

Palynozonation of Jhuran and Bhuj formations in Kutch Basin

Hari K. Maheshwari & B. N. Jana

Maheshwari, Hari K. & Jana, B. N. (1988). Palynozonation of Jhuran and Bhuj formations in Kutch Basin. *Palaeobotanist* 36 : 177-182.

The palynological assemblages of Jhuran and Bhuj formations of Kutch Basin have many genera in common. *Araucariacites*-complex is the dominating group of palynofossils. The assemblage of Bhuj Formation differs from that of Jhuran Formation in variety of trilete genera and in the frequent occurrence of hilate group (viz., *Aequitriradites*, *Cooksonites*, *Coptospora*, *Triporoletes*, etc.). The occurrence of hilate group in the assemblages from Jhuran Formation is almost nil. In all, four palynological zones have been recognized, one palynological zone is in Jhuran Formation and the other three zones are in Bhuj Formation. On the basis of palynological data it seems that the Jurassic-Cretaceous boundary lies somewhere in the Upper Member of Jhuran Formation.

Key-words—Palynozonation, *Araucariacites*-complex, Bhuj Formation, Jhuran Formation, Kutch Basin (India).

Hari K. Maheshwari & B. N. Jana, Birbal Sahni Institute of Palaeobotany, 53 University Road, Lucknow 226 007, India.

सारांश

कच्छ द्रोणी में झुरन एवं भुज शैल-समूहों का परागाणविक मंडलन

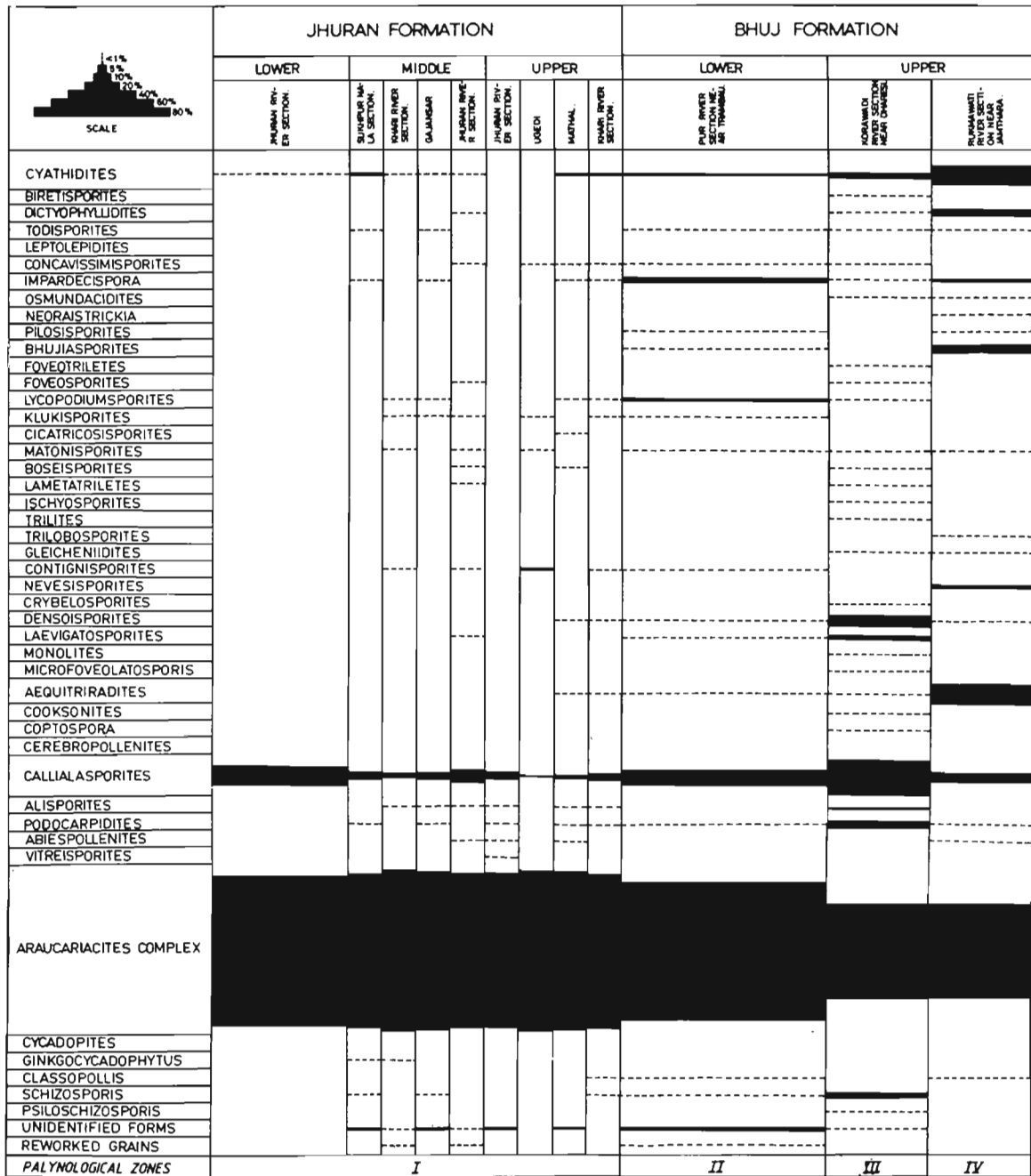
हरिकृष्ण माहेश्वरी एवं वृजेन्द्र नाथ जाना

