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Constraining the thermal histories of enstatite (E) chondrites during their cosmic ray exposure using ^{3}He and ^{21}Ne

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The cosmic ray exposure (CRE) ages of enstatite (E) chondrites have been studied in efforts to understand the collisional history of the E chondrite parent body and identify their source region. The source region of E chondrites is of particular interest because the E chondrite parent body is likely a good analog for an early Earth. However, CRE ages obtained from cosmogenic ^{3}He measurements of E chondrites, as well as other meteorite classes, are often considered unreliable because of diffusive loss of ^{3}He or precursor ^{3}H from the major phases present. Here, we utilize the diffusive loss of cosmogenic ^{3}He to obtain information about E chondrites' thermal histories during cosmic ray exposure, which is a function of their orbital histories and therefore source region. We obtained CRE ages of three enstatite chondrites: Caleta el Cobre (CeC) 024, CeC 025, and CeC 028, using measurements of ^{3}He and ^{21}Ne. We combine results from ^{3}He diffusion kinetics experiments on the major phases in E chondrites with the ^{3}He and ^{21}Ne CRE ages to place constraints on the recent thermal histories and orbital trajectories of these three E chondrites. We observe CRE ages derived from cosmogenic ^{21}Ne measurements ranging from 8.7 to 15 Ma, and find that the amount of cosmogenic ^{3}He retained is consistent with orbits experiencing temperatures between 60 and 150 ºC on the order of tens of thousands of years and up to a few million years. Recent thermal histories with these characteristics are plausible for meteoroids with near Earth asteroid-like orbits. Ongoing work refining orbital dynamical simulations and constraining the irradiation conditions and terrestrial ages of our samples using cosmogenic radionuclides will enable us to place more quantitative constraints on the recent thermal histories of these E chondrites.