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The amino acid and hydrocarbon contents of the Paris meteorite, the most primitive CM chondrite

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The Paris meteorite is reported to be the least aqueously altered CM chondrite [1,2], and to have experienced only weak thermal metamorphism [2-5]. The IR spectra of some of Paris' fragments suggest a primitive origin for the organic matter in this meteorite, similar to the spectra from solid-state materials in molecular clouds [6]. Most of the micron-sized organic particles present in the Paris matrix exhibit $0 < \delta D < 2000‰$ [7,8]. In order to understand the effect of aqueous alteration and thermal metamorphism on the abundance and distribution of meteoritic soluble organic matter, we have analyzed for the first time the amino acid and hydrocarbon contents of the Paris meteorite [9]. Extensive aqueous alteration in the parent body of carbonaceous meteorites may result in the decomposition of α-amino acids and the synthesis of β- and γ-amino acids. When plotted with several CM chondrites, Paris has the lowest relative abundance of β-alanine/glycine (0.15) for a CM chondrite, which fits with the relative abundance of β-alanine/glycine increasing with increasing aqueous alteration [10,11]. In addition, our results show that the isovaline detected in this meteorite is racemic (D/L= 0.99 ± 0.08; L-enantiomer excess (%) = 0.35 ± 0.5; corrected D/L = 1.03; corrected L-enantiomer excess (%) = -1.4 ± 2.6). Although aqueous alteration does not create by itself an isovaline asymmetry, it may amplify a small enantiomeric excess. Therefore, our data may support the hypothesis that aqueous alteration is responsible for the high L-enantiomer excess of isovaline observed in the most aqueously altered carbonaceous meteorites [12,13]. Paris has n-alkanes ranging from C16 to C25 and 3- to 5-ring non-alkylated polycyclic aromatic hydrocarbons (PAHs). The lack of alkylated PAHs in Paris seems to be related to the low degree of aqueous alteration on its parent body [9,14]. The extra-terrestrial aliphatic and aromatic hydrocarbon content of Paris may have an interstellar origin or contribution from interstellar precursors. In summary, the soluble organic content of the primitive CM chondrite Paris possibly relates to late phases of condensed phase chemistry in molecular clouds.

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