कच्छ द्रोणी में झुरन एवं भुज शैल-समूहों के परागाणविक समुच्चयों से उपलब्ध बहुत सी प्रजातियाँ सामान्य हैं। *अँराकेरिआसाइटिस*-सम्मिश्र परागाणविक-रूपकों का प्रभावी समूह है। भुज शैल-समूह का समुच्चय त्रिअरीय प्रजातियों की विभिन्नता एवं हाइलेट समूह (*एँक्वीट्राइरेडाइटिस*, *कुक्सोनाइटिस*, *कोप्टोस्पोरा*, *ट्राईपोरोलिटीस*, आदि) की प्रचुर उपस्थिति के कारण भिन्नता प्रदर्शित करता है। झुरन शैल-समूह से उपलब्ध समुच्चयों में हाइलेट समूह की उपस्थिति प्रायः नगण्य है। कुल मिलाकर चार परागाणविक मंडल बनाये गये हैं जिनमें एक मंडल झुरन शैल-समूह में है तथा शेष अन्य तीन भुज शैल-समूह में हैं। परागाणविक आँकड़ों के आधार पर ऐसा प्रतीत होता है कि जुराई-क्रीटेशी सीमा झुरन शैल-समूह के उपरि सदस्य में विद्यमान है।

IN Kutch Basin the Mesozoic sedimentaries, ranging in age from Bathonian to Aptian, extend in an east-west direction along the whole length of Kutch Mainland. The sediments are also exposed in the islands in the Rann located to the north of mainland. The Mesozoic rocks have been variously classified by different workers, but the classification that seems to be accepted most is by Biswas (1971). He has divided the Mesozoic rocks of Kutch Mainland into

four formations, viz., Jhurio, Jumara, Jhuran and Bhuj, in order of superposition.

Palynological investigations of Mesozoic sediments of the Kutch Basin were initiated by Singh, Srivastava and Roy (1964). Later on, more data were made available through the works of Mathur and Mathur (1965), Venkatachala (1967, 1969a, 1969b), Venkatachala and Kar (1967, 1968a, 1968b, 1970, 1972), Venkatachala, Kar and Raza (1969a,



Text-figure 1—Showing percentage frequency of various miospore genera and palynological zones in Jhuran and Bhuj formations.

1969b, 1969c), Mathur *et al.* (1970), Mathur (1980), etc. Koshal (1975, 1983) reported palynological assemblages from subsurface samples of Banni and Nirona wells.

The palynological data incorporated in this paper have been obtained from surface sediments collected during last ten years from Kutch Mainland. Out of four lithounits, the basal two, i.e. Jhurio and Jumara formations did not yield any worthwhile palynofossils except for nannofossils in the Jumara.

The Jhuran and the Bhuj formations have yielded a rich palynological assemblage comprising spores, pollen and dinoflagellates. Nannoplankton have also been recovered from few Jhuran samples. Here we deal only with spore-pollen assemblages.

