

# MICROSTRUCTURE OF WOODY LIGNITE FROM DARRANG DISTRICT AREA, ASSAM, INDIA\*

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## ABSTRACT

The microstructural details of woody lignite from the Darrang district area in Assam have been studied; the lignite is derived from the secondary wood of a dicotyledonous angiosperm. Xylinite and resinite (brown and yellow resins) are the main petrological constituents. The common occurrence of resins accounts for the high volatile content of the lignite. Films of clayey matter occupy the fracture and joint planes and account for the variable proportion of ash content. Sulphur is low, which indicates formation of the lignite in conditions other than marine.

## INTRODUCTION

THE present paper contributes to the meagre data available on the microstructural details of the petrological constituents of Indian lignites. The woody lignite described is from the Dhansiri Forest Reserve area, district Darrang, Assam. Lignite occurs as streaks, lenticles and lumps in medium-grained sandstones of Tipam series (Middle to Upper Eocene) of Lower Siwaliks, and is not known to be of any economic importance. Maclaren (1904) has described the lignite to be "characterized by the abundant presence of semi-carbonized, semi-silicified wood".

## CHEMICAL COMPOSITION

Chemically, the lignite has high volatile matter and low to medium ash content (see TABLE 1). The variation in ash content of two samples from the same specimen is inferred to be due to greater occurrence of joints and fractures which are occupied by clayey matter. The lignite can be suitable for steam-raising in locomotives and in gasification work.

## MICROSTRUCTURAL STUDY

Megascopically, the lignite is brownish-black in colour and appears quite compact, hard and lustrous. It breaks with a conchoidal fracture, the fractured planes being

of shining appearance and exhibiting woody pattern. Thin films of clayey matter are present commonly along these planes, and thus ash content varies in the same sample (TABLE 1).

The lignite was studied microscopically in thin sections prepared along the different planes for anatomical investigation. The lignite shows its secondary woody nature (PLATE 1), preserved as xylinite. Resinous substances are prevalent throughout, occurring as brown and yellow resins and cell fillings.

*Xylinite*—The fibres are the main component appearing as thick, closely-placed, long, parallel tubes in tangential section (PL. 1) and folded (PL. 1, FIG. 5) or flattened and elongated (PL. 1, FIGS. 6, 7, 8) in cross section. Minute cells filled with yellow resin, occurring in parallel zones and which appear to be klood parenchyma are seen conspicuously traversing the wood in cross section (PL. 1, FIGS. 6, 7). The miniature cells are thick-walled and infilled by a

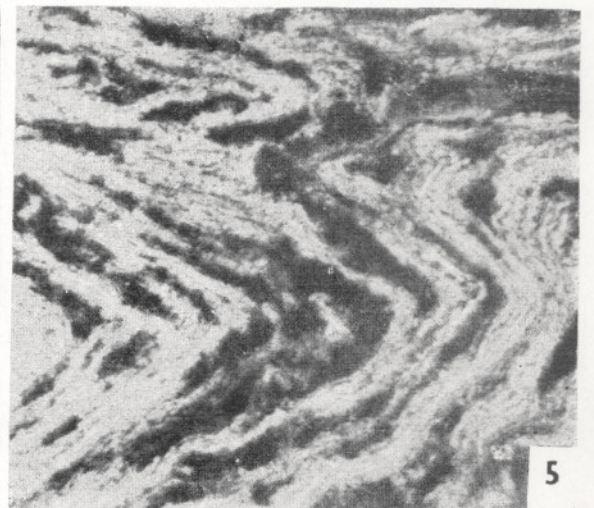
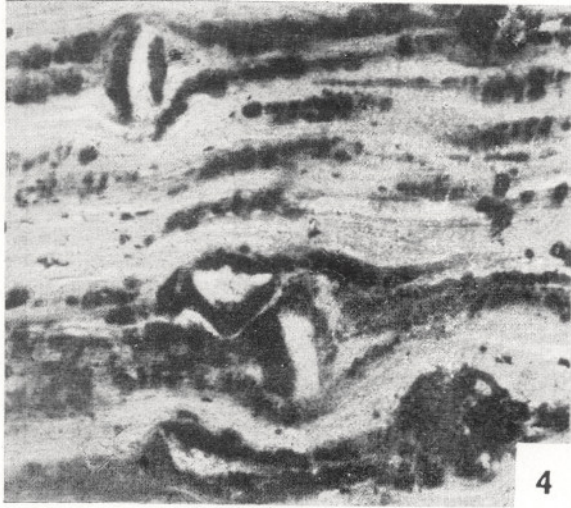
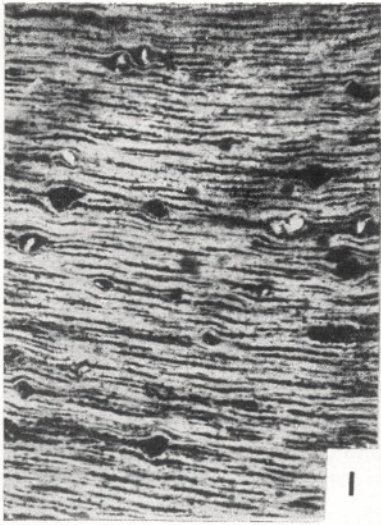
TABLE 1—PROXIMATE ANALYSIS OF  
WOODY LIGNITE

