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Molecular Characterization of Some of the Earliest Terrestrial Organisms

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Phytoterrestrialization was one of the most important events in the history of life on Earth with repercussions for terrestrial animals, cycling of organic matter, sedimentation, weathering and atmospheric composition. The fossils themselves are often not readily assigned to extant groups. Two examples of such fossils are *Prototaxites* Dawson and *Pachytheca* Hooker which are often reported in assemblages of early vascular plants. Anatomically they are quite distinct from tracheophytes (including club mosses, horse-tails, ferns and seed plants) and bryophytes (mosses and liverworts). They also have no extant counterparts in algae or fungi although an affinity with the latter has recently been hypothesized for *Prototaxites* (Hueber, 1996).

Comparative anatomy having failed to establish affinities of enigmatic taxa such as *Prototaxites* and *Pachytheca* we attempted to use chemical signatures from coalified residues to resolve this issue. Before we analysed the problematic fossils we characterized unequivocal tracheophytes, including *Renalia*, *Psilophyton* and *Zosterophyllum* as examples of the three major clades of early vascular plants (Ewbank et al., 1996; Edwards et al., 1997). All of these early land plants possessed a vascular system. Their flash pyrolysates are consistent with the view that they contained lignin but coalification has resulted in demethylation and demethoxylation of the distinctive methoxy group on the phenylpropanoid components of lignin. In the presentation results will be presented which show the major reactions of 2-methoxyphenol; 2,6-dimethoxyphenol (Vane and Abbott, 1999) and some methoxyphenol dimers synthesized in our laboratory. Spectroscopic and flash pyrolysis data will also be presented which have been used to describe the organic molecular composition of *Prototaxites* and *Pachytheca* (Abbott et al, 1998). Finally new challenges will be outlined, focusing on the fungal degradation of plant material.

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