

PALYNOLOGICAL DATING OF OLIVE-GREEN SHALES UNDERLYING THE ATHGARH SANDSTONE IN MAHANADI BASIN

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ABSTRACT

The Infra-Athgarh sedimentary deposits observed at Garh Haladia, west of Bhubaneswar in Mahanadi Basin comprising of khaki-green needle shales, contain a palynoflora which is characterized by the presence of radial monosaccate pollen *Plicatipollenites* and a few organic bodies of unknown origin. On the basis of these fossils an Early Permian age is assigned to these sediments.

INTRODUCTION

THE Athgarh Gondwana Basin occurring within the Mahanadi delta around Bhubaneswar has been known to be the repository of Late Gondwana sediments of Lower Cretaceous age. Blanford¹ identified these sedimentaries as 'Athgarh stage' which occupies lowlying hills west of Cuttack and is supposed to overlie directly on the metamorphics². This formation comprises arenaceous shale, fire clay, sandstone, grit and conglomerate. On the basis of plant megafossils as well as pollen and spores found in the shale and fire clay units a Jurassic to Early Cretaceous age is assigned to it³⁻⁵. These rocks constitute the northernmost exposures of East Coast Gondwana. Recent work at the Geological Survey of India has indicated the presence of Talchir-like needle shales along the southwestern margin of the basin. The present paper describes the occurrence of Talchir palynofossils in these shales thus confirming their age.

MATERIAL AND METHODS

Outcrops of the khaki-green needle shales are exposed in gulies occurring 1 km south of Garh Haladia village on either side of the Khurda-Garh Haladia road (figure 1). The beds dip at angles varying from 10 to 15° towards south, display the presence of olive-green splintery shales, buff to green siltstone, shales with rhythmites (individual couplets varying from 1 to 2 mm in thickness) and varve-like units and occasional calcareous concretions in greenish shales and mudstones. The contact of this khaki-green shale unit with overlying porous gritty Athgarh Sandstone is not exposed and the base of the shale is also concealed (figure 2a).

The total exposed thickness of the khaki-green shale unit from where the samples for palynological study were collected is ~8 m. Their gross lithological characters are akin to the typical periglacial sediments of the Talchir Formation of other Peninsular Gondwana basins. The dimictites which are ubiquitous in type section is not exposed here. As such, the nature of ice advancement in the Orissa coastal tract could not be precisely defined.

Thirteen samples were collected from various lithologies of olive-green shale suite and were repeatedly tried for palynofossil extraction. Of these, three samples (khaki-green shale at the middle level) yielded pollen grains and a few black organic bodies.

PALYNOLOGICAL OBSERVATIONS

The palynoflora recovered from khaki-green shale is qualitatively non-diversified. The only monosaccate constituent represented is the genus *Plicatipollenites* Lele 1964 with two species, namely — *P. gondwanensis* (Balme & Hennelly) Lele 1964 (figures 2b and e) and *P. indicus* Lele 1964 (figure 2c). A few psilate trilete spores, probably immature as they are not released properly, could be referred to *Leiotriletes* Naumova ex Potonié & Kremp 1954 and two specimens of nonstriate disaccate pollen are assigned to ?*Vestigisporites* (figure 2d). Some specimens which could be referred to the alate genus *Leiosphaeridia* Eisenack have also been identified in this assemblage. The yield of the palynomorph being very poor, quantitative analysis has not been possible at present. As such, the genus *Plicatipollenites* alone appears to be the prominent element of the flora.

Beside pollen and spores, some black organic bodies (figures 2f, g) are also recorded. In outline

