PAH CONTENT OF CM CHONDRITES: INFLUENCE OF AQUEOUS ALTERATION ON THE PARENT BODY?

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Introduction: Carbonaceous chondrites (CC) contain water and organic matter (OM - up to 4 wt.%). Organic matter occurs as a diverse suite of soluble compounds and an aromatic-rich macromolecule. Chondrite parent-bodies were affected by aqueous alteration events shortly after their accretion. During these episodes, organic molecules could have undergone molecular evolution and isotope exchange. Polycyclic Aromatic Hydrocarbons (PAH) are soluble molecules consisting of two or more fused benzene rings. They are expected to originate from the interstellar medium [1] and have been detected in CC [2, 3]. As PAH likely made it through alteration [4], they can constitute remarkable indicators of organic interstellar history and aqueous alteration impact on OM. Indeed, it has been thought for forty years that PAH absolute and relative concentrations are driven by the extent of alteration, and so is the fraction of alkylated PAH products [5]. We will here confront this hypothesis to the study of PAHs in four CM chondrites recently collected. Moreover, PAH carbon and hydrogen isotope ratio measurement may bring a hint of PAH formation mechanism and interstellar history [5].

Methods: We extracted PAH from four CM2 meteorites: Mukundpura, Aguas Zarcas, Kolang and Tarda. They were identified by GC-MS and were quantified by GC-FID. Compound specific isotope investigations using GC-irMS are under progress and will be reported at the conference.

Results: We detected PAH from naphthalene to pyrene (2 to 4 cycles) plus alkylated products from one to three additional carbon. It must be noted that heterocyclic nitrogen and sulphur-containing compounds are detected. PAH absolute concentration increases in the order Tarda < Aguas Zarcas < Kolang <= Mukundpura. Moreover, relative concentrations of PAH differ from a meteorite to another. This difference of PAH size distribution can be attributed to the parent-body history. Also, we detected more PAH alkylation products in the more altered meteorites.

Discussion: Isotope signature measurement would give a clue of PAH formation mechanism. Carbon and hydrogen signatures are proof of interstellar origin: a result of low-temperature interstellar chemistry. On another hand and as suggested by [5], PAH formation may be linked to synthesis through addition or cracking of macromolecular material. Lastly, we will try to decipher if hydrogen signature has been modified by aqueous alteration in the parent-body or not.

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