

## **Carbon contents in reduced basalts at graphite saturation: Implications for the degassing of Mars, Mercury, and the Moon**

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Carbon geochemistry in magma oceans is fundamental in understanding the origin and distribution of carbon in planetary different reservoirs, which in turn is critical in understanding partial melting of the planetary mantles. We previously constrained the core-mantle partitioning of carbon in magma ocean conditions, and showed that accretion of a Mercury-like or a sulfur-rich differentiated body to the growing Earth can explain the Earth's carbon budget [ 1 ]. Here, carbon contents in reduced Martian basalts at graphite saturation were experimentally studied at 1400-1550 °C, 1-2 GPa, and  $\log fO_2$  of IW-0.4 to IW+1.5. The results show that carbon solubility in Martian basalts is 20 to 1400 ppm, increasing with increasing  $fO_2$ . Raman and FTIR measurements on the quenched silicate glasses show that the dominant carbon species in Martian basalts is carbonate ( $CO_3^{2-}$ ). The experimental data generated here were combined with literature data to develop an empirical model that can be used to predict carbon content in graphite-saturated mantle melts of the Mercury, Mars, and the Moon. The results show that graphite may be consumed during the production and extraction of some Martian basalts, and  $CO_2$  released by volcanism on Mars cannot be an efficient greenhouse gas in the early Mars. The lunar mantle carbon may be one of the main propellant driving the fire-fountain eruption on the Moon; however, the Mercurian mantle carbon may not be an important propellant for the explosive eruption on Mercury.

[ 1 ] Li et al. 2016 Nature Geoscience. 9, 781-785