Goldschmidt 2023 Abstract
https://doi.org/10.7185/gold2023.19682

Strong ^{13}C depletion induced by solar UV photolysis of CO_2 and its implication for early Mars

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We have conducted photochemical experiment and ab initio calculation, both of which demonstrated that solar UV photodissociation of CO_2 yields strongly ^{13}C-depleted CO owing to wavelength-dependent isotope effect. The newly identified large carbon isotope fractionation mechanism implies that the cause of ^{13}C enrichment of CO_2 in early Mars atmosphere should be re-considered in addition to the carbon escape into space. Furthermore, the ^{13}C-depleted CO should have been converted into aldehydes and carboxylic acids under a reducing early Mars atmosphere, and could have deposited into sediment [1,2]. The expected scenario could explain the observed strong ^{13}C depletion of some sedimentary organic matter in early Martian sediment [3].

[1] Zang et al. (2022). *Astrobiology* 22, 387-398.

[2] Lammer et al. (2020). *Space Science Reviews* 216, 74.

[3] House et al. (2022). *PNAS* 559, 613-616.