ANALYZING UNCLASSFIED METEORITES. R. G. Mayne[1], S. Crossley[1], and J. Gregory[1] [1]Monnig Meteorite Collection, School of Geology, Energy, and the Environment, 2950 West Bowie SWR 207, Texas Christian University, Fort Worth, TX 76109 (r.g.mayne@tcu.edu)

Abstract: In 2009, the Monnig Meteorite Collection was gifted a large number of meteorites by a generous collector. The vast majority of these samples were specimens of previously classified meteorites and could therefore be accessioned into the Monnig Collection. 37 of the donated meteorites do not have an official classification listed in MetBase, although all have been assigned provisional names as they are eligible for the NWA designation. None of the 37 samples are large in size; they are all small slices less than 20 grams in weight. The previous owner had assigned provisional classifications, none of which seem outlandish when the samples are inspected using a binocular microscope. Eventually, the aim is to establish an official classification status for all of the donated meteorites. However, an accepted classification requires detailed analyses, which are both costly and time consuming, particularly at an institution that does not have the facilities to classify them in-house like Texas Christian University (TCU).

Classification Cross Check: A previous study illustrated that the XRF can give a good approximation as to the general type of meteorite being analyzed [1]. It was even able to identify atypical qualities, which would not be obvious upon examination of a hand specimen, such as eucrite-clasts within a diogenite. It was decided to analyze each of the 37 unclassified samples with the same methodology used in the earlier study, to allow comparison of *unknown* samples with those that have an official status. The goals of this study were to:

1) add to the previously collected XRF library of meteorite spectra.
2) gain an better understanding of what type of meteorites are represented in the unclassified portion of the donated specimens.
3) use the analyses to prioritize future classification efforts.

Methodology: XRF analyses were performed using the Bruker Tracer-III SD at TCU. Operating conditions were a voltage of 40.00 and a current of 3.00 amps. No vacuum was used. These conditions were chosen to mirror those used in the previous study [1], so that the data are comparable. Each analysis lasted a total of 60 seconds. The raw spectra were then analyzed using ARTAX 7. Due to a catastrophic hard-drive crash, the methods and data produced from this stage in [1] were lost. Therefore, all data was reprocessed.

In the previous study, each sample was analyzed six times and the data were averaged to produce one date point per sample. These meteorites were chosen because of their size, allowing six different locations on the meteorite to be selected for analysis. In this study, the meteorites are all significantly smaller in size and only two analyses were taken as a result.

Discussion: For the purposes of this abstract, we will focus on only a selection of the 37 unclassified meteorites – those proposed to be chondrites (ordinary, enstatite, and carbonaceous), or eucrites and diogenites.

29 samples were proposed to be chondiritic in origin: 3 ECs, 14 CCs, and 12 OCs. When the XRF data for these samples is compared to previously collected data from these groups (Figure 1), a good match is seen between proposed classifications and the data from the official meteorites within that type. There is some overlap between all the chondrite fields shown. The ECs, in particular lie close to the higher Si/Mg CCs and crosscut through the OC field as they reach higher measured Mn values. These groupings can be separated to a greater degree using a variety of multiple elements plots; however, in this study we cannot accurately distinguish ECs from either OCs or CCs using XRF alone.

Among the unclassified samples there are also 5 proposed eucrites and 2 diogenites. These samples show a strong affinity with the previously collected data for their respective suspected families (Figure 2). It seems extremely likely that these samples do belong to the HED family in the groupings suggested. This supports the findings of a previous study [1]. that. the XRF appears to be capable of distinguishing between eucrites and diogenites with relative ease.

Future Work: We plan to continue building a library of XRF meteorite spectra from samples in the Monnig Meteorite Collection. We will also combine the XRF results with hand specimen analysis to prioritize the classification of provisionally named NWA meteorites into the Collection.

Conclusions: While XRF analyses are absolutely no substitute for those that elucidate the chemical composition of meteorites in far more detail, they do appear able to distinguish between certain meteorite types with some confidence. Such analyses also require little to no sample preparation and only a few minutes of analytical time, which is significantly faster and more convenient than other more detailed techniques. The XRF may well be a useful tool for the initial assessment of meteorites, particularly large groups of unclassified samples.

