, tectonics and petroleum possibilities of Cauvery basin, South India. 3 *ECAFE sym. Dev. Petrol. Res. Asia & Far East* (Tokyo).

RAMANUJAM, C. G. K. (1966). Palynology of the Miocene lignite from south Arcot district, Madras, India. *Pollen Spores.* **8:** 149-204.

RAMANUJAM, C. G. K. (1967). Pteridophytic spores from the Miocene lignite of South Arcot district, Madras, *Palynol. Bull.* **2 & 3:** 29-40.

RAMANUJAM, C. G. K. (1968). Some observations on the flora of the Cuddalore sandstone series. *Geol. Soc. India, Mem.* 2, *Cretaceous—Tertiary Formations of South India:* 271-286.

RAO, C. R. N. (1932). On a new fossil *Hyaena. J. Mysore Univ.* **6:** 99-105.

SAHNI, B. (1931). Revisions of Indian fossil plants—Part II. Coniferales (b. petrifactions). *Mem. geol. Surv. India.* N. S. **11:** 51-120.

SASTRI, V. V. & RAIVERMAN, V. (1968). On the basin study programme of the Cretaceous-Tertiary sediments of the Cauvery basin. *Geol. Soc. India, Mem.* 2, *Cretaceous-Tertiary Formations of South India:* 143-153.

THIERGART, F. & FRANTZ, U. (1962). Some spores and pollen grains from the Tertiary brown coal of Neyveli. *Palaeobotanist.* **11:** 43-45.

VENKATACHALA, B. S. (1972) Resume of work done in the Palynology Laboratory, Institute of Petroleum. Exploration—Cauvery basin. Abs. Oil & Gas Conference, O. N. G. C., Dehradun: 173.

VENKATACHALA, B. S. (1973). Palynological zonation of the Mesozoic and Tertiary subsurface sediments in the Cauvery basin. *Proc. Aut. Sch. Palaeobot.* Kodaikanal, *Birbal Sahni Institute. Palaeobotany.* (in press).

VENKATACHALA, B. S. & RAWAT, M. S. (1972). Palynology of the Tertiary sediments in the Cauvery basin 1. Palaeocene—Eocene palynoflora from the subsurface. in : A. K. Ghosh (Ed.), *Proceedings of Seminar on Palaeopalynology & Indian Stratigraphy, Calcutta.* : 292-335

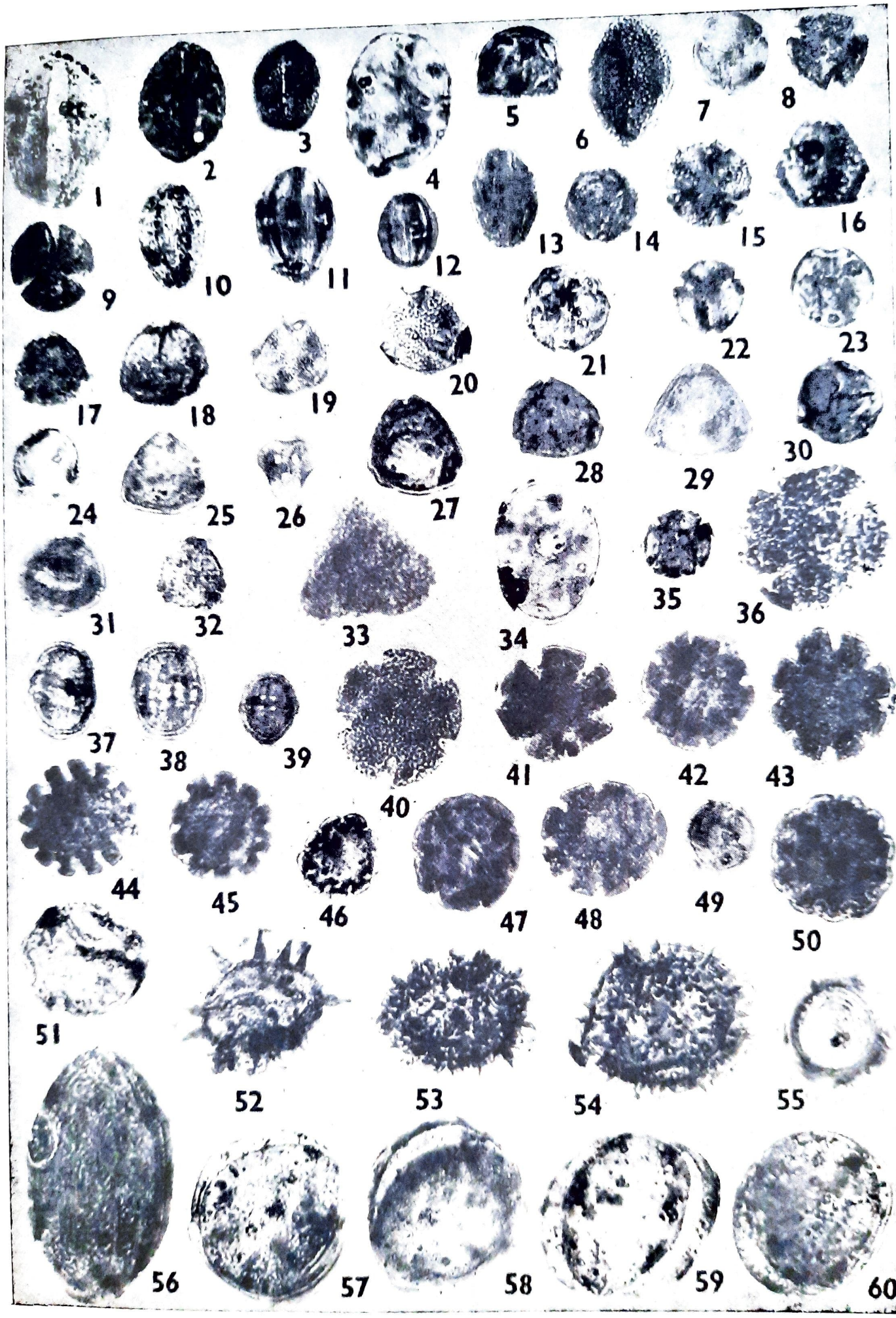
VENKATACHALA, B. S. & RAWAT, M. S. (1973). Palynology of the Tertiary sediments in the Cauvery basin. 2. Oligocene—Miocene palynoflora from the subsurface. *Palaeobotanist.* **20** (2): 238-263.