PROXIMATE ANALYSIS (*)	AIR-DRIED BASIS		UNIT COAL BASIS	
	Sample No. 1	Sample No. 2	Sample No. 1	Sample No. 2
Moisture	11.65	13.11	—	—
Ash	19.84	5.08	—	—
Volatile matter	34.14	39.59	48.4	48.1
Fixed carbon	34.37	42.22	51.6	51.9
Total	100.00	100.00	100.0	100.0
Colour of ash	Cinnara brown	Light brownish olive		
Sulphur	0.45	0.63		
Coke button (V. M. Test)	Non-caking	Non-caking		

(\*) P.R. No. 12355, Analysed by Chemical Division, G.S.I., Calcutta.

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resinous substance of light brownish colour (PL. 1, FIG. 8). The vessels are conspicuous in transverse section and occupied by a dark coaly material (PL. 1, FIG. 8). The medullary rays are mostly uniseriate and only rarely biseriate, being up to 24 cells in height. Pits are recognizable as chains (PL. 1, FIG. 3). The nature of the wood, arrangement of the rays and appearance of the vessels is indicative of the wood belonging to a dicotyledonous angiosperm.

*Resinite* — It constitutes brown and yellow resins and cell-filling. "Knots" of variable shape and size (PL. 1, FIGS. 1, 4) appear commonly and are usually traversed by a yellowish band through their central part (PL. 1, FIG. 4). Yellow resins are much smaller in size and are of phylogenetic origin-melanoresinite (PL. 1, FIG. 7). The cell-fillings are of light to dark brownish colour and of resinous nature in most of

the cases occupying medullary ray cells (PL. 1, FIGS. 3, 4), tracheids, fibres and vessels (PL. 1, FIG. 8). This material is not unlikely to have been an original part of the wood rather than permeated it in the lignification stage.

The woody lignite is distinct in microstructural details from that derived from a gymnospermous wood (PAREEK, 1960).

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#### EXPLANATION OF PLATE

(All figures are from thin sections)

##### PLATE 1

1. Tangential section of the woody lignite showing thick fibrous tracheids and dark brownish "knots" of resinous nature.  $\times 45$ .
2. Oblique section showing medullary rays and yellow resins.  $\times 45$ .
3. Tangential section of woody lignite showing rows of uniseriate medullary rays of height up to 18 cells, chains of pits and yellow resins.  $\times 135$ .
4. Tangential section of the woody lignite under high power showing the nature of finely compressed fibrous tracheids, "knots", and medullary rays. A dark brownish resinous material infills the cell cavities.  $\times 600$ .
5. Folded fibrous tracheids as seen in a transverse section. The dark brownish material is similar to that as cell-fillings.  $\times 135$ .
6. Transverse section of the woody lignite showing its secondary woody nature conspicuously, yellow resin zones, cells of wood parenchyma across the structure and compressed and flattened aspect of the cells.  $\times 135$ .
7. Transverse section of the woody lignite under high power showing the miniature fibre cells and a large yellow resin.  $\times 350$ .
8. Transverse section of the woody lignite showing under the high magnification the nature of miniature cells, vessels and the resinous cell-fillings.  $\times 600$ .