

Almod Bed : a Permian-Triassic transition zone

Pramod Kumar

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The Almod Bed located between the Bijori (Late Permian) and Pachmarhi Formations (Early Triassic) in Satpura Basin, has been palynologically analysed. The palynoassemblage is dominated by *Striatopodocarpites* + *Faunipollenites* complex. Other characteristic palynofossils are *Arcuatipollenites* (= *Lunatisporites*), *Chordasporites*, *Falcisporites*, *Goubinispota*, *Krempipollenites*, *Lundbladispota*, *Playfordiaspora*, *Podocarpidites*, *Satsangisaccites*, etc. In its totality the palynological assemblage has a Late Permian aspect though the presence of the genera *Goubinispota*, *Playfordiaspora* and *Lundbladispota* in significant frequency indicates an Early Triassic influence.

Key-words — Almod Bed, Transition zone, Permian-Triassic, India.

Pramod Kumar, Birbal Sahni Institute of Palaeobotany, 53 University Road, Lucknow 226 007, India.

सारांश

अल्मोद संस्तर : एक परमियन-ट्रायैसिक परिवर्तन मंडल

प्रमोद कुमार

सतपुड़ा द्रोणी में बिजौरी (अनंतिम परमियन) एवं पचमढ़ी (प्रारम्भिक ट्रायैसिक) शैल-समूहों में स्थित अल्मोद संस्तर का परागाणविक विश्लेषण किया गया है। उपलब्ध समुच्चय *स्ट्रिएटोपोडोकार्पाइटिस* + *फॉनिपोलिनाइटिस* सम्मिश्र से प्रभावी है। इसमें *आर्कुएटीपोलिनाइटिस*, *कोर्डोस्पोराइटिस*, *फाल्सीस्पोराइटिस*, *गाउबिनिस्पोरा*, *क्रेम्पीपोलिनाइटिस*, *लुन्ब्लाडिस्पोरा*, *प्लेफोर्डियास्पोरा*, *पोडोकार्पाइडिस्पोरा*, *सत्संगीसेक्काइटिस* आदि अन्य लाक्षणिक वर्गक भी विद्यमान हैं। हालाँकि *गाउबिनिस्पोरा*, *प्लेफोर्डियास्पोरा* एवं *लुन्ब्लाडिस्पोरा* नामक प्रजातियों की अच्छी प्रतिशत बारम्बारता प्रारम्भिक ट्रायैसिक प्रभाव व्यक्त करती है तथापि कुल मिलाकर यह समुच्चय अनंतिम परमियन आयु की है।

THE Almod Beds exposed near Almod Village on the southwestern flank of Pachmarhi plateau in Satpura Basin are characterised by a sequence of sandstones alternating with carbonaceous shales (Medlicott, 1873). The latter contain plant fossils, mainly *Glossopteris*. Fox (1931) and Crookshank (1936) did not favour maintaining "Almod Beds" as a separate unit since they were lithologically similar to the Upper Bijoris, except being slightly more arenaceous in nature.

Ghosh *et al.* (1988) on the basis of the occurrence of certain conchostracans assigned an Early Triassic age to these beds. In view of the limited palaeobotanical records from these beds, the palynoflora has been studied from an exposure in Tultula Nala, 500 m north of Almod Village, in order to assess the stratigraphic status of the Almod Beds.

