

RECOVERING MICROMETEORITES FROM HISTORICAL COLLECTIONS: COSMIC DUST FROM HMS *CHALLENGER* DEEP SEA DEPOSITS.

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The voyage of the HMS *Challenger* (1872-76) was a seminal moment in the history of science. During the voyage, HMS *Challenger* circumnavigated the planet collecting hundreds of samples of rocks, sediments, animals, plants and ocean waters, and gave birth to the science of oceanography. It is also a seminal moment in the study of micrometeorites, as it was the magnetic spherules discovered in these deep sea sediments that were the some of the earliest scientifically described micrometeorites from the deep ocean [1]. Following the voyage, hundreds of sediment samples from the deep ocean were returned and now form part of the Ocean Bottom Deposits collection at the Natural History Museum, UK. These provide an abundant collection of scientifically and historically important material.

Micrometeorites extracted from deep sea sediments have been used to constrain the modern day flux of cosmic dust to the Earth and understand more about their mineralogy, textures, and origins [2,3,4,5]. This project returns to the HMS *Challenger* deep sea sediments and is extracting and building a new collection of *Challenger* micrometeorites. This in turn develops a scientific resource that will help us understand fundamental questions about the ‘modern’ flux of material to the Earth as recorded in deep sea sediments; and build a reference collection of micrometeorites preserved in ocean bottom sediments, suitable for direct comparison with fossil micrometeorite collections..

New micrometeorites have been obtained from the HMS *Challenger* sediments using a combination of sieving and magnetic separation for large samples and non-invasive methods such as micro-computed tomography (CT) for targeting micrometeorites in precious, small volume samples. These Iron-dominated micrometeorites (or I-type micrometeorites) will be analysed and characterised using a combination of scanning electron microscopy (SEM), quantitative energy-dispersive X-ray spectroscopy (EDS) and electron microprobe analysis (EMPA) techniques, as well as micro-CT to non-destructively examine internal structures.

In addition to shedding light on the modern flux of sediments to the Earth, findings from this work will investigate storage and alteration of micrometeorites on the ocean floor. I-type micrometeorites are typically composed of magnetite, wüstite, and metal, and are thought to be reasonably resistant to dissolution and corrosion; however the processes of long-term storage and alteration in relatively acidic ocean waters and sediments is poorly understood [6]. This work will provide a comparison with pristine Antarctic micrometeorites (e.g., [7]) and fossil micrometeorites [6].

This work will also develop standard protocols for extraction and processing of micrometeorites from historical collections, and the analytical pipelines developed can be used for futurework on sample return missions[8,9].

References:

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