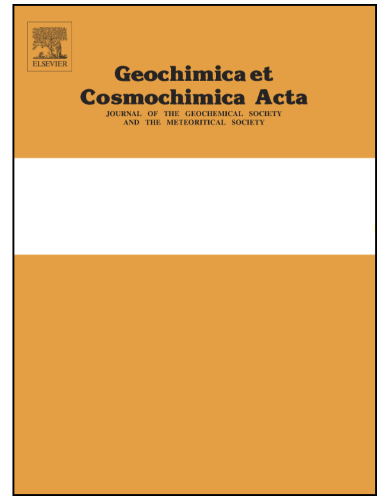
Accepted Manuscript



Noble gases in micrometeorites from the Transantarctic Mountains

Bastian Baecker, Ulrich Ott, Carole Cordier, Luigi Folco, Mario Trieloff, Matthias van Ginneken, Pierre Rochette

PII: S0016-7037(18)30471-X
DOI: https://doi.org/10.1016/j.gca.2018.08.027
Reference: GCA 10900

To appear in: *Geochimica et Cosmochimica Acta*

Received Date: 5 April 2018
Revised Date: 10 August 2018
Accepted Date: 13 August 2018

Please cite this article as: Baecker, B., Ott, U., Cordier, C., Folco, L., Trieloff, M., van Ginneken, M., Rochette, P., Noble gases in micrometeorites from the Transantarctic Mountains, *Geochimica et Cosmochimica Acta* (2018), doi: https://doi.org/10.1016/j.gca.2018.08.027

Noble gases in micrometeorites from the Transantarctic Mountains

Bastian Baecker[1,2†], Ulrich Ott[1,2,3*], Carole Cordier[4], Luigi Folco[5], Mario Trieloff[2], Matthias van Ginneken[6] and Pierre Rochette[7]

[1]Max-Planck Institut für Chemie, Hahn-Meitner-Weg 1, 55128 Mainz, Germany
[2]Klaus-Tschira-Labor für Kosmochemie, Institut für Geowissenschaften, Universität Heidelberg, Im Neuenheimer Feld 234-236, 69120 Heidelberg, Germany
[3]MTA Atomki, Bem tér 18/C, 4026 Debrecen, Hungary
[4]Univ. Grenoble Alpes, Univ. Savoie Mont Blanc, CNRS, IRD, IFSTTAR, ISTerre, 38000 Grenoble, France
[5]Dipartimento di Scienze della Terra, Università di Pisa, Via S. Maria 53, 56126 Pisa, Italy
[6]Département des Géosciences, Environnement et Société, Université Libre de Bruxelles, Avenue FD Roosevelt 50, 1050 Bruxelles, Belgium
[7]CEREGE, CNRS, Aix-Marseille Université, PB 80, 13545 Aix en Provence Cedex 04, France

*corresponding author; e-mail: uli.ott@mpic.de; phone: +49-6136-959876

†current address: BHGE, Baker-Hughes-Str. 1, 29221 Celle, Germany

Abstract

The bulk of extraterrestrial matter currently accreted by the Earth is in the form of micrometeorites (MMs) and interplanetary dust particles (IDPs), thus they may have collectively made a substantial contribution to the volatile inventory of the Earth and the other terrestrial planets. We have performed a complete noble gas study, accompanied by a complete petrographic characterization, of MMs from the Transantarctic Mountain (TAM) collection in the size range ~300 to ~1000 µm that fell over an extended time period during the last ~ 1 Ma. Our noble gas study includes krypton and xenon, which have been largely missing in previous works. Helium and neon are dominated by a solar component, with generally lower abundance in scoriaceous MMs than in unmelted ones, and also generally lower in abundance than in previously studied MMs, which may be explained by the larger particle size (surface/volume ratio) of the MMs we studied. Considering an enhanced MM flux in the early Solar System, such MMs may have supplied a significant fraction of Earth's neon. A number of MMs have kept what was probably their pre-terrestrial He/Ne ratio, from which we infer that the observed solar component is retained in a tiny surface region not affected by atmospheric entry. The abundances of (volume-correlated) heavier gases are similar to what was found in previous studies of smaller MMs. While Ar contains both solar and "planetary" contributions, the heavy noble gases (Kr, Xe) generally show "planetary" patterns but are often also compromised by terrestrial contamination as evidenced by an enhanced Kr/Xe ratio. Kr and Xe in a subset of scoriaceous MMs are dominated by isotopically fractionated air, possibly acquired during the passage through Earth's ionosphere. Those not obviously affected by air show isotopic ratios similar to primitive meteorites (the Q component), thus primordial heavy gases supplied to the Earth by MMs are likely as those found in macroscopic meteorites. There is no evidence for the presence of a "cometary" Xe component as identified in the coma of comet 67P/Churyumov-Gerasimenko, hence a cometary source for a significant fraction of MMs in the studied size range is unlikely. Cosmogenic helium, neon and argon were detected in several cases. Cosmic ray exposure ages were calculated based on cosmogenic ^{21}Ne in combination with the Poynting-Robertson