CORRELATION OF MULTI-DIMENSIONAL STRUCTURAL, CHEMICAL, AND SPECTRAL DATA: INCREASING ACCESS, AWARENESS, AND AVAILABILITY OF MUSEUM SAMPLE MEASUREMENT HISTORY. M. E. Gemma[1,2,*], S. P. Alpert[1,3], D. S. Ebel[1,2], [1]Department of Earth and Planetary Sciences, American Museum of Natural History, New York, NY, [2]Department of Earth and Environmental Sciences, Columbia University, New York, [3]Earth and Environmental Sciences, CUNY Graduate Center, New York. (*mgemma@amnh.org).

Introduction: Since 2002, the American Museum of Natural History (AMNH) meteorite group has collected synchrotron computed microtomography (S-CT) images of ~1 cm^2 volumes of samples in the AMNH meteorite collection [1]. Since 2010, CT data has been collected on a GE v|tome|x s240 scanner in the Microscopy and Imaging Facility (MIF) at the AMNH. Many of these samples have one or multiple interior polished surfaces mapped in X-ray emission on the Cameca SX100 or SX5/Tactis electron probe microanalyzer (EPMA) at AMNH [2, 4]. Samples have been cut orthogonally to various planes such that the 3D petrographic context of any surface measurement becomes challenging to track [2].

Many samples have also been imaged in 2D in the MIF using a Zeiss EVO-60 variable pressure LaB6 SEM. Additionally, spot quantitative analyses (via EPMA or laser ablation inductively coupled plasma mass spectrometry (LA-ICP-MS)) of many surfaces exist, with digital maps illustrating where on X-ray-mapped or SEM imaged surfaces those spots were measured. All of these data relate to various projects already or partially completed. Some maps and quantitative data are on thin sections with no relation to 3D data. Other CT scans are all that remains of samples that have been consumed for chemical analysis leaving only a polished thin section [3].

It has been realized through curation that it is debilitating to samples for X-ray mapping and other procedures to be repeated unnecessarily. Therefore, it would be of great advantage to the curatorial and larger communities if **all** existing data on meteoritic samples were to be available to researchers who request those samples for further analysis. So, for example, LA-ICP-MS analyses to address a particular question would benefit from the petrological context of previous 2D or 3D analyses of the samples requested from repositories (museums, NASA JSC, etc.). Providing such data to investigators would benefit repositories in that it would potentially minimize repetitive exposure of samples to not only electron beams (EPMA, SEM) and X-rays (CT), but destructive analysis (LA-ICP-MS) as well, if investigators are able to use the context of previous analyses to more carefully choose and possibly minimize areas for their planned analyses.

The problem here is that making such data available to borrowers of material is costly and lacking in standardization across the repository community. It is currently done based on ad hoc curator - investigator relationships, or otherwise on a very case-by-case basis subject to the time constraints on all parties.

Data: Each instrument (CT, EPMA, SEM, FTIR, LA-ICP-MS, etc.) provides primary data in various and often proprietary formats. Furthermore, many of the processing software can output datasets in various file formats, depending on the preference of the user – leading to inconsistency in data formatting across samples in the collection. EPMA X-ray maps and derived products are generally TIFF or ASCII files [4]. CT data on samples is voluminous (typically thousands of 32-bit TIFF files) and can be difficult for clients of the sample collections to incorporate into their contextual knowledge of the samples. Conversely, spot analyses such as LA-ICP-MS measurements are exported in simple CSV files but lack information on the spatial context of the measured spots. The problem of combining these myriad data, e.g., registering spot analyses and 2D maps of sample surfaces within 3D CT scan volumes, is particularly difficult. Adding additional data, such as IR spectroscopic maps of those surfaces (or Raman or other area maps) further complicates data assimilation into single data structures which preserve sampled area relationships in the 3D data context.

Objective: The ideal presentation of the various data would be an interactive platform (similar to Astromaterials 3D [5]) that could effectively incorporate point analyses, 2D maps, and 3D volumes by correcting for the individual coordinate systems and various spatial scales (resolutions) of the data. Making AMNH meteorite data accessible online would most readily begin with recent, comprehensive data sets that combine several types of analysis [6]. In this workshop, we hope to explore solutions that would include a searchable, relational data structure that could make these kinds of data accessible in an integrated, inexpensive, and preferably low maintenance way.

References: [1] Ebel D.S. and Rivers M.L. (2007) *MAPS, 42*, 1627-1646. [2] Ebel D.S. et al. (2008) *MAPS, 43*, 1725-1740. [3] Williams C.D. et al. (2020) *PNAS, 117,* 23426-23435. [4] Ebel D.S. et al. (2016) *GCA,* 172, 322-356. [5] https://ares.jsc.nasa.gov/astromaterials3d/index.htm. [6] Gemma, M. E. et al. (in prep).