Geophysical Research Abstracts, Vol. 9, 00280, 2007
SRef-ID: 1607-7962/gra/EGU2007-A-00280

Biogeomacromolecules of Palynomorphs as revealed by Pyrolysis-Gas Chromatography-Mass Spectrometry

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Palynomorphs have a long history of use, starting from fossil fuel exploration to the entities that provide stratigraphical, palaeoenvironmental and palaeocological information. However, the molecular composition of those palynomorphs remain obscure. Here we report outcomes of an ongoing study in which the chemical and physical nature of biogeomacromolecules of extraordinarily well preserved prasinophytes, chitinozoans, scolecodonts and megaspores are investigated. Samples of *Tasmanites* have been sourced from Hazro (SE Turkey), Tasmania (Australia), Oklahoma and Virginia (USA). Chitinozoans and *Leiosphaeridia* were sampled from Hazro and scolecodonts from Gotland (Sweden). Several megaspores, sampled from several localities within Germany reflecting Lower Tertiary, Lower Cretaceous and Upper Carboniferous ages were also investigated.

Following kerogen isolation, organic residues were cleaned by dichloromethane to remove free hydrocarbons. Taxonomically classified palynomorph specimens were handpicked. The pure concentrate was then subjected to Curie point pyrolysis-gas chromatography-mass spectrometry.

The overall chemical compositions of the *Tasmanites* and *Leiosphaeridia* were similar. The pyrolysates from both are dominated by a series of $C_{6-22}n$-alkene/n-alkane doublets. Tricyclic terpenoids, present in the pyrolysates of *Tasmanites* from Tasmania (see also Greenwood et al., 2000), were not detected by analytical pyrolysis of the *Tasmanites* from SE-Turkey and USA. Interestingly, the pyrolysates of *Leiosphaeridia* from SE Turkey show the presence of several unsaturated and aromatic tricyclic terpenoids (Dutta et al., 2006). Thus, an inherent source-biomarker relationship between the *Tasmanites* and tricyclic terpenoids may not always exist.

The major pyrolysates of chitinozoans are aromatic hydrocarbons such as akylbenzenes, alkylnapthalenes, alkylphenantherenes, alkylphenols. A homologous series of n-alkene/alkane doublets also indicated the presence of a significant aliphatic moiety. No pyrolysis products diagnostic of chitin were detected.

The pyrolysis products of the scolecodonts also included alkylbenzenes, alkylnaphthalenes, alkylphenols and a homologous series of $C_{6-18}n$-alkene/n-alkane doublets. A lack of pyrolysates attributable to amino acids in scolecodonts is likely due to their facile diagenetic loss.

Alkylbenzenes and alkylphenols are the major aromatic pyrolysates and a homologous series of n-alkenes/n-alkanes the major aliphatic products of all megaspores. Oxygenated aromatic compounds like benzaldehyde, acetophenone and 4-vinyl-phenol were detected in the Lower Tertiary and Lower Cretaceous megaspores but were not detected in Upper Carboniferous megaspores.

Thus, it is concluded that megaspores, chitinozoans and scolecodonts contain significant aliphatic and aromatic moieties, whereas algal walls represent highly aliphatic biomacromolecules. The data does confirm that pyrolysis of marine derived kerogen can yield phenols and aromatic compounds, hence these compounds are not always diagnostic of kerogen derived from terrestrial higher plants.

References

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Preferred Presentation: **Oral**