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Geochemistry of the North-Eastern Saharan Basins: Correlation between Oils and Source Rocks Based on Isotope Ratios in Polar Compounds

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The principal hydrocarbon source rocks of the north-eastern Saharan basins are Silurian (Gothlandian) and Devonian (Emsian, Givetian, Frasnian, Famennian) and, to a lesser degree, Ordovician shales (El-Gassi and Azzel formations). Silurian source rocks started with oil generation from the Carboniferous onwards whereas middle and late Devonian source rocks began genarating liquid hydrocarbons during the Permian.

The Oued Mya- Ghadames, Triassic, and North Illizi basins of the Triassic province have been studied in detail. The distribution of saturated C_{10} and aromatic C_8 Hydrocarbons, Hydrocarbon C_4-C_7, gasoline compositions, hydrocarbon C_5-C_8 oil compositions, and oil-source rock thermolisi products (soluble organic matter neglected for biodegraded oils), as well as effective source rock distribution are used to complement a correlation based on carbon isotopes in polar fractions. Carbon isotope composition (σ^{13} C) was correlated for five oil and bituminoid fractions (hexane, hexane-benzene, benzene, benzene methanol, asphaltene). Under the influence of biological (fermentational) fractionation and diagenetic elimination of isotopically heavy groups like –COH or $–OCH_3$ and polarization, an isotopic composition is established in the kerogen of the source rock which then is inherited by the respective oil. Given the direct link between the polarity of the compounds and their isotopic ß-factor, five fractions may be distinguished for oil and bituminoids. These are with increasing degree of polarity: hexane, hexane-benzene, benzene, benzene-methanol and asphaltene. As a result we have obtained an "isotopic portrait" of the oil from the Cambro-Ordovician, Devonian and Triassic reservoirs in the Triassic Province.

The oil families mentioned above may be divided isotopically into two main groups distinguished clearly by their isotopic curves. In the Devonian and Silurian source rocks examined we have studied the isotopic composition of the various fractions of different polarity in the bituminoids. The first group of oils exhibits exactly the same sharp-peaked curves characteristic of the isotopic composition of the bituminoid fractions of the Silurian shales which also contain isotopically light asphaltenes.

However, the "isotopic portraits" of the bituminoids from the Devonian shales differ markedly from those of the Silurian and follow the isotopic image of the oils of the second group which is characterized by a spread of σ^{13} C values similar to that of the five fractions in the Devonian bituminoids investigated.