Experimental simulation of organic fossilisation

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Pre-Tertiary arthropod and leaf fossils are comprised of recalcitrant aliphatic macromolecules, similar in composition to Type I/II kerogen. Typically, their extant counterparts lack any such resistant aliphatic precursor, precluding selective preservation of such a compound as a source for the fossil aliphatics. Instead, recent research reveals that fossil aliphatic macromolecules could be a product of lipid polymerisation. To understand this process, confined pyrolysis gold tube experiments were carried out on pure and chemically treated modern arthropod and plant tissues.

Artificially matured scorpion, shrimp and cockroach cuticle contains moieties related to phenols, pyridines, pyrroles and possibly indenes (derived from matured chitin), while straight-chain C_{16} and C_{18} fatty acyl moieties and C_{10} to C_{20} *n*-alkyl moieties indicate the presence of an aliphatic polymer. Cuticles matured after lipid extraction and saponification do not show the presence of these aliphatic components proving that they must derive from the extractable lipids of the cuticle/tissue. Similarly, pyrolysis of leaf tissue matured without any treatment yielded alkane/alkene homologues ranging from *n*-C_{10} to *n*-$C_{34/35}$, whereas leaves matured after lipid extraction contained few long-chain *n*-alkyl moieties and leaves matured after base-hydrolysis apparently contain no aliphatic moieties. Thus, in the absence of cutan, other aliphatic components - cutin, waxes and internal lipids - contribute to formation of an aliphatic polymer.

The effect of a basalt flow on the chemical composition of sedimentary organic matter

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Thermal maturation is one of the most important controls on the preservation of fossil organic matter, but its effect is often difficult to separate from environmental or diagenetic controls due to the extended sedimentary sequences (>1000 m) through which thermally induced changes occur. The Enspel lacustrine deposit (Germany) is an ideal location to study the thermal imprint on sedimentary organic matter composition as it contains a sedimentary sequence abruptly terminated by a basalt flow but no subsequent deep burial. Thus, the sediments immediately underlying the basalt flow represent a compressed sequence of increasing organic matter thermal alteration – from highly immature (remarkably, sterols and hopanols are still present) to advanced catagenesis.

The thermal imprint is obvious in a range of bulk organic chemical and specific biomarker parameters. Among the parameters that decrease upsection are: total organic carbon and total nitrogen contents; degree of functionalization of both bulk organic matter and individual compounds; and the average chain length of *n*-alkanoic acids. Increasing upsection are the aromatic content of bulk organic matter and the extent of sterane and hopane stereochemical isomerization. Considered together, these records reveal how both algal and higher plant organic matter has changed in response to thermal alteration and will ultimately facilitate comparison of such pristine deposits as the Clarkia Formation to more ancient and thermally altered units.