PALYNOLOGICAL DATA

The Jhuran Formation has been divided into four formal members, i.e., lower, middle, upper and

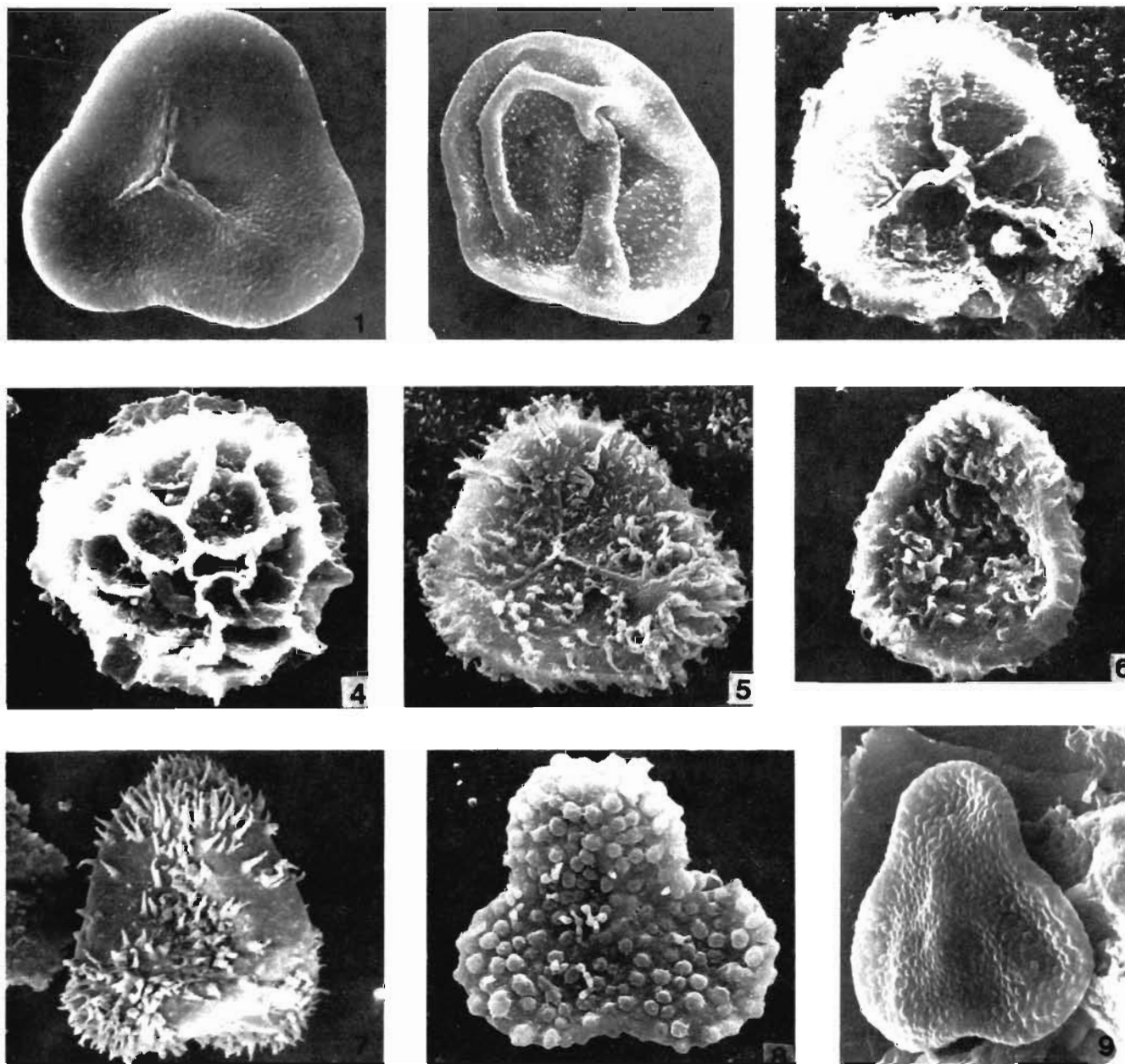


PLATE 1

Photomicrographs of important spore and pollen taxa from Jhuran and Bhuj formations.

1. *Cyatbidites ghuneriensis* Singh, Srivastava & Roy. × 600.
2. *Todisporites major* Couper. × 600.
- 3,4. *Lycopodiumsporites trambauensis* Singh, Srivastava & Roy, 3. Proximal view. × 600; 4. Distal view. × 500.

5,6. *Bhujiasporites* sp. proximal and distal view. × 600.

7. *Pilososporites* sp. × 600.

