

Carbon isotope composition of natural SiC (moissanite) from the Earth's mantle: New discoveries from ophiolites

ROBERT B. TRUMBULL¹, JING-SUI YANG²,
PAUL T. ROBINSON^{1*}, TORSTEN VENNEMANN³
AND MICHAEL WIEDENBECK¹

¹GFZ German Research Centre for Geosciences,
Telegrafenberg, Potsdam, 14473 Germany
(*correspondence: p.robinson@ns.sympatico.ca)

²Key Laboratory for Continental Dynamics, Institute of
Geology, Chinese Academy of Sciences, Beijing, 100037
China

³Institute of Mineralogie and Geochemistry, University of
Lausanne, CH-1015 Switzerland

Moissanite (natural SiC) has been recovered from podiform chromitites of the Luobusa and Donqiao ophiolites of Tibet, the Semail ophiolite of Oman and the Ray-iz ophiolite of the Polar Urals, Russia. The moissanite grains are mostly small fragments (20 to 150 μm) with a conchoidal fracture produced during sample preparation. A few euhedral hexagonal grains were recovered and many grains are clearly fragments of euhedral grains. Some grains are twinned crystals. The moissanites are colorless to light bluish-gray to blue or green. Many grains contain inclusions of native Si and Fe-Si phases. The carbon isotope compositions of the moissanites were determined by SIMS analyses on polished grain mounts. All ophiolite-hosted moissanite grains have distinctive ^{13}C -depleted isotopic compositions ($\delta^{13}\text{C}$ from -18 to -35 ‰; mean = -27 ± 3.4 , $n = 28$), a range that includes all published C-isotope data from terrestrial moissanite. These findings confirm that silicon carbide is a widespread mineral in Earth's mantle. The light C-isotope values are difficult to explain by sediment subduction because subducted sediments should contain a significant proportion of marine carbonates, which have $\delta^{13}\text{C}$ values of 0 ‰. The moissanite values are significantly lower than those of most kimberlitic diamonds and other phases thought to represent the main carbon reservoir in the mantle ($\delta^{13}\text{C}$ near -5‰, suggesting the possibility of C isotope fractionation between SiC and C phases but the degree of fractionation needed seems unlikely at the high temperatures expected. Thus, we tentatively suggest the presence of separate carbon reservoirs in the mantle.

Simplicity versus accuracy in global secondary organic aerosol modeling

K. TSIGARIDIS^{1*}, M. KANAKIDOU²,
S. MYRIOKEFALITAKIS² AND L. PERAKIS²

¹NASA Goddard Institute for Space Studies, New York, USA
(*correspondence: ktsigaridis@giss.nasa.gov)

²Environmental Chemical Processes Laboratory, Department
of Chemistry, University of Crete, Heraklion, Greece
(mariak@chemistry.uoc.gr, stelios@chemistry.uoc.gr,
perakis@nah.gr)

Atmospheric aerosols consist of a large number of components with an important fraction in organic form produced by oxidation of gaseous precursors, namely secondary organic aerosols (SOA). The significant contribution of SOA to the total aerosol mass and their effect on the physical and optical properties of aerosols has now been acknowledged.

For the SOA parameterization in global atmospheric models, an independent aerosol module has been developed accounting for SOA production from both biogenic and anthropogenic precursors. This module is suitable to simulate aerosol production in environments presenting different pollution levels. Various configurations exist, with different degrees of complexity; from the simplest ones with the minimum number of species for models where CPU time and memory are vital, to others with more species and processes included, for models that demand a detailed representation of SOA.

The effect of the degree of complexity of the module on the present day SOA production and burden is investigated by performing global 3-d chemistry transport simulations. The computational efficiency of the lumping methodology is demonstrated by the similar results obtained using the more detailed SOA production scheme. This method is flexible and compatible with the newly developed volatility-basis set method for the total organic aerosols.