GEOLOGY OF THE AREA

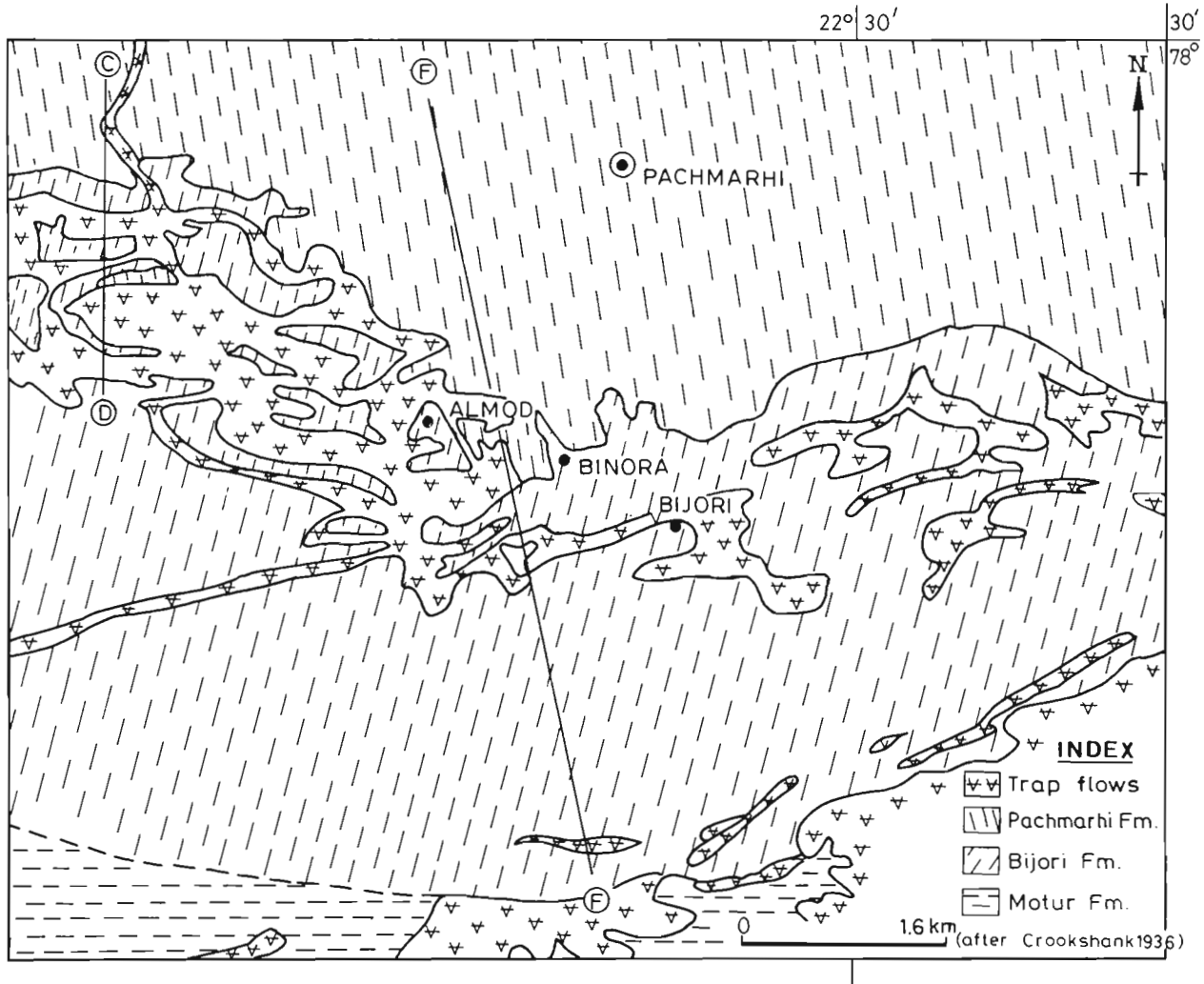
The geological succession exposed near Almod village (22° 23'N lat. : 78° 22' E long.; Text-figure 1) is given in Table 1.

Table 1

AGE	FORMATION/BED	LITHOLOGY (THICKNESS IN METERS)
Lower Triassic	Pachmarhi	White coarse-grained, massive thick, cross-bedded sandstones with lenses of subangular quartz pebbles.
	Almod	Maroon clays, carbonaceous shales mixed with micaceous shales and sandstones.
Upper Permian	Bijori	Micaceous flaggy sandstones and shales, at places micaceous.