8. *Impardecispora* × 600.

9. *Concavissimisporites verrucosus* (Delcourt & Sprumont) Delcourt, Dettmann & Hughes. × 600.

Katesar members. All members except Katesar are fossiliferous.

The palynological assemblage representing Lower Member of Jhuran Formation, recovered from Jhuran River Section near Jawaharnagar, is very poor

in spore-pollen content. Trilete spores represented by the genera like *Cyatbidites*, *Todisporites*, *Biretisporites* and *Lycopodiumsporites* are less than 1 per cent of the assemblage. In quantitative estimation, dominance of conifer pollen (i.e.

Araucariacites-complex) is noticed; this group constitutes 88.75 per cent of the total assemblage. *Callialasporites* is 10.75 per cent (Text-fig. 1).

The palynological assemblage of Middle Member has been recovered from Sukhpur Nala, Khari River, Gajansar and Jhuran River sections. In this assemblage the trilete spores are relatively more than in the Lower Member. The assemblage comprises *Cyathidites*, *Biretisporites*, *Todisporites*, *Dictyophyllidites*, *Leptolepidites*, *Impardecispora*, *Concavissimisporites*, *Foveosporites*, *Foveotrilletes*, *Lycopodiumsporites*, *Klukisporites*, *Matonisporites*, *Lametatrilettes*, *Contignisporites*, *Laevigatosporites*, *Callialasporites*, *Alisporites*, *Podocarpidites*, *Abiespollenites*, *Vitreisporites*, *Araucariacites*-complex, *Classopollis*, *Cycadopites*, *Ginkgocycadophytus*, *Schizosporis*, etc. Here too, the *Araucariacites*-complex is the dominant group of palynofossils and constitutes 91.4 to 95.67 per cent of the total assemblage. *Callialasporites* is 3.05 to 4.69 per cent of the assemblage. Quantitative representation of individual trilete spore genera is less than 1 per cent except for *Cyathidites* which is up to 2 per cent in some of the samples. The palynological assemblage from the Jhuran River Section has the highest number of spore-pollen genera.

The Upper Member of Jhuran Formation is exposed in Jhuran River near Jawaharnagar, Ugedi well, Chawad River near Mathal and Khari River near cremation ground. The palynological assemblage is more or less similar to that of the Middle Member in having only a few trilete spores but the genera like *Densoisporites*, *Cicatricosisporites* and *Aequitriradites* make their first appearance here. The *Araucariacites*-complex constitutes 91.5 to 95 per cent of the total assemblage. *Callialasporites* is only 1.5 to 4.4 per cent of the total. The trilete genera are less than 1 per cent except for *Cyathidites* and *Contignisporites*.

The Bhuj Formation overlies the Jhuran Formation and is underlain by the Deccan Trap flows. It has been divided into two members, lower and upper.

Palynological assemblages recovered from the Bhuj sediments are very rich and well-diversified. The representative assemblage of Lower Member has been recovered from Pur River Section near Trambau. This assemblage comprises: *Deltoidospora*, *Cyathidites*, *Todisporites*, *Dictyophyllidites*, *Osmundacidites*, *Concavissimisporites*, *Impardecispora*, *Baculatisporites*, *Baculareticulosporis*, *Pilosisporites*, *Bhujiasporites*, *Klukisporites*, *Lycopodiumsporites*, *Boseisporites*, *Matonisporites*, *Contignisporites*, *Murospora*, *Densoisporites*, *Laevigatosporites*, *Monolites*, *Aequitriradites*,

Callialasporites, *Podocarpidites*, *Alisporites*, *Abiespollenites*, *Classopollis*, *Araucariacites*-complex, *Schizosporis*, etc. The *Araucariacites*-complex is the dominant group of palynofossils constituting 82 per cent of the total assemblage. The genus *Callialasporites* is 9 per cent. The commonly encountered trilete genera are *Cyathidites*, *Impardecispora*, *Lycopodiumsporites* and *Bhujiasporites*. Almost all trilete spore genera are less than 1 per cent except for *Cyathidites* (1.7%), *Impardecispora* (4.25%) and *Lycopodiumsporites* (2.5%).

