METEORITE POLISHED SECTIONS: X-RAY MAP IMAGERY FOR DOCUMENTATION, CURATION AND 'VIRTUAL-LOAN' OF IRREPLACEABLE MATERIALS.

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Introduction: Polished meteorite surfaces are primary research materials and each may reveal unique textural relationships between phases of diagnostic composition and equilibration level. Many meteorites are represented by only a low total mass. They are challenging materials to prepare, with soft or reactive components that may alter in prolonged contact with water and air. Informed choice of abrasive compounds for lapping and polishing is important to avoid later confusion in searches for interesting grains (such as SiC, Al_2O_3 and diamond). Each section is therefore a substantial investment in precious sample and preparation time. As the significance of features may only be realized much later, with development of new analytical techniques, careful curation, storage and informed access is essential to use these resources responsibly. Fortunately, digital storage of diverse analytical data from a sample may now aid this process.

Compositional imagery: Analytical scanning electron microscopy (SEM) is widely applied in meteorite research. Many textures are revealed by backscattered electron images (BEI), shown in almost all petrographic publications. Unfortunately, similarity of BE coefficients between diverse compositions often prevents distinction by gray tones in these images. Maps of element distribution may overcome this limitation, yielding such images as the three-colour combined X-ray maps used to document calcium- and aluminium-rich inclusions so effectively [e.g. 1]. However, mapping by wavelength dispersive X-ray spectrometers [e.g. 2] requires long collection time, limiting the area examined in an acceptable length of instrument use. Recent improvements in energy dispersive (EDX) collection efficiency (especially large area silicon drift detectors (SDD), faster pulse processing, classifying many tens of thousands of X-rays per second), combined with sophisticated methods of automated beam and stage movement, now allow collection of a full EDX spectrum from each micrometre-scale pixel across areas of multiple square centimetres in instrument sessions of a few hours [e.g. 3]. A sample holder can be loaded at the end of a day of instrument use, map areas defined, and the instrument left to acquire data overnight, automatically saving results which are downloaded to a separate server the next morning, for processing and extraction of selected element X-ray maps. An entire collection of meteorite sections can be documented in this way, with copies of compositional image files then available as a 'virtual-loan', allowing on-line selection of appropriate samples for research, without the need to transport precious samples whose suitability for a specific investigation would otherwise be unknown in advance.

References: [1] Krot, A.N. and Keil, K. 2002. *Meteoritics & Planetary Science* 37:91-111. [2] Ivanova, M.A. et al. 2008. *Meteoritics & Planetary Science* 43: 915-940. [3] Bland, P.A. et al. 2007. *Meteoritics & Planetary Science* 42:1417-1427.