Details of the samples collected from the Almod Bed are given in Table 2.

The contact of Almod Bed with the underlying Bijori Formation and overlying Pachmarhi Formation is gradational. The sandstones of Almod Bed are medium to coarse-grained, and the carbonaceous shales are more micaceous as compared to those of the Bijori Formation. Towards the top of the succession maroon clays are predominant.



Text-figure 1 — Geological map of the Almod area.

Table 2

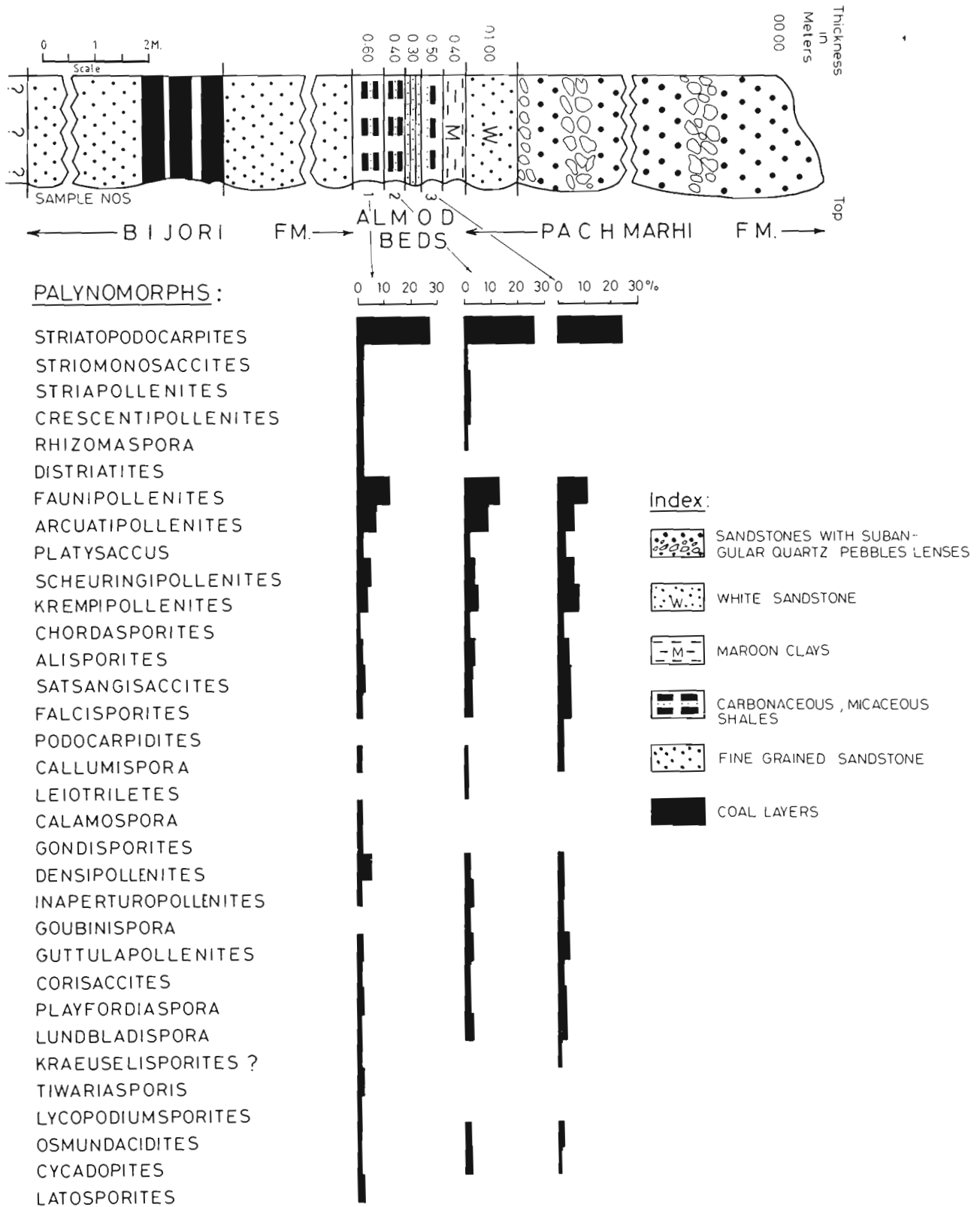
SAMPLES NOS.	LITHOLOGY	THICKNESS IN METER	PALYNOMORPHS PRESENT (+) ABSENT (-)
4464/3	Carbonaceous micaceous shales	00.50	+
	Sandstone	00.30	-
4464/2	Carbonaceous micaceous shales	00.40	+
4464/1	Carbonaceous micaceous shales	00.60	+
Bijori Formation	Sandstone fine-grained	??	-

