Cardiopulmonary Inflammatory Response to Meteorite Dust Exposure – Implications for Human Health on Earth and Beyond

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The Apollo missions not only helped answer questions related to our solar system, they also highlighted many hazards associated with human space travel, including health effects from surface dust exposure. Given the ever-surging interest in sending humans back to the Moon and onward to Mars, as well as the acceleration in the number of astromaterial sample return missions, it has never been more important to understand the potential health hazards associated with astromaterial dust exposure. Expanding on previous lunar dust assessments, the authors initiated an extensive study evaluating the role of a particulate's innate geochemical features in generating adverse toxicological responses. To allow for a broader planetary and geochemical assessment, seven samples were evaluated: six meteorites from either the Moon, Mars, or Asteroid 4 Vesta and a terrestrial basalt analogue.

Even with the relatively small geochemical differences (all samples basaltic in nature), significant difference in cardiopulmonary inflammatory markers developed in both single exposure and multiple exposure studies. More specifically: 1) the single exposure studies reveal relationships between toxicity and a meteorite sample's origin, its pre-ejected state (weathered versus un-weathered), and geochemical features (e.g. bulk iron content) and 2) multiple exposure studies reveal a correlation with particle derived reactive oxygen species formation and neutrophil infiltration.

This comprehensive dataset allows for not only the toxicological evaluation of astromaterials but also clarifies important correlations between geochemistry and health on Earth and beyond.