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CSI Solar System: Clues from chromites in cosmic dust

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The mineral phase chromite ($FeCr_2O_4$) is found in a wide range of extraterrestrial (ET) materials, including meteorites and micrometeorites [1]. Chromite grains have a strong resistance to terrestrial weathering, promoting their survival in sedimentary successions and advancing our comprehension of the ET flux through time [2]. A complete characterization of individual chromite grains is necessary to constrain which Solar System reservoirs they derive from, which processes affected their compositions, and how the relative abundance of source materials changed over time.

Here, we compile data for chromites in cosmic spherules from two Antarctic micrometeorite collections in order to acquire a template to interpret data obtained on individual grains found in the sedimentary record: 17 particles from the Transantarctic Mountains (TAM) and 10 particles from the Sør Rondane Mountains (SRM) [3-4]. In total, 53 chromite grains were identified: 33 in the TAM collection and 20 in the SRM collection. All micrometeorites were studied for their elemental compositions using a JEOL JXA-8200 EMPA at the NIPR in Tokyo (Japan) and analyzed for their oxygen isotope ratios using a Cameca IMS 1270 ion microprobe at the CRPG in Nancy (France). Data for both individual chromites and groundmass were acquired to refine the parentage and alteration history of these particles.

Based on the oxygen isotope composition, two particles (<10%) show a carbonaceous chondritic lineage ($\Delta^{17}O \approx -3.1$ to -1.7 ‰ and $^{18}O \approx -4.4$ to 25.7 ‰). The remaining particles derive from ordinary chondritic precursors ($\Delta^{17}O \approx 0.5$ to 1.5 ‰ and $^{18}O \approx 3.1$ to 16.1 ‰) [5]. These data confirm that most chromite-bearing particles derive from ordinary chondrites, but also show that eight chromites display ^{17}O and ^{18}O values deviating from chondritic values, implying reprocessing during atmospheric entry and terrestrial residence.

References: **[1]** Rubin and Ma (2017) *Chemie der Erde* 77:325–385. **[2]** Schmitz et al. (2017) *Geology* 45 (9):807–810. **[3]** Rochette et al. (2008) *Proc. Natl. Acad. Sci. U.S.A.* 105 (47):18206–18211. **[4]** Goderis et al. (2020). *Geochim. Cosmochim. Acta* 270:112–143. **[5]** Suavet et al. (2010). *Earth Planet. Sci. Lett.* 293:313–320.