BIOMARKER SIGNATURES OF ICONIC GLOSSOPTERIS FLORA OF GONDWANALAND

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Glossopteris flora is an extinct group of seed ferns (Pteridospermatophyta), and is the primary constituent of the southern supercontinent Gondwanaland during the Permian period. The flora got its name after the dominant and best known genus *Glossopteris* of the order Glossopteridales (Sarbadhikari 1974). First discovered in India, Glossopteris flora has been recognized in all the southern continents and corroborates the continental drift hypothesis. The present study aims to explore the botanical affinity of the Glossopteris flora from its molecular fossil signatures. A detailed documentation of biomarkers of a *Glossopteris* leaf tissue from Lower Permian, Upper Barakar Formation, collected from Lower Gondwana sediments of Khottadih colliery, Pandaveshwar area, Damodar Basin, eastern India has been performed. The sample was analysed using Rock-Eval pyrolysis for thermal maturity and gas chromatography–mass spectrometry (GC-MS) for biomarker analysis.

The biomarkers present in the *Glossopteris* leaf extract, are dominated by a series of *n*-alkanes ranging from C_{15} to C_{34}. The other biomarkers present in the saturated hydrocarbon fraction include hopanes and steranes. Steranes are dominated by C_{29} regular steranes, followed by C_{29} rearranged steranes. The hopanes include C_{27} to C_{30} hopanes and C_{31} homohopanes with both S and R epimers. The aromatic hydrocarbon fraction of the extract is mainly characterized by polycyclic aromatic hydrocarbons (PAHs). Aromatic biomarkers include sesquiterpanes (cadalene and tetrahydrocadalene), diterpanes (bisnorsimonellite, simonellite, retene and tetrahydroretene with its two other isomers). Other PAHs comprise of phenanthrene, methylphenanthrenes, fluoranthene, pyrene, benzo[a]anthracene, chrysene, benzofluoranthene and benzopyrene (?). A similar diterpane distribution has been reported in the Permian coals from the same formation of the Damodar Basin (Tewari et al., 2017). Diterpenoid biomarkers are widely accepted as marker compounds of modern as well as extinct conifers. Abietic acid, which is a major component of extant conifer resins, may produce the identified diterpanes during its diagenetic alteration (Fig. 1).

The thermal maturity of the fossil leaf has been inferred using some biomarker parameters as well as Rock-Eval pyrolysis. The C_{30} moretane/hopane ratio and the methyl phenanthrene index of the studied sample are 0.38 and 0.78, respectively, which indicate that the sample is thermally immature. This is also supported by low Rock-Eval T_{max} value, i.e., 429 °C.

The present study illustrates that the Permian Glossopteris flora was able to biosynthesize abietic acid and related plant terpenoids.

Figure 1 *Diagenetic transformation of abietic acid. Compounds with an asterisk (*) were detected in the studied Glossopteris leaf extract.*

REFERENCES

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