METEORWRONGS RECEIVED BY THE ARKANSAS CENTER FOR SPACE AND PLANETARY SCIENCES. PROGRAM RESULTS AND POTENTIALS. R. E. Beauford[1], [1]Arkansas Center for Space and Planetary Sciences, MUSE 202, University of Arkansas, Fayetteville, AR, 72701, USA. rbeaufor@uark.edu

The accumulated body of cataloged meteorwrongs currently in the possession of the University of Arkansas was reviewed, along with accompanying accession documents and return correspondence, in order to better understand the role, purpose, and potential of the meteorite identification program. The study looked at the regional demographic served and at the effectiveness of the program as 1) a source of new meteorites; 2) a vehicle for community outreach and education; 3) a student practical in mineral identification; and 4) a student practical in 'real world' scientific interaction with the general public. In addition, in order to attempt to answer the question 'Why did they think these rocks were meteorites?,' clues pointing to public perception were sought in the written records of correspondence.

Introduction: The word 'meteorwrong' is not a formal part of the lexicon of meteoritics, but probably should be, since its meaning is almost universally understood. A meteorwrong, in the common parlance of the area of study, is a rock, mineral, or other specimen that is thought to be, hoped to be, or presented to be, a meteorite, but that is not.

Since 1998, the Arkansas Center for Space and Planetary Sciences has received 197 recorded meteorwrongs. These are samples tentatively identified as meteorites, with formal requests for identification by University personnel. Of these specimens, 177 were tentatively identified as to rock or mineral type, and 20 were listed as 'unidentified, but not a meteorite.' No meteorites have been received to date by the program.

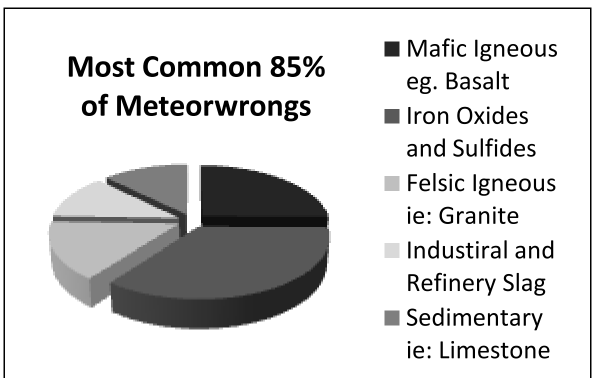

Figure 1. Distribution, by broad classification, of the 5 most common meteorwrongs. Together, these make up 85% of all meteorwrongs received since 1998.

Most Common Meteorwrongs: *Mafic Igneous Rocks* such as basalt, gabbro, and peridotite make up a little over 21%, or about 2 out of every 10 meteorwrongs. These rocks are primarily composed of dark colored, relatively dense iron and magnesium rich silicate minerals. [Raymond, 1995] Interestingly, some of the most common minerals in terrestrial mafic igneous rocks, such as olivine and pyroxene, are also some of the more common minerals in chondrites. [Norton, 2002] These specimens, frequently described as 'burnt' by people sending them in for analysis, are commonly used in construction and landscaping, have been transported to a wide variety of unusual locations, and can be visually striking when found out of context.

Iron Oxides and Iron Sulfides Taken together, iron oxide (primarily hematite and magnetite) and iron sulfide minerals (mostly pyrite and marcasite) make up about 30%, or about 3 out of every 10 meteorwrongs received by the University. Many of these specimens are in the form of nodules, which means they have unusual, often naturally aerodynamic shapes. Most of these nodules are formed in sedimentary environments. [Prothero and Schwab, 2001] When they weather out of the rock, these specimens are found as dense, dark colored, obviously metallic, rusty, aerodynamic objects sitting incongruously surrounded by sand, limestone, or shale. Unless there is enough magnetite present to attract a magnet, they fail a magnet test, but their appearance, morphology, and context are sufficient to compel many finders to send them in for analysis even after making this observation for themselves.

Felsic Igneous Rocks Granite, granodiorite, diorite, and rhyolite make up 13%, or a little over 1 out of every 10 meteorwrong specimens analyzed. These light colored, relatively low density, often obviously crystalline rocks, alongside limestone and mudstone, are among the most unexpected of the samples received, since they share very few physical similarities with meteorites. Since these rocks are common and durable, they are widely used as landscaping and architectural stones. Cobbles are also frequently found far from source areas in glacial or fluvial deposits. These factors presumably contribute to their abundance among the samples.