The carbonaceous shales of the unit contain fragments of *Glossopteris* leaves and have yielded a rich assemblage of palynofossils. The spore-pollen slides studied are preserved in the repository of Museum of Birbal Sahni Institute of Palaeobotany, Lucknow.

PALYNOLOGICAL COMPOSITION

Following is the list of taxa recorded from the assemblage. A frequency count at generic level is plotted in Text-figure 2.

Callumtspora gretensis (Balme & Hennelly) Bharadwaj & Srivastava 1969, *Leiotriletes* sp., *Calamospora exila* Bharadwaj & Salujha 1964, *Osmundacidites pilatus* Tiwari & Rana 1981, *?Lycopodiumsporites* sp., *Gondtsporites raniganjensis* Bharadwaj 1962, *Densosporites novitcus* (Weyland & Krieger) Bharadwaj & Kumar 1972, *D. complicatus* (Balme) Maheshwari & Banerji 1975, *Lundblatdspora microconata* Bharadwaj & Tiwari 1977, *L. brevicula* (Balme) Venkatachala & Rawat 1978, *L. willmotti* (Balme) Venkatachala & Rawat 1978, *Indotrtradites mamillatus* Bharadwaj & Tiwari 1977, *Latosporites*



Text-figure 2 — Percentage frequency of palynomorphs from Almod Beds exposed at Almod Village, Hoshangabad District, Madhya Pradesh