References: [1] Daviau K. C., Mayne R. G., and Ehlmann A. J. (2012) *LPS XXXXIII,* Abstract #1306.

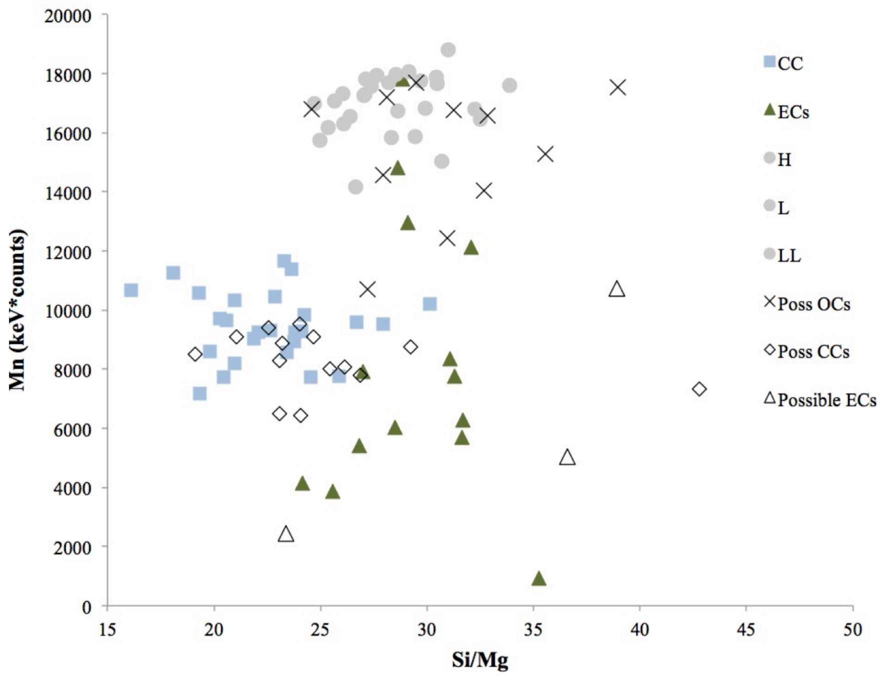

Figure 1: Qualitative XRF analyses of unknown meteorite samples proposed to be chondritic compared to known chondrites

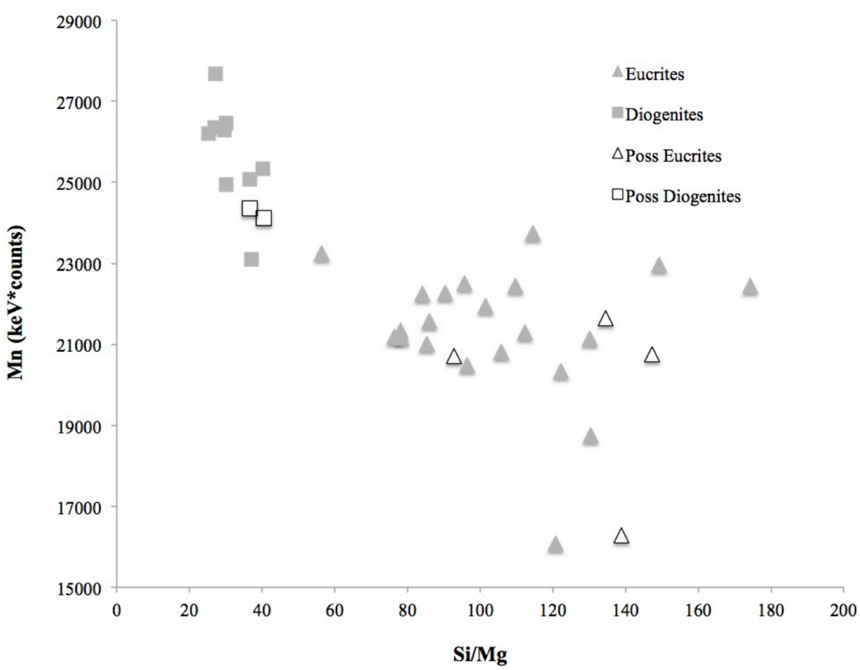

Figure 2: Qualitative XRF analyses of unknown meteorite samples proposed to be HEDs compared to those with an official classification.