EXPLORING XRF AS A NEW TECHNIQUE FOR BASIC METEORITE CLASSIFICATIONS.

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Current Classification Methods: In the 2010/2011 season, the Antarctic Search for Meteorites (ANSMET) collected around 1200 meteorites. These will all be classified over the next two years, according to the U.S. Federal Regulation on Antarctic Meteorites [1], by the curatorial staff at the Smithsonian Institution’s National Museum of Natural History. The vast majority of the meteorites collected in Antarctica are equilibrated ordinary chondrites and the current method employed for their identification is that of visual examination combined with oil immersion of olivine grains. This technique requires that a small amount of each meteorite be powdered, sieved, and then examined in refractive index oils under a petrographic microscope. This is a timely process and the Smithsonian’s main goal is to be able to “separate the ~10% of meteorites that deserve further scientific study” [1].

XRF: The Monnig Meteorite Collection deals with many requests from the general public for meteorite identification. The vast majority of these samples are industrial slag. The newly purchased Bruker handheld XRF will be used to analyze these samples to confirm that their composition is not meteoritic. The goal of this study is to explore XRF as a new technique for meteorite identification. In this preliminary study we will present data on the first two parts of this study: (i) estimating the Ni content of iron meteorites (ii) examining previously classified ordinary chondrites to establish a calibration technique for unknowns. The eventual aim is to see if the XRF technique outlined here can be used to distinguish LL, L, and H chondrites from one another, to provide an alternative streamlined process to oil immersion.

Methodology: All meteorites will be analyzed on the Bruker Tracer III-SD handheld XRF system at Texas Christian University. For part (i) only meteorites from the Monnig Meteorite Collection with a published Ni content were selected for analysis. All Ni contents were taken from [2]. A minimum of three analyses were taken for each sample. The number of counts for Ni Kα were tabulated each time and a calibration curve was constructed. Previously classified ordinary chondrites were selected from the Monnig Collection for part (ii) of the study. Twenty meteorites of each ordinary chondrite group (H, L, LL) will be measured.

Preliminary Results: Initial results relating Ni Kα counts to Ni content of iron meteorites show that these two components do appear to be directly related and no further reduction of the data (into percentage Ni) is required. The calibration curve constructed from the preliminary data has an R² value of 0.94.

At the time of writing, only 5 H, L, and LL meteorites have been analyzed on the XRF. While there appear to be some differences between the ordinary chondrite groups, there is currently not enough data for statistical analysis to see if these differences are significant enough to allow their identification.