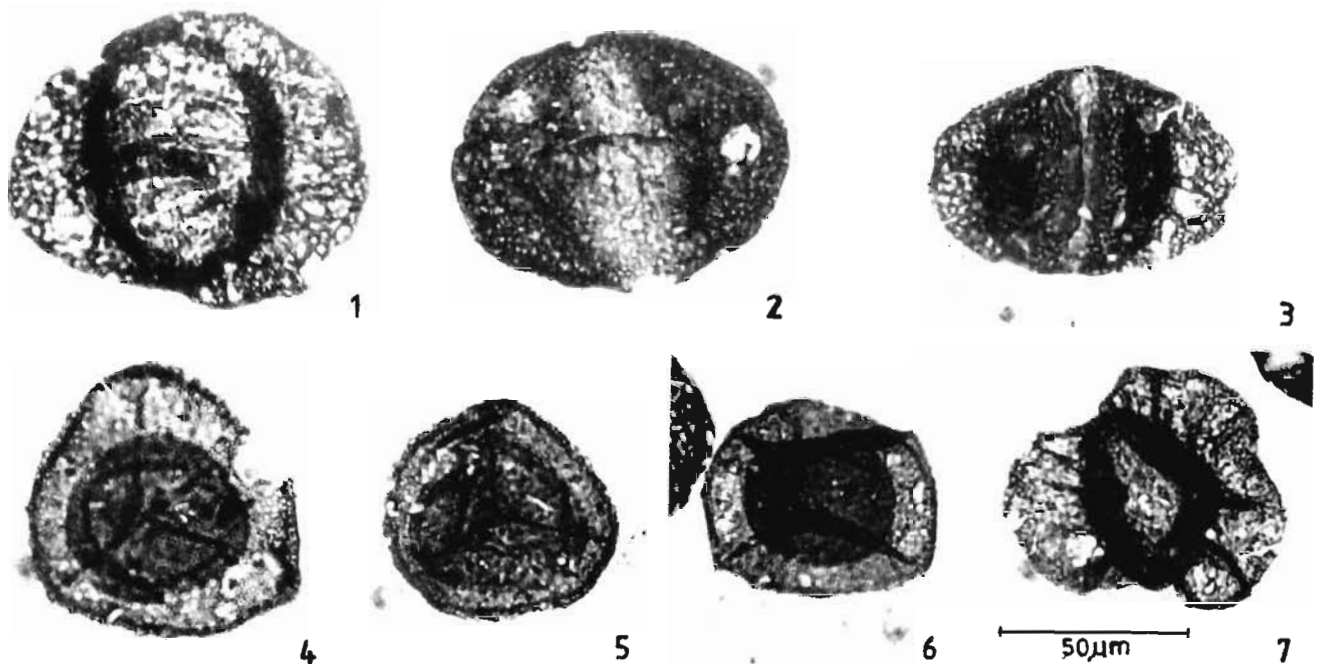


PLATE 1

(All figures ca x 500; Microscope Laboulx-D, Carl Zeiss coordinates within parenthesis)

- | | |
|---|--|
| 1. <i>Striatopodocarpites nidpurensis</i> , Slide no. BSIP 11706 (19 x 94.5). | 5. <i>Lundbladispota microconata</i> , Slide no. BSIP 11710 (40.5 x 96.5). |
| 2. <i>Krempipollenites indicus</i> , Slide no. BSIP 11708 (43 x 111). | 6. <i>Lundbladispota willmotti</i> , Slide no. BSIP 11709 (38 x 99.5). |
| 3. <i>Falcisporites stabilis</i> , Slide no. BSIP 11709 (22 x 107). | 7. <i>Goubinispota</i> cf. <i>morandavensis</i> , Slide no. BSIP 11710 (41.5 x 106.5). |
| 4. <i>Lundbladispota brevicula</i> , Slide no. BSIP 11706 (40 x 107). | |

colltensts (Balme & Hennelly) Bharadwaj 1962, *Playfordiaspora cancellosa* (Playford & Dettmann) Maheshwari & Banerji 1975, *Goubinispota* cf. *morandavensis* (Goubin) Tiwari & Rana 1980, *Striomonosaccites ovatus* Bharadwaj 1962, *Plicatipollenites indicus* Lele 1964, *Densipollenites inuisus* Bharadwaj & Salujha 1964, *D. densus* Bharadwaj & Srivastava 1969, *Altsporites indicus* Bharadwaj & Srivastava 1969, *A. ovalis* Kumar 1973, *Platysaccus queenslandii* de Jersey 1962, *Podocarpidites* sp., *Falcisporites minutosaccus* Kumaran & Maheshwari 1980, *F. stabilis* (Balme) Banerji & Maheshwari 1975, *F. nuthalenis* (Clarke) Balme 1970, *Satsangisaccites royii* Bharadwaj & Srivastava 1969, *Krempipollenites indicus* Tiwari & Vijaya 1975, *Scheuringipollenites tentulus* Tiwari 1973, *Fauntipollenites varius* Bharadwaj 1962, *F. perextigus* (Tiwari) Tiwari *et al.* 1989, *Striatopodocarpites ovalis* Sinha 1972, *S. dubrajpurensis* Tripathi *et al.* 1990, *S. nidpurensis* Bharadwaj & Srivastava 1969, *Crescentipollenites fuscus* (Bharadwaj) Bharadwaj *et al.* 1974, *Rhizomaspora*