VREDENBERG, E. (1908). Cretaceous orbitoid of India. *Rec. geol. Surv. India.* **36** (3).


## EXPLANATION OF PLATE 1

(All Photomicrographs magnified ×500)

1. *Palmaepollenites* sp.
2. *Palmaepollenites baculatus* Venkatachala & Rawat, 1972.
3. *Liliacidites* sp.
4. *Psilodiporites hammenii* Varma & Rawat, 1963.
5. *Dicolpopollis* sp.
6. *Retitricolpites florentinus* Gonz. 1967.
7. *Tricolpites minor* Sah, 1967.
8. *Tricolpites brevicolpus* Couper, 1960.
9. *Tricolpites* cf. *T. densiornatus* Venkatachala & Rawat, 1972.
10. *Marginipollis* sp.
11. *Rhoipites conatus* Venkatachala & Rawat, 1972.
12, 13. *Rhoipites striatoreticulatus* Sah, 1967.
14. *Tricolpites brevicolpus* Couper, 1960.
15. *Margocolporites sitholeyi* Ramanujam, 1966.
16. *Cupanieidites* sp.
17. *Cupanieidites cauveriensis* Venkatachala & Rawat, 1972.


1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60

18. *Cupanieidites* sp.
19, 20. *Favitricolporites* sp.
21. *Favitricolporites ornatus* Sah, 1967.
22. *Favitricolporites* sp.
23. *Favitricolporites ornatus* Sah, 1967.
24. *Paleocoprosmadites arcotense* Ramanujam, 1966.
25. *Myricaceoipollenites dubius* Venkatachala & Rawat, 1972.
26. *Anacolosidites trilobatus* Venkatachala & Rawat, 1972.
27. *Myricipites harrisii* (Coup.) Venkatachala & Rawat, 1972.
28, 29. *Myricaceoipollenites dubius* Venkatachala & Rawat, 1972.
30. *Favitricolporites ornatus* Sah, 1967.
31. *Myricaceoipollenites* sp.
32. *Proteacidites* cf. *P. retusus* Anderson, 1960.
33. *Proteacidites dehaani* Germ., Hopp. & Mull. 1968.
34. *?Cricotriporites* sp.
35. *Tetracolporites* sp.
36. *Tetracolpites* sp.
37, 38. *Zonocostites ramonae* Germ., Hopp. & Mull. 1968.
39. *Zonocostites* sp.
40, 41. *Retistephanocolpites coromandeliensis* Venkatachala & Rawat, 1972.
42, 43. *Stephanocolpites* sp.
44, 45, 46. *Polycolpites pedaliaceoides* Sah, 1967.
47. *Stephanocolpites* sp.
48. *Polycolpites pedaliaceoides* Sah, 1967.
49. *Stephanocolpites globatus* Venkatachala & Kar, 1968.
50. *Pseudonothofagidites* sp.
51. *Stephanoporites* sp.
52. *Spinizonocolpites echinatus* Muller, 1968.
53, 54. *Mauritiidites densispinus* Venkat. & Raw. 1972.
55. *Circulisporites* sp.
56. *Schizosporis rugulatus* Cookson & Dettmann, 1959.
57, 58. *Proxapertites operculatus* V. d. Hammen, 1956.
59, 60. *Proxapertites hammenii* Venkatachala & Rawat, 1972.