The palynological assemblages of the Upper Member exposed in Korawadi River Section near Dharsi and Rukmawati River Section near Jamthara is compositionally rich and contains genera like *Deltoidospora*, *Cyathidites*, *Biretisporites*, *Dictyophyllidites*, *Todisporites*, *Concavissimisporites*, *Osmundacidites*, *Impardecispora*, *Lycopodiacidites*, *Foveotrilletes*, *Foveosporites*, *Lycopodiumsporites*, *Matonisporites*, *Boseisporites*, *Lametatrilettes*, *Ischyosporites*, *Trilites*, *Gleicheniidites*, *Crybelosporites*, *Densoisporites*, *Laevigatosporites*, *Monolites*, *Microfoveolatosporis*, *Aequitriradites*, *Cooksonites*, *Coptospora*, *Cerebropollenites*, *Callialasporites*, *Alisporites*, *Platysaccus*, *Podocarpidites*, *Araucariacites*-complex, *Psiloschizosporis*, etc. The *Araucariacites*-complex shows an appreciable fall and constitutes only 54 per cent of the total assemblage. The Dharsi assemblage shows a certain increase in *Callialasporites* (up to 19.7%) and *Densoisporites* (7.1%). There is a remarkable variation in the genus *Densoisporites* in Dharsi Assemblage. A number of hilate forms such as *Aequitriradites*, *Cooksonites*, *Coptospora* and *Triporeletes* are also represented.

In the palynological assemblage of Rukmawati River Section there is a sudden rise of certain trilete and hilate genera. Some of the characteristic forms of this assemblage are *Cyathidites* (11.66%), *Deltoidospora* (1.08%), *Dictyophyllidites* (3.92%), *Impardecispora* (15%), *Pilosisporites* (0.25%), *Nevesisporites* (1.5%), *Bhujiasporites* (3%), *Trilobosporites* (0.5%), *Aequitriradites* (10.75%), *Callialasporites* (4.5%), *Araucariacites*-complex (53.5%), *Schizosporis* (3%), etc. As a whole the palynofossil assemblage of Rukmawati River Section is different from other known palynofossil assemblages of the Kutch Basin.

PALYNOLOGICAL ZONATION

It is evident from the above that the poorest assemblage has been found in the Lower Member of Jhuran Formation. In the Middle Member there is a qualitative as well as quantitative rise of trilete

