

Geochemistry of the organic mineral evenkite in septarian concretions in the Oxfordian marls of the French Alps

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Crystals of evenkite, paraffin-type hydrocarbon, from the septarian concretions in the Oxfordian (Upper Jurassic) marls of the Dauphinois subalpine tectonic domain, France (Martin, 1985) have been analysed by gas chromatography mass spectrometry (GC/MS) and compound specific isotope analyses based on gas chromatography - combustion - isotope ratio mass spectrometry (GC/C/IRMS). Evenkite was first discovered in geodes lined with chalcedony and quartz associated in a polymetallic vein cutting vesicular tuff in the Evenki district, Lower

Tunguska River, Siberia by Skropyshev (1954). This waxy hydrocarbon was described as colourless or yellowish, pseudohexagonal tabular crystal with mica like cleavage and hardness of 1. The crystallographic data of the evenkite from the type locality matches those of other straight-chain normal paraffins (*n*-alkanes), which showed it to be a monoclinic modification of normal tetracosane (*n*-C₂₄H₅₀, Strunz and Contag, 1965). The molecular and isotopic data of evenkite from two localities in the French Alps, Serres (Hautes-Alpes) and

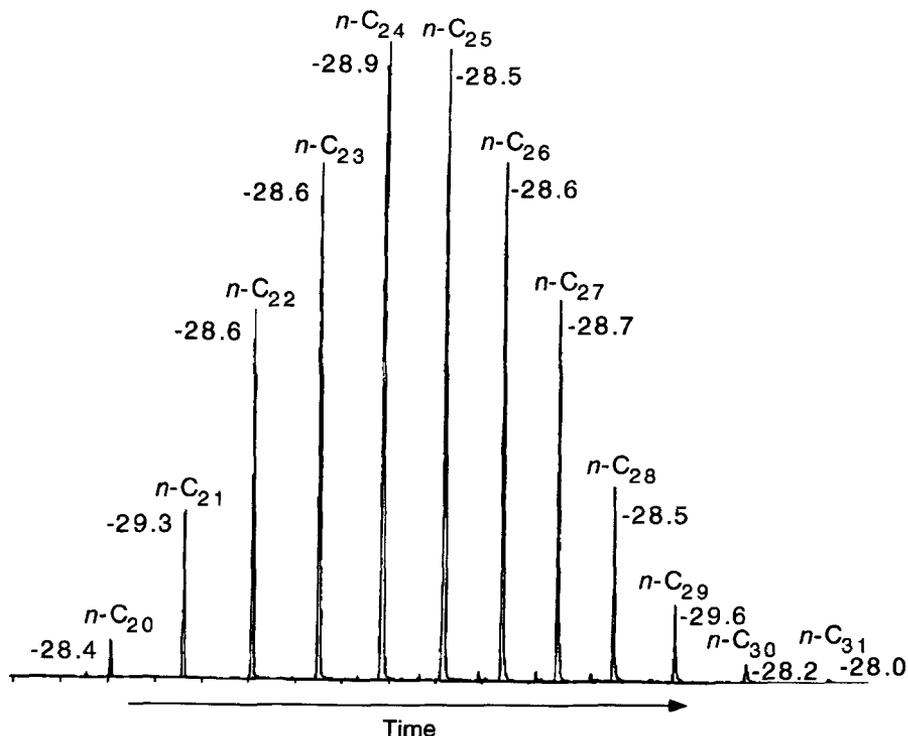


FIG. 1. Total ion chromatogram and carbon isotope composition of the *n*-alkanes from the evenkite (Serre, France).

Condorcet (Drôme) areas, give insight into the composition of this organic mineral and permit the distinction between the two possible origin of the source hydrocarbons: a) hydrocarbons produced *in situ* during thermal evolution of organic material trapped in the septarian concretions, or b) infiltration of extrinsic migrated hydrocarbons caused by the passage of formation/metamorphic hot fluids through the Oxfordian rocks. During the Jurassic burial, the host sediments were heated up to 200°C, the nodules cracked and were cemented with epigenetic minerals (Barlier, 1974). Mechanical and geothermal stress during the alpine uplift (15 Ma) enhanced the thermal maturation of these sediments and produced probably new fracture of the nodules and partial recrystallisation of the vug-filling minerals. The evenkite at Serres is associated with calcite, celestite, dolomite and quartz, and at Condorcet with quartz, chalcedony and calcite. Evenkite appears to be the latest stage epigenetic mineral, which forms tabular crystalline aggregates of white to brownish waxy crystals with strong basal cleavage. The crystals from both localities have the same X-ray powder diffraction and FT-IR (KBr pressed pellet) patterns and are identical to those described for evenkite from the Siberian type locality (Skropyshev, 1953) and for synthetic *n*-tricosane - *n*-tetracosane mixed crystals (Hasnaoui *et al.* 1988). The molecular analyses show that evenkite is an assemblage of *n*-alkanes waxes in the range C₂₀ to C₃₀, with no odd-even predominance and highest concentrations in the C₂₃-C₂₅ range. Trace amounts of branched alkanes elute between the *n*-alkanes. The empirical formula calculated from the

relative concentrations of the individual *n*-alkanes is C_{24.4}H_{50.8}, with an expected chemical composition of 85.21% C and 14.78% H. These values are similar to the measured carbon and hydrogen of the Condorcet evenkite (83.4% C, 14.8% H), and are very close to the composition of the Siberian evenkite (85.43% C, 14.99% H, Skropyshev, 1953). These results indicate that evenkite is an assemblage of solid straight chain alkanes with 20 to 30 carbon atoms (see Fig.), and not a crystalline phase of pure tetracosane as believed previously. The uniform isotopic composition of the bulk mineral (-28.7‰) and of the individual *n*-alkanes (-28.0 to -29.6‰, mean = -28.6 ± 0.4‰) indicate that the hydrocarbons are indigenous, and were produced by thermal cracking of the organic matter (marine plants and higher organism) trapped in the septarian concretions during Jurassic burial and tectonic/low-temperature-metamorphism history of the calcareous rocks in the Dauphinois subalpine domain.

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