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A study of nitride inclusions in chondrites: Tracers for nebular processes?

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Nitrogen is the most abundant component in Earth's atmosphere and one of the key elements for the evolution of Earth's biosphere. However, the types of nitrogen carriers, their abundances and N-isotopic compositions are not well constrained for all the potential terrestrial building blocks. Chondritic meteorites contain small quantities of various nitrides. Si_3N_4, TiN, and sinoite (Si_2N_2O) are common accessory phases of enstatite chondrites (ECs). Nitrides in ordinary (OCs) and carbonaceous chondrites (CCs), however, have been scarcely reported [e.g., 1–6]. Here, we report the discovery of Si-, Cr- and Fe-nitride in several carbonaceous chondrites. The average N-isotopic compositions of nitrides from CCs differ significantly from those in ECs [7], and we also observe variations between different CC groups. Generally, nitrogen becomes isotopically heavier in nitrides from EC-(OC-) through CV&CM to CR-CH&CB chondrites. This could be indicative of increasing amounts of outer Solar System nitrogen contributing to the respective Si- and Cr-nitrides, and may reflect different heliocentric distances of the formation regions [8]. We also observe that the N-isotopic compositions of these nitrides are sometimes significantly different from those of their host meteorites and meteorite groups [e.g.,7,9]. This seems to suggest several different nitrogen reservoirs and/or different alteration pathways for the various N-carriers within a given meteorite group, and could also explain the bulk N-isotopic variations observed for, e.g., the OCs [10].

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