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Micrometeorite Diversity in a Time-Resolved Sedimentary Record from the Atacama Desert – A Key to Understanding Solar System Events

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Micrometeorites (MMs) are more or less recrystallized submillimetre spherical melting droplets, so-called "cosmic spherules" [1]. They accumulate on the Earth's surface and become part of geological archives. Hence, such time-resolved MM-containing deposits record dust-producing processes in the solar system, such as asteroid collisions, cometary sublimation, and likely impacts on planetary surfaces [2]. To establish a potential link between temporal occurrences of certain MMs and specific cosmic events, the MMs need to be initially characterized and classified based on their mineralogical and petrological properties.

Sediments from hyper-arid regions of the Atacama Desert serve as a suitable time-resolved archive for cosmic dust due to minimal weathering and sedimentation rates. We examined a stratigraphic profile from a clay pan in the Yungay Valley near Antofagasta with a depth of 180 cm, spanning approximately the last 19 ka [3]. MM candidates were extracted from the sediments through aqueous leaching of salts followed by wet sieving and picking the individual MMs using a stereomicroscope. Subsequently, the morphological and compositional characterization was performed using SEM-EDX. We identified >40 MMs with a typical range of petrological types of cosmic spherules (see backscattered electron images in the figure). The initial quantitative analysis of this data set indicates that variations in abundance and type of the MMs along the stratigraphic profile do not result from local sedimentary enrichment or selection processes, but may reflect variation of cosmic dust input during sedimentation. However, further petrological analyses are necessary for linking such changes in MM occurrences to dust-producing events in our solar system [4]. For example, our future work will involve measuring cosmogenic isotopes (^{26}Al, ^{10}Be) in individual MMs to determine their cosmic exposure ages and provide information about their parent bodies.

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