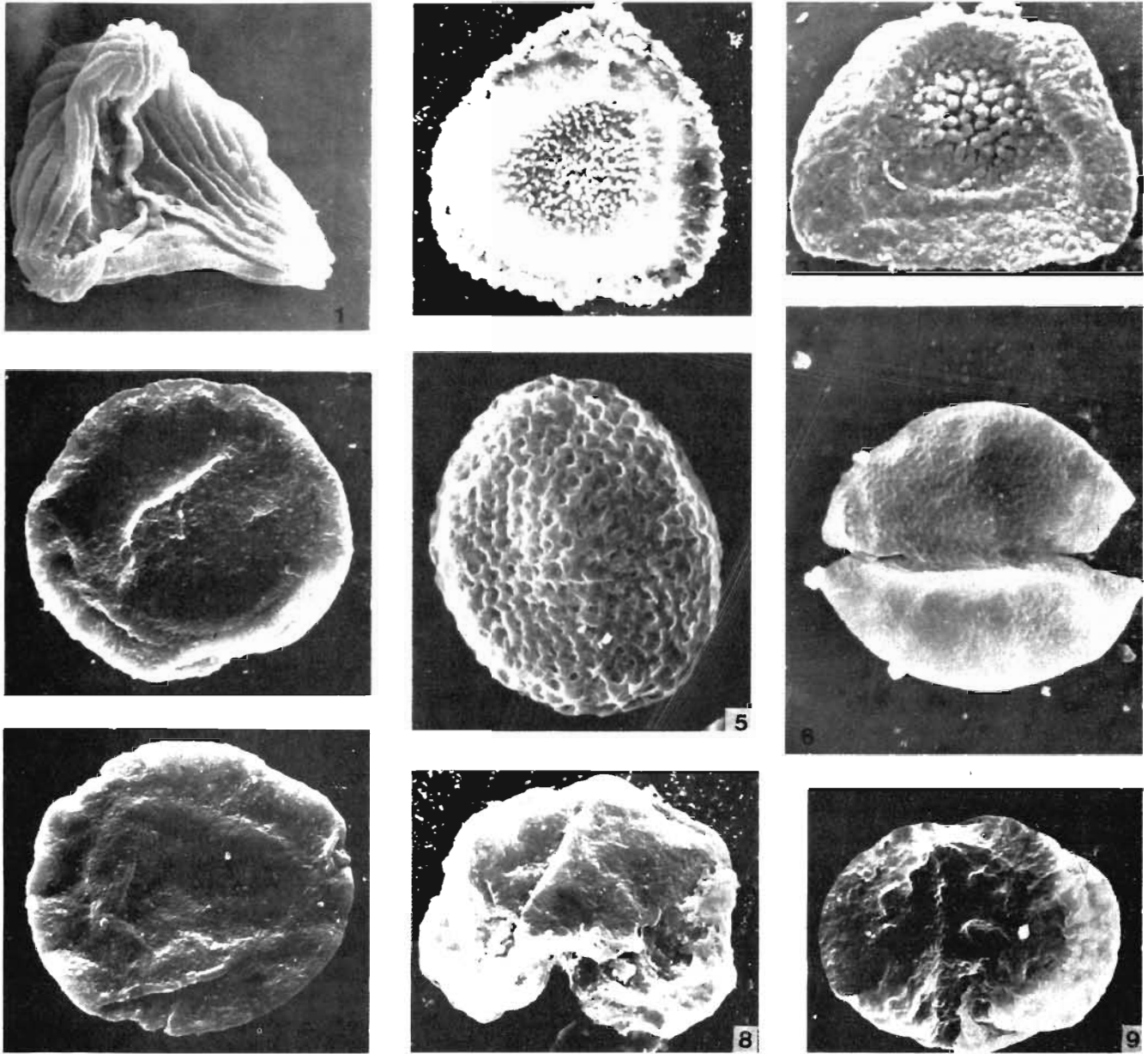


PLATE 2

- | | |
|---|--|
| 1. <i>Cicatricosisporites australiensis</i> (Cookson) Potonié. × 700. | 6. <i>Schizosporis</i> sp. × 500. |
| 2. <i>Aequitriradites</i> sp. × 800. | 7. <i>Callialasporites dampieri</i> (Balme) Dev. × 600. |
| 3. <i>Cooksonites</i> sp. × 800. | 8. <i>Abiespollenites</i> sp. × 600. |
| 4. <i>Callialasporites</i> sp. × 600. | 9. <i>Alisporites grandis</i> (Cookson) Dettmann. × 700. |
| 5. <i>Schizosporis reticulatus</i> Cookson & Dettmann. × 450. | |

genera. In both the members, the dominant palynofossil is the *Araucariacites*-complex. The representation of *Callialasporites* declines in the Middle Member. In the Upper Member the induction of certain trilete and hilate genera enriches the assemblage. The first appearance of certain

stratigraphically important genera such as *Cicatricosisporites*, *Aequitriradites*, etc. heralded the initiation of Lower Cretaceous Epoch. So, the Jurassic/Cretaceous time boundary lies somewhere in the Upper Member of Jhuran Formation. The palynological assemblage of Jhuran Formation

constitutes the *Palynozone I*. This zone also has frequent representation of dinoflagellate cysts and scanty occurrences of nannofossils.

The palynological assemblages of the Bhuj Formation are distinguishable from that of Jhuran Formation by the variety and abundance of spores and pollen and almost total absence of marine elements. The trilete group, which forms only 0.2 to 3.36 per cent in Jhuran Formation, constitutes 10.3 to 26.4 per cent in the Bhuj Formation. The oldest one, i.e. *Palynozone II* from the Bhuj sediments near Trambau, shows the common occurrence of trilete spore genera *Impardecispora*, *Bhujiasporites* and *Lycopodiumsporites*, etc. *Palynozone III* is characterised by the richness of flora and the high representation of *Densoisporites* (up to 7.1%). *Palynozone IV* is characterized by the sudden rise in quantitative representation of trilete and hilate forms. It is only in *Palynozone IV* that the subdominant genus is other than *Callialasporites*. In this zone the genera *Cyathidites* and *Aequitriradites* contribute 11.66 and 10.75 per cent, respectively. Palynozones III and IV are represented in Korawadi and Rukmawati sections, respectively.

