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ORGANIC GEOCHEMICAL AND COMPOUND SPECIFIC STABLE CARBON ISOTOPE ANALYSIS OF SATURATED CARBOXYLIC ACIDS, EXTRACTED FROM LATE PALEOZOIC COALS

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Many isotopic studies have been carried out recently on coals to gain information about the response of past ecosystems and plant communities to climate change (e.g. Ahrens 2000, Peters-Kottig et al. 2006). Especially compound specific stable carbon isotope analyses (CSIA) have been applied successfully for such investigations. The aim of this study was to evaluate a possible application of a stable carbon isotope analysis of carboxylic acids in Late Paleozoic coals for paleoenvironmental analyses. For this purposes thirty coal samples from different paleogeographic locations, deposited under different paleoenvironmental and paleoclimatic conditions were analyzed. Firstly, an analytical procedure was developed to isolate carboxylic acids from extracted organic matter for a gas chromatographic isotope ratio mass spectrometric analysis. Secondly, compound specific isotope analysis of coals from different paleovegetational realms (Euramerica and Gondwana) revealed differences in isotope signals measured for bulk samples, alkanes and carboxylic acids. The fatty acid isotope signal shows closer response for different depositional environments, where paraffin signals do not vary significantly. Differences were also measured between wax derived carboxylic acids and those derived from plant fats and seed oils. This differentiated isotope signal for fatty acids revealed isotopic differences between coal from different paleovegetational realms, e.g. Eurameric and Gondwana as well as differences inside a depositional system e.g. Saar-Nahe Basin. Thus, compound specific isotope analyses of carboxylic acids give access to more detailed information compared to analyses of bulk tissue or paraffins alone. The combination of isotope analyses with mass spectrometric analyses of lipid distribution patterns improves identification of changes in geochemical source signals encoded in coal. This study also proves the importance of cross-validation using different proxy parameters to identify and distinguish different source signals.

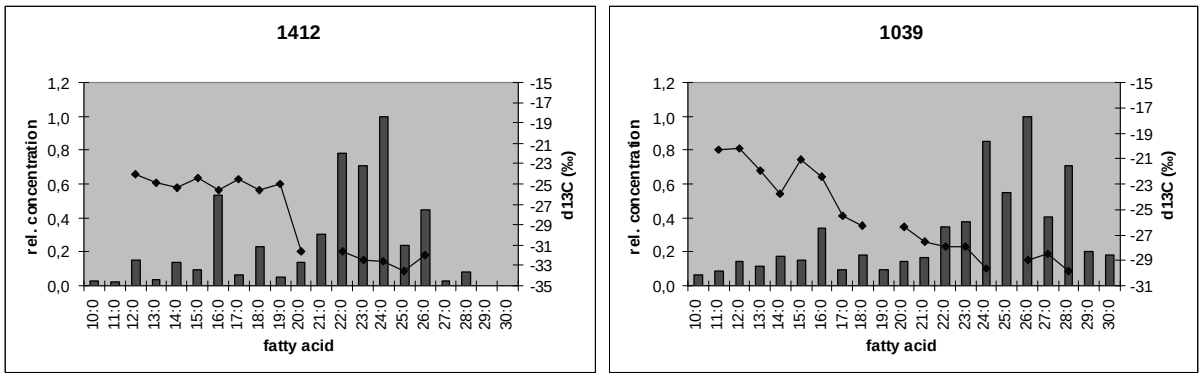

Figure 1. Overlay of $\delta^{13}C$ fatty acid values (curves) with relative acid distribution (bars) for selected Late Palaeozoic coal samples.

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