ISOTOPIC ANALYSIS OF NUCLEOBASES IN THE MURCHISON METEORITE

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Nucleobases are important compounds in modern terrestrial biochemistry, because they are key components of nucleic acids (DNA and RNA), which are the central biopolymers used in the storage, transcription and translation of genetic information.

Nucleobases have been detected in carbonaceous chondrites by several research groups [1-5]. Because of the fact that significant quantitative and qualitative differences were observed (even within the same meteorite), confirmation of the extraterrestrial origin of these nucleobases is still open to question. In order to address this crucial question, we have performed an extensive analysis that included formic acid extraction of samples of the Murchison meteorite [6], followed by an extensive purification procedure, analysis and quantification by high-performance liquid chromatography with UV absorption detection and gas chromatography-mass spectrometry. We obtained results that were qualitatively consistent with previous results [3,4], but showed some significant quantitative differences. Compound specific carbon isotope values for xantine and uracil were obtained, using gas chromatography-combustion-isotope ratio mass spectrometry. We also analyzed a soil sample that was collected in the proximity of the Murchison meteorite fall site, subjecting it to the same extraction, purification and analysis procedure.

Stable carbon isotope measurements unambiguously confirm that the nucleobases in the Murchison meteorite are indigenous to the meteorite, and clearly differ from the values determined for the terrestrial nucleobases measured in the surrounding fall site soil. These results support the hypothesis that nucleobases were exogenously delivered to the early Earth, contributing to a feedstock of molecules crucial for the origin of life on our planet.

References: [1] Hayatsu R. et al. 1975. *Geochimica et Cosmochimica Acta* 39: 471-488. [2] Folsome C. E. et al. 1971. *Nature* 232: 108-109. [3] Stoks P. G. & Schwartz A. W. 1979. *Nature* 282: 709-710. [4] Stoks P.G. & Schwartz A. W. 1981. *Geochimica et Cosmochimica Acta* 45: 563-569. [5] Shimoyama A. et al. 1990. *Geochemical Journal* 24: 343-348. [6] Martins Z. et al. 2004. *Meteoritics & Planetary Science* 39: A5145.