SOLAR PROTON EVENTS AND THEIR EFFECTS ON METEORITES. R. C. Reedy[1]. [1]Planetary Science Institute, 152 Monte Rey Dr., Los Alamos, NM 87544 USA. E-mail: rcreedy@gmail.com.

Introduction: In space, meteoroids are continuously exposed to the energetic particles in the galactic cosmic rays (GCR). Solar activity can occasionally create energetic particles. Both particles can make nuclides in meteoroids.

Solar particles typically have energies of ~1-100 MeV and are rapidly stopped in the top ~1 cm of the surfaces of meteorites [1]. Usually these solar energetic particles (SEPs) have little or no effect on meteorites. A few meteorites have observable amounts of nuclides made by SEPs, such as Sutter's Mill [2]. Sutter's Mill had a very low perihelion at a time of high solar activity, so was exposed to high fluxes of solar energetic particles. It also had some samples that suffered very little ablation.

The best meteorites in which to search for SEP-proton-produced nuclides are those that fell soon after large solar particle events (SPEs). Samples from falls during or soon after periods of high solar activity should be measured to find pieces that were near the pre-atmospheric surface. Finding such a fragment is useful both to study the meteorite, its entry through the Earth's atmosphere, and recent solar activity.

Solar Particle Events: Solar particle events (SPEs) occur irregularly, usually away from periods of low solar activity. Many SPEs have occurred between 1954 and 2008 [3]. Only a few events are intense, such as those in Aug. 1972 and late 1989. Such intense events are rare and on the high-fluence tail of recent SPEs [3]; their effects can be very large [4].

Studies of SPEs that are much more intense that those observed since 1954 are important to determine their probabilities and to aid in planning future space missions. One huge SPE very likely occurred in 1 September 1859, called the Carrington event after the astronomer who observed a very intense flare on the Sun [5]. The effects of the Carrington event were observed by instruments near the equator, implying it was very intense.

A major increase in ^{14}C in tree rings around the world occurred in 775 AD [6]. This excess is best explained by a huge SPE. Another major SPE probably occurred in 993-994 based on tree ring ^{14}C data, the only other huge SPE during the last 3000 years [7].

Conclusion: Large SPEs seen recently can make large amounts of cosmogenic nuclides in the surfaces of meteorites. Meteorite falls soon after periods of very high solar activity, such as Sutter's Mill, should be measured for cosmogenic nuclides

Extremely large solar particles events are very rare, but there is good evidence that they have occurred. Should such an extreme SPE occur, the concentrations of cosmogenic nuclides in falls after that SPE could be very large. Measurements of cosmogenic nuclides in those falls would be important both to study that meteorite's exposure history and the Sun soon before the fall.

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