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Amines in Carbonaceous Meteorites

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Carbonaceous chondrites are primitive stony meteorites that are subdivided into eight groups, according their mineralogical composition and oxygen isotope ratios [1]. Carbonaceous chondrites contain a diverse variety of solvent-soluble organic compounds which include aliphatic monoamines (hereafter called "amines"). We have investigated the molecular abundance and distributions of amines in the CI, CM, CR, CO, CV, and CK chondrites finding that the concentration of meteoritic amines mostly correlates with the levels of aquesous and thermal processing occurred inside asteroid parent body (Figure 1). The abundance of amines decreases with increasing aqueous alteration; for example, amines are between one and two orders of magnitude less abundant in CI1 and CM1/2 compared to less aqueously altered CR2 chondrites [2,3]. A similar detrimental effect on the abundance of amines may be exerted by extensive thermal metamorphism such that occurred in CV3, CK4 and CK5 chondrites. The relationship observed between parent body processes and amine concentration, however, does not apply to the CO3 chondrites we have studied (DOM 08006 and MIL 05013), as these chondrites represent some of the least aquesously and thermally altered carbonaceous chondrites available in the Antartic meteorite catalog, yet they exhibit low amine contents. We will discuss these results, along with the isotopic and enantiomeric data collected, and the potential parent-daughter relationships that may exist between meteoritic amines and amino acids. Our collective data is critical for understanding the chemical inventory of the early Solar System, the primordial synthesis of organic matter, and how life could have appeared on Earth.

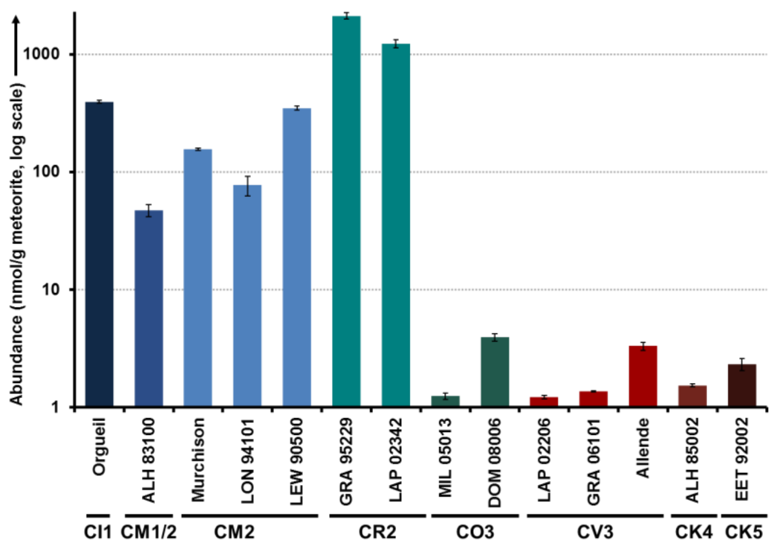

Figure 1 – Total abundance of amines in acid-hydrolyzed hot water extracts of the carbonaceous chondrites studied.

References: [1] Sears DWG and Dodd RT (1988). Overview and classification of meteorites. In *Meteorites and the Early Solar System* (ed. Kerridge JF and Matthews MS), pp. 3-31. University of Arizona Press: Tucson, AZ. [2] Aponte et al. (2016) *Geochimica et Cosmochimica Acta* **189**, 296-311. [3] Aponte et al. (2014) *Geochimica et Cosmochimica Acta* 141, 331-345.