Noble gases and organic matter – correlations, trends and the Attempt to date Phase Q

H. BUSEMANN[1], S. HOLINGER[1], M. RIEBE[1], M. KUGA[1], N. H. SPRING[2], R. WIELER[1], C. MADEN[1] AND P. L. CLAY[2]

[1]Inst. of Geochemistry and Petrology, ETH Zurich, Switzerland,
[2]SEAES, The University of Manchester, UK

Primordial noble gases and macromolecular, insoluble organic matter (IOM) are ubiquitously found in primitive meteorites, some achondrites, comet Wild 2 dust [1] and interplanetary dust particles [2] [3]. Most of the heavy noble gases, but also some He and Ne reside in an elusive, possibly carbonaceous, acid-resistant phase dubbed Q [4]. Various trends are observed in the composition and structure of the IOM, extracted from meteorites by acid dissolution, and in the composition of Q gases [5-7]. This suggests that the bodies in the solar system may have incorporated a similar mixture of phase Q and IOM (and also presolar grains, not discussed here). This mixture may then have been modified during parent body thermal and aqueous alteration.

Here, we will summarize the "knowns and unknowns" of Q gases, which includes attempts to define and physically separate their carrier [8] [9], better constrain their compositions [7] [10], verify their distribution throughout the solar system [11], experimentally reproduce their fractionation relative to solar composition (depleting the lighter element or isotope) [12] [13] and explain them theoretically [14]. We will discuss correlations between Q gases and IOM, but also highlight where Q and IOM do not follow the same trends, which might be used to assess the degree of homogenization in the nebula. We will also review how phase Q and IOM are used to trace parent body aqueous and thermal processes and for classification purposes. Finally, we will present first results of an etch experiment on a neutron-irradiated sample of IOM extracted from CV3 chondrite Allende.

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