IDENTIFICATION OF IRON METEORITES IN THE PRAIRIE NETWORK FIREBALL DATA; R.S. Rajan and D.O. ReVelle, Jet Propulsion Laboratory, Pasadena, California 91109

Using a combination of theory and observational data, the U.S. Prairie Network data has been reanalyzed in order to locate possible iron meteorites among the fireballs. On the basis of the observed meteorite record alone, we would expect that about 5% of the bodies could be iron. This identification process has been carried out in a manner similar to that employed by Wetherill and ReVelle, but is inherently more difficult because of the more complicated ablative characteristics of irons (due to the relatively large thermal conductivity with respect to that of chondritic materials) and due to the fact that calibration of an end height iron line cannot be made on the basis of an observed meteorite fall. In the absence of such a calibration, we have proceeded using a combination of theoretical and observational methods in order to determine an effective ablation parameter for irons in the extreme limits of melting dominant ($s=0.0743\ s^2/km^2$ with $m<2.10(5)$ kg) and of vaporization dominant ($s=0.0124\ s^2/km^2$ with $m>2.10(5)$ kg). The quoted ablation parameter values are also functions of velocity and altitude, but can be utilized whenever the ratio of the energy conducted into the interior of the body compared to the arriving convective and radiative energy from the shock wave is either sufficiently small (vaporization limit) or large (melting limit). These values have been arrived at using four distinct methods that rely on modeling (simple and quasi-simple ablation theory), laboratory measurements (cosmic ray track