STRONTIUM-84 HOMOGENEITY OF THE INNER SOLAR SYSTEM.

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Introduction: Nucleosynthetic isotope anomalies in meteorites are a powerful tool for tracing the processing and transport of solid material in the solar accretion disk and to assess genetic relationships among and between meteorites and planets. For many elements the isotope anomalies among bulk meteorites allow differentiating between carbonaceous (CC) and non-carbonaceous meteorites (NC), which has led to the proposal that the solar accretion disk was subdivided into two co-existing but spatially separated reservoirs [1,2]. These isotope anomalies often also reveal characteristic trends among the individual meteorite groups within each reservoir, which provides critical information on the nature and origin of the NC-CC dichotomy, and the compositional evolution within the NC and CC reservoirs [3]. As shown in previous studies, nucleosynthetic Sr isotope anomalies (expressed as variations in the $^{84}Sr/^{86}Sr$ ratio after internal normalization to $^{88}Sr/^{86}Sr$) exist in Ca, Al-rich inclusions (CAIs) and some bulk meteorites [4,5]. However, overall Sr shows less systematic isotope variations compared to almost all other elements. For instance, it is unclear as to whether there is a systematic offset in Sr isotope anomalies between NC and CC meteorites that goes beyond the effect of variable CAI addition, and whether or not there is a resolvable trend in Sr isotope anomalies within the NC reservoir. This uncertainty partly reflects inconsistent results among different studies. For example, while some [4] reported homogeneous ^{84}Sr isotope compositions for several NC meteorites (angrites and eucrites) and terrestrial rocks, others [6] reported resolved variations among NC meteorites and between NC meteorites and terrestrial samples. In addition, the origin of Sr isotope anomalies is debated and the variations among bulk meteorites may reflect complex mixtures of isotopically distinct Sr from different nucleosynthetic sources and carriers [7,8]. To better constrain the origin of Sr isotope variations among meteorites, and to assess whether or not NC and CC meteorites have systematically different Sr isotope compositions, we obtained new high-precision Sr isotopic data for a comprehensive set of NC and CC meteorites, as well as several samples from Earth, Mars, and the Moon.

Methods: Terrestrial weathering can significantly alter the Sr isotopic composition of meteorite finds [5], and so we avoided meteorite finds from hot deserts whenever possible. Of the 35 meteorite samples analyzed in this study only one is a desert find, seven are finds from Antarctica, and 27 meteorite samples are observed falls. After complete digestion of the samples, Sr was separated from the matrix using established ion exchange procedures [e.g., 4]. The Sr isotope measurements were performed using the Triton Plus TIMS at the Institut für Planetologie in Münster.

Results: All NC meteorites of this study, including angrites, eucrites as well as enstatite and ordinary chondrites, display indistinguishable $\mu^{84}Sr$ values averaging at 5±5 ppm (2 s.d.). The terrestrial and lunar samples, and the martian meteorites all have $\mu^{84}Sr$ values that are indistinguishable from those of the NC meteorites, and all samples together define a mean $\mu^{84}Sr = 5\pm9$ ppm (2s.d.). By contrast, the carbonaceous chondrites of this study, including CV, CM, CR, and CI chondrites as well as the ungrouped chondrites Tagish Lake and Tarda, have more variable $\mu^{84}Sr$ values, which range from the characteristic NC composition up to $\mu^{84}Sr$ anomalies of ~80 ppm. This $\mu^{84}Sr$ variability among CC meteorites is largely controlled by their variable CAI contents.

Discussion: Unlike in some previous studies [6,9], we find no resolvable $\mu^{84}Sr$ variation between NC meteorites, Mars, and the Earth and Moon. This contrasts with the well-resolved and correlated isotope anomalies observed among NC meteorites for many other elements [3,7], including the Fe-group elements Cr and Ti, and the heavier elements Zr, Mo and Ru whose isotope anomalies are predominantly governed by variations in the abundance of *s*-process nuclides. The origin of this disparate behavior of Sr is unclear, but it may reflect either that the isotopically distinct carrier(s) responsible for the isotope variations among NC meteorites did not contain sufficient Sr, or that two competing processes (i.e., coupled *s*- and *p*-process variations) resulted in a net zero change of the Sr isotope compositions of NC meteorites. Either way, the $\mu^{84}Sr$ homogeneity among NC meteorites appears inconsistent with the idea that the nucleosynthetic isotope variability among NC meteorites in particular reflects thermal processing of s-process-enriched presolar grains (e.g., SiC) in the inner disk (e.g. [9]). When compared with other elements, such a process would imply $\mu^{84}Sr$ variations among NC meteorites of at least 20-30 ppm, which is well outside the observed range for inner solar system materials observed in this study.

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