divaricata Wilson 1962, *R. triassica* Tiwari & Rana 1981, *Striatites levistriatus* Bharadwaj & Tiwari 1977, *S. sidhiensis* Bharadwaj & Srivastava 1969, *Lunatisporites gopadenis* Bharadwaj & Srivastava 1969, *Verticipollenites finittimus* Bharadwaj & Salujha 1964, *Circumstriatites ovatus* (Lele & Makada) Maheshwari & Banerji 1975, *Striapollenites obliquus* Bharadwaj & Salujha 1964, *Distriatites insculptus* (Playford & Dettmann) Kumaran & Maheshwari 1980, *Arcuatipollenites pellucidus* (Goubin) Tiwari & Vijaya 1995, *Chordasporites australiensis* de Jersey 1962, *Guttulapollenites hannonicus* (Goubin) Venkatachala *et al.* 1967, *Corisaccites alutas* Venkatachala & Kar 1968, *Tiwariasporis* sp., *Cycadopites* sp., *Inaperturopollenites nebulosus* Balme 1970.

COMPARISON

Palynological assemblage from the Bijori Formation has dominance of striated disaccates pollen, viz., *Striatopodocarpites* followed by *Fauntipollenites*, in association with *Crescentipollenites*

and *Densipollenites* (Bharadwaj *et al.*, 1978; Sarate & Patil, 1994). The significant aspect of the assemblage is the appearance of nonstriated disaccates, such as, *Alisporites*, *Kremptipollenites*, as well as, *Cortisacctes*, *Guttulapollenites* and the trilete cavate *Lundbladispora*. The palynoassemblage from the Almod Beds shows a similar dominance of *Striatopodocarpites* and *Faunipollenites* in association with *Crescentipollenites*. But these forms are present here in comparatively low frequencies. Some forms which appeared in the Bijori exhibit an increasing trend in percentage frequency, such as, *Alisporites*, *Kremptipollenites* and *Lundbladispora*. The Almod palynoassemblage contains some significant forms, e.g., *Podocarpidites*, *Chordasporites*, *Satsangisacctes*, *Falctisporites*, *Goubinitispora*, etc., which are absent in the Bijori Formation. These forms have been reported from the younger sequences, i.e., Panchet Formation (Tiwari & Singh, 1983) and Pachmarhi Formation (Kumar, 1995, 1996). But elsewhere these forms have been reported from older horizons also. The Pachmarhi palynoassemblage has the dominance of nonstriated disaccates *Falctisporites*, *Satsangisacctes* and *Alisporites*.

Thus the Almod palynoassemblage though shows a close relationship with the Late Permian Bijori palynoassemblage in having dominance of striated disaccates with a few taeniate pollen and trilete cavate forms. Yet it apparently has a younger aspect in having comparatively more nonstriated disaccate pollen and in the appearance of *Goubinitispora*, *Chordasporites*, *Lundbladispora*, etc. generally found in the Early Triassic.

CONCLUSION

The palynoassemblage from the Almod Beds is characterised by the dominance of *Striatopodocarpites* followed by *Faunipollenites* and *Crescentipollenites*. Apart from these striated disaccate pollen, it also contains some significant forms, viz., *Goubinitispora*, *Chordasporites*, *Podocarpidites*, *Kremptipollenites*, *Satsangisacctes*, *Lundbladispora*, *Playfordiaspora*,

Cycadopites, etc. The Almod Beds are thus definitely younger than the Bijori Beds of Sukh-Tawa area and in Denwa River, Harshdwar Nala and Tamia scarp (Bharadwaj *et al.*, 1978; Sarate & Patil, 1994; Kumar, 1996). The Almod Beds exhibit onset of *Striatopodocarpites-Kremptipollenites-Falctisporites* assemblage zone. The occurrence of *Goubinitispora* in sample nos. 2 and 3 indicates the influence of Early Triassic.

It would thus seem that the Almod palynological assemblage, though having strong Late Permian affinities, yet has certain elements which clearly indicate an Early Triassic influence. It may fall in the Permian-Triassic transition zone but much more data are required for exactly fixing the age of the Almod Beds.

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