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Exploring grain-scale chemistry of African meteorites using Synchrotron X-ray Fluorescence Microprobes

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A large fraction of all the meteorites recovered on Earth's surface are found in Africa. These include carbonaceous chondrites, samples of primitive material from the early Solar System that include prebiotic organic compounds and essential nutrients for the development and sustenance of life. There are also rock fragments from the Moon and from Mars, the latter being the only physical samples from our planetary neighbor that we currently have for study. These reveal important aspects of planet formation and differentiation processes.
Synchrotron X-ray fluorescence (XRF) microprobes provide an excellent – and generally non-destructive – set of element-specific tools for microscale characterization of chemistry in these rare samples, and provide a wealth of information about the formation and early evolution of the Solar System. Elemental maps of sample sections and surfaces reveal the distributions, co-locations, and host phases of most elements heavier than Na. By scanning the incident beam energy across an element's absorption edge, microscale X-ray absorption spectroscopy can reveal an element's local-scale oxidation state, chemical speciation, and local structure, in both crystalline and non-crystalline phases.
Examples will be presented that include Northwest Africa 11288, which is a Martian meteorite consisting of a highly shocked igneous rock, and Northwest Africa 12748, which is a CM2 carbonaceous chondrite. Other African meteorites including a CV3 and a lunar meteorite will be shown.

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