Slag refers to a group of compositionally varied industrial byproducts of the processing of metal ores. Over 1 billion tons of this material have been distributed throughout the US, largely as aggregate, road base, and railroad ballast. [Kelly et al., 2009] Pieces of slag vary in character and appearance, but they are generally metal rich silicates with a glassy, 'burnt,' or metallic surface, dark color, relatively high density, and immediately noticeable surface textures such as ripples, flow lines, or drip patterns. The exotic appearance and wide distribution of these materials makes them, essentially, the perfect meteorwrong for the untrained explorer, and accounts for their presence as a little over 10.2% of meteorwrongs cataloged by the institution.

Limestone, Sandstone, Mudstone and Shale While there is almost no resemblance between these materials and meteorites, they make up over 75% of the continental surface covering rock in the world. [Prothero and Schwab, 2001] This fact alone is presumably significant enough to account for the presence of the most common sedimentary rock types as approximately 10.7% of the meteorwrongs received.

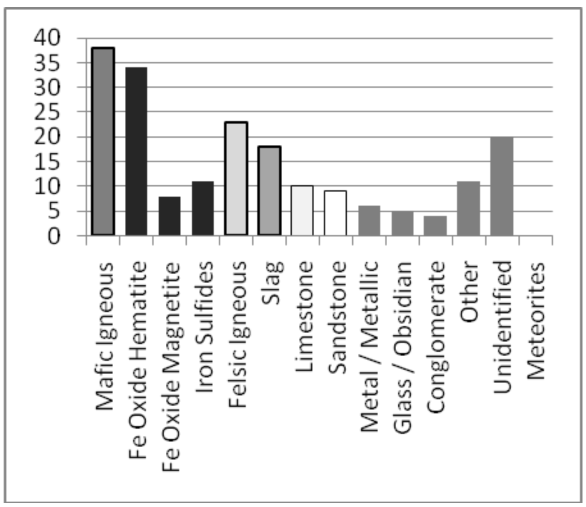

Figure 2. About 25 different broadly grouped rock and mineral varieties have been reported by investigators in the program to date.

The Written Communications: The regional demographic served by the program has been surprisingly varied. Only about 19% of inquiries originated within the state of Arkansas. About 72% originated in other states, and about 7% were from outside the US. People are reaching out for information across state and even national boundaries.

The samples come from an extremely wide range of people both in terms of age and education. Most seem to be working age adults, though many are very young or elderly. Education level, as self reported in correspondence, ranges from primary school to PhD.

Motivations for sending in samples also vary, along with reasons for believing the samples might be meteorites. Repeated themes included: 'The rock was unusual for its surroundings.' 'The rock was found after a meteor was observed.' 'The rock was found during routine activities or work.' 'The rock has been in my family for a long time.' 'A local authority said it might be a meteorite.' Very few communications involved stories of witnessed falls, craters, hot rocks, loud noises, or other dramatic circumstances.

The extent to which these minerals have attributes of actual meteorites indicates that people are noticing characteristics such as density, color, magnetic responsiveness, and surface quality, but are not willing to discount their hope for a meteorite identification based on a lack of conformity to these characteristics. Dark or rust color, high density, unusual shape, metallic or semi-metallic appearance, and a surface that can be interpreted as melted or burnt are generally favored over low density, light colored, friable or porous materials. Stones that are out of context with their surroundings, very reasonably, seem to be favored over stones that are typical of their surroundings.

What people and purpose are the program serving? If it is assumed that the primary purpose a meteorite identification program is to identify and gather new meteorites for purposes of scientific study, then it is questionable whether such a program is justified. The time and energy involved, per return, is not in keeping with the expense.

If, however, the goal of the program is perceived more broadly: to educate students on meteorites within a real world context of similar rocks, to provide real world experience in interacting with the general public, to engage and encourage the public in scientific inquiry, and to encourage interest and support for space and planetary science programs, then these programs might be very effective instruments. Within this context, the discovery of an occasional new meteorite is a nice potential bonus within an already effective education and outreach effort. Like any program, however, it will be what students and educators make of it.

Acknowledgment: This research could not have been completed without the excellent records maintained by John Craig, Derek Sears, and others previous participants in the meteorite identifications program.

References: [1] Prothero, D. R. and Schwab, F. (2001), Sedimentary Geology – An Introduction to Sedimentary Rocks and Stratigraphy, W. H. Freeman and Company, New York, NY [2] Raymond, L. A. (1995), Igneous Petrology, Wm. C. Brown Publishers, Dubuque, IA. [3] Kelly, T.D. et al. (2009), Iron and Steel Slag Statistics, in Historical statistics for mineral and material commodities in the United States: U.S.G.S. Data Series 140. [4] Kalyoncu, R. S. (2000), Slag—Iron and steel, in U.S.G.S. Minerals Yearbook – 2000. [5] Norton, O. R. (2002), The Cambridge Encyclopedia of Meteorites, Cambridge University Press, Cambridge, UK