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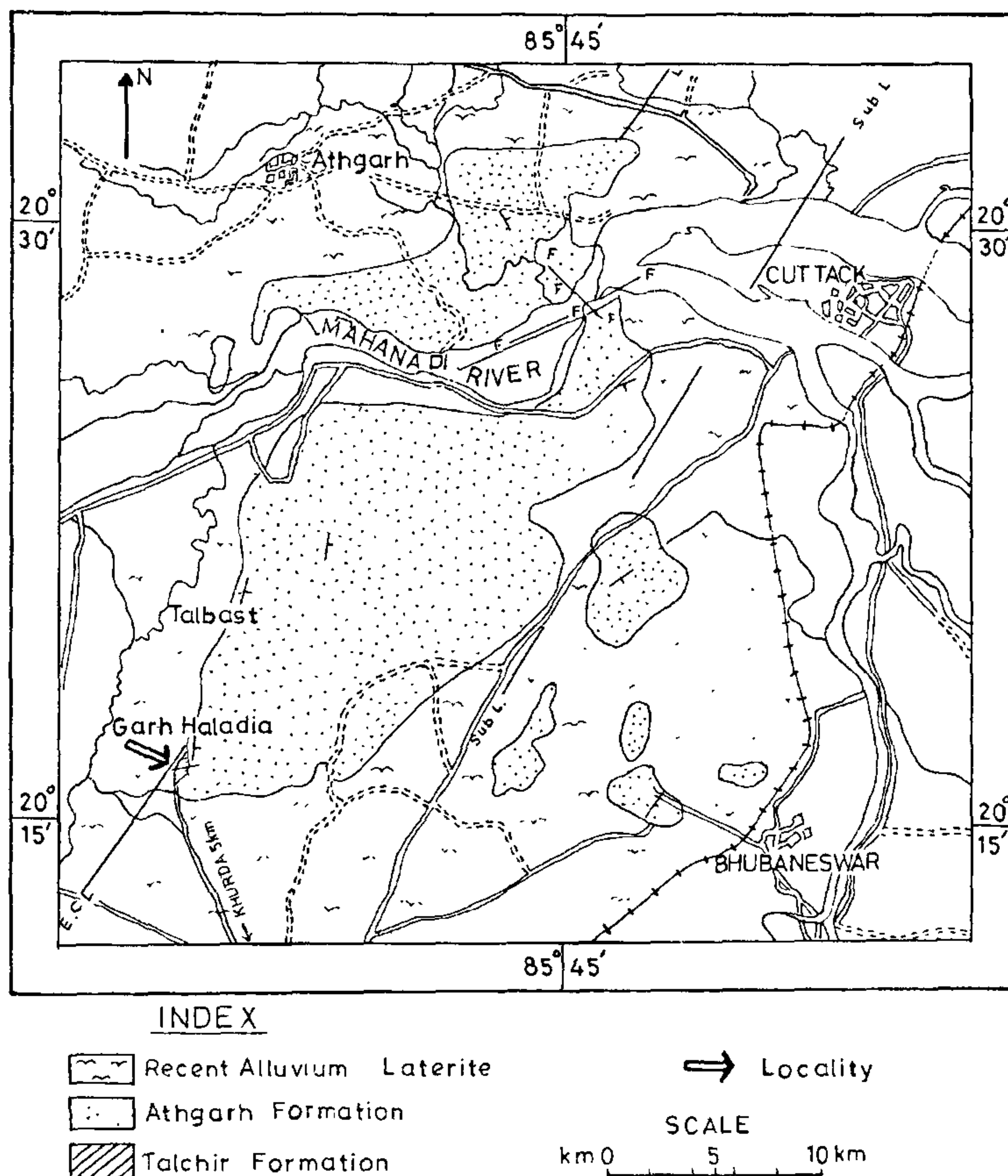


Figure 1. Geological map of part of Athgarh Basin showing the location of outcrops of olive green shales (see arrow) analysed in the present study (Toposheet No. 73H; geology after Ball, 1877; partly revised by P. K. Dutta, 1978, GSI DOCD No. 4/79.)

they resemble *Lagenochitina* Eisenack 1931 and *Desmochitina* Eisenack emend. Eisenack 1962.

AGE DETERMINATION

Compositionally, this assemblage is of Talchir affinity. A comparison with other known assemblages from Talchir sediments suggests its resemblance with Zone T-I of Tiwari⁶. The Lower Talchir flora described by Chandra and Lele⁷ from Johilla Coalfield has prominence of *Plicatipollenites* but it is a more diversified assemblage as it is also associated with other girdling monosaccate forms, such as

Potonieisporites, *Parasaccites* and *Rimospora*. The presence of only one monosaccate type, rarity of disaccates and absence of apiculate trilete spores apparently show the lack of diversification in the Garh Haladia assemblage. Possibly, it suggests an affinity within the older Talchir palynoflora⁶.

Further, it is interesting to note that the specimens of *Plicatipollenites* found here have a relatively smaller size range (50–85 μm) than those recorded from other palynofloras having older Talchir affinity^{8,9} (124–160 μm). This small size of monosaccate specimens suggests an adaptability towards the extreme cold conditions in the early Talchir

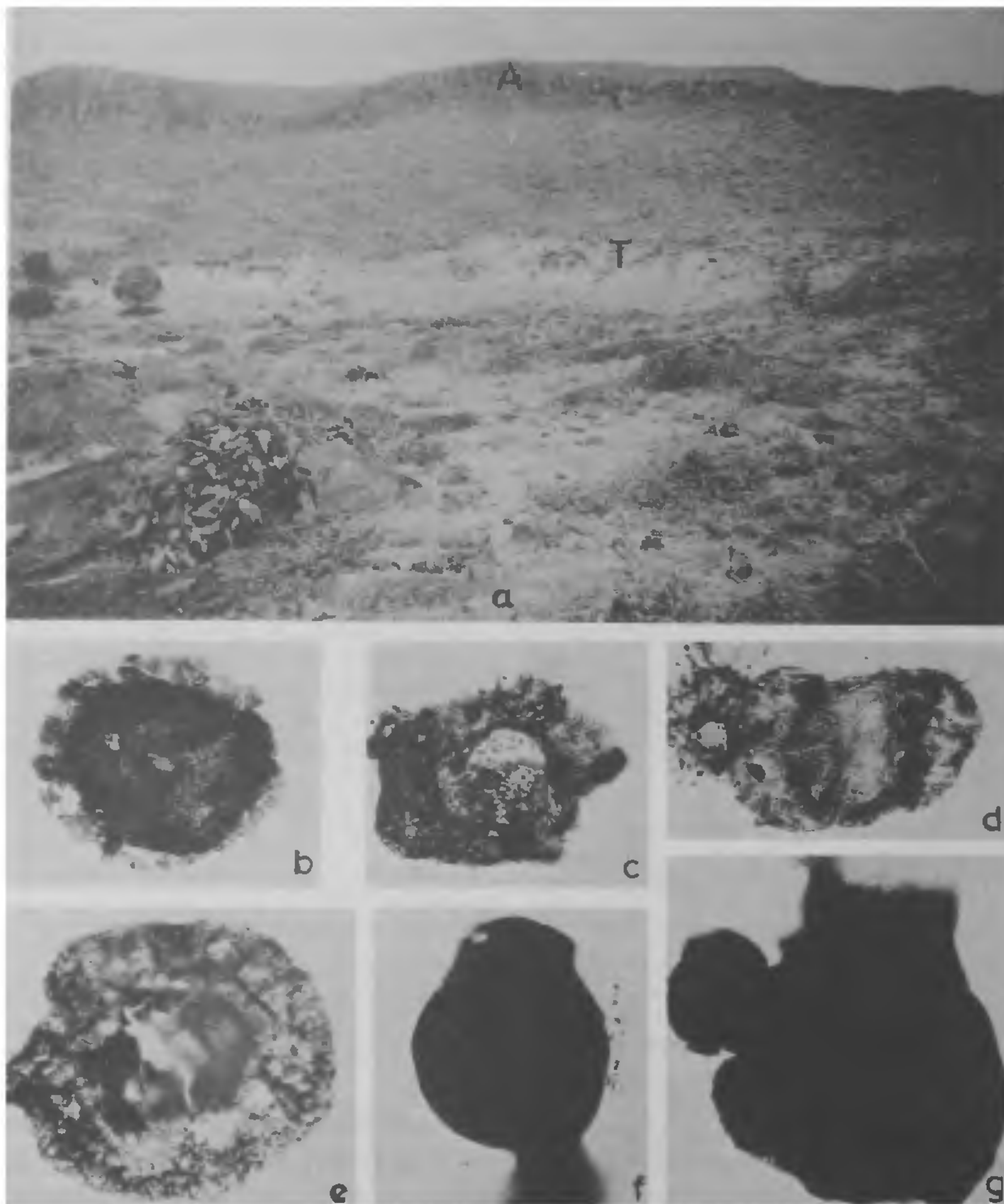


Figure 2a-g. a. Photograph showing Talchir needle shales (T) and Athgarh Sandstone (A) exposed along the road side near Garh Haladia Village; b, e, *Plicatipollenites gondwanensis*; BSIP slide Nos. 9583, 9586; c. *Plicatipollenites indicus*; slide No. 9584; d. ? *Vestigisporites* sp. ; BSIP slide No. 9585; f, g. Organic bodies; BSIP slide Nos. 9587; 9588.

time. The Chitinozoa-like bodies and *Leiosphaeridia* are indicators of shallow marine conditions of deposition.

CONCLUSIONS

The assemblage of palynoflora from the infra-Athgarh khaki-green shale, in all probability, repre-

sents the lower level amongst the known assemblages of the Talchir Formation reflecting extreme cool conditions and marine environment of deposition. The presence of Talchir sediments in Garh Haladia area extends the occurrence of Lower Gondwana sediments along the east coast of Peninsular India up to Bhubaneswar. These Talchir

shales are directly overlain by the Athgarh Sandstone. Thus the time gap between the earliest Permian and the Late Mesozoic is not represented by sediments in this area, a case comparable to the Palar Basin¹⁰.

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NEWS

BIGGEST NORTH SEA OIL FIND IN THIRTEEN YEARS

Energy companies believe they have made the biggest oil and gas find in Britain's North Sea during the past 13 years.

They estimate that the field, about 200 km east of the Orkney Islands, could contain between 350 and 700 million barrels of oil and 20,000 million cubic metres of gas.

This would make it the most important field since

the discovery in 1974 of the Ninian field, containing 1,000 million barrels of oil and lying some 175 km further north.

It would also confound the generally held belief that all large fields in the North Sea have already been identified. (*British Information Services*, British High Commission, Chanakyapuri, New Delhi 110 021.)

NEW TECHNOLOGY OF FRUCTOSE PRODUCTION

A valuable new technology of fructose production has been developed by the Institute of Microbiology of Armenian Academy of Sciences. The method is based on the treatment of the Jerusalem artichoke.

Under the new technology the yield of fructose is doubled compared to the conventional method based on starch and cellulose. The new technology

will be commercialized at a special shop to be built in the Institute campus. (*Soviet Features—Science and Technology*, Vol. XXVI, No. 106, Sept. 8, 1987; Published by the Information Department, USSR Embassy in India, Barakhamba Road, New Delhi 110 001).