REFERENCES

- Biswas, S. K. 1971. Note on the geology of Kutch. *Q. Jl geol. Min. metall. Soc. India* **43** : 223-235.
- Koshal, V. N. 1975. Palynozonation of Mesozoic sub-surface sediments of Banni, Kutch, Gujarat. *Q. Jl geol. Min. metall. Soc. India* **47** : 79-82.
- Koshal, V. N. 1983. Jurassic- Early Cretaceous palynofossil assemblage in the subsurface of Banni-Nirona, Kachchh (Gujarat), western India. in: Maheshwari, H. K. (Ed.)—*Cretaceous of India*, Indian Association of Palynostratigraphers, Lucknow, pp. 84-88.
- Mathur, Y. K. 1980. Dharesi—The highest Mesozoic plant beds of Kutch, its age and implications of the plant beds in biostratigraphy. *Geosci. Jl* **1** : 47-54.
- Mathur, Y. K. & Mathur, K. 1965. Occurrence of gnetalean pollen grains in Katrol (Upper Jurassic) Formation of Kutch, India. *Nature, Lond.* **208** : 912.
- Mathur, Y. K., Soodan, K. S., Mathur, K., Bhatia, M. L., Juyal, N. P. & Pant, J. S. 1970. Microfossil evidences on the presence of Upper Cretaceous and Palaeocene sediments in Kutch. *Bull. Oil nat. Gas Commn.* **7** : 109-114.
- Venkatachala, B. S. 1967. Palynology of the Umia plant beds of Kutch, western India—I. Stratigraphic palynology of the Bhuj exposures near Walkamata (Kutch District, Gujarat State). *Rev. Palaeobot. Palynol.* **5** : 163-177.
- Venkatachala, B. S. 1969a. Palynology of the Umia plant beds of Kutch, W. India-2. Bhuj exposures near Walkamata, Kutch District, Gujarat State—Systematic palynology. *Palaeobotanist* **17** : 1-8.
- Venkatachala, B. S. 1969b. Palynology of the Mesozoic sediments of Kutch-4. Spores and pollen from Bhuj exposures near Bhuj, Gujarat District. *Palaeobotanist* **17** : 208-219.
- Venkatachala, B. S. & Kar, R. K. 1967. *Katrolaites* gen. nov., a new fossil from Jurassic rocks of Kutch, India. *Curr. Sci.* **36** : 613-614.
- Venkatachala, B. S. & Kar, R. K. 1968a. *Frangospora* gen. nov., a new fossil genus from the Bhuj Series of Kutch, W. India. *Curr. Sci.* **37** : 205-207.
- Venkatachala, B. S. & Kar, R. K. 1968b. *Psilospora* gen. nov., a new fossil genus from the Mesozoic rocks of Kutch, W. India. *Curr. Sci.* **37** : 442-443.
- Venkatachala, B. S. & Kar, R. K. 1970. Palynology of the Mesozoic sediments of Kutch, W. India-10. Palynological zonation of Katrol (Upper Jurassic) and Bhuj (Lower Cretaceous) sediments of Kutch, Gujarat. *Palaeobotanist* **18** : 75-86.
- Venkatachala, B. S. & Kar, R. K., 1972. Palynology of the Mesozoic sediments of Kutch, W. India-9. Palynological fossils from the Bhuj exposures near Dayapar, Kutch District, Gujarat State. in: Ghosh, A. K. et al. (eds)—*Proceedings of the seminar on palaeopalynology and Indian stratigraphy, 1971*. Bot. Dept., Calcutta Univ., pp. 166-171.
- Venkatachala, B. S., Kar, R. K. & Raza, S. K. 1969a. Palynology of the Mesozoic sediments of Kutch, W. India-2. *Bhujiasporites* gen. nov., a new trilete spore genus. *Palaeobotanist* **17** : 121-122.
- Venkatachala, B. S., Kar, R. K. & Raza, S. K., 1969b. Palynology of the Mesozoic sediments of Kutch, W. India-3. Morphological study and revision of the spore genus *Trilobosporites* Pant ex Potonié, 1956. *Palaeobotanist* **17** : 123-126.
- Venkatachala, B. S., Kar, R. K. & Raza, S. K. 1969c. Palynology of the Mesozoic sediments of Kutch, W. India-5. Spores and pollen from Katrol exposures near Bhuj, Kutch District, Gujarat State. *Palaeobotanist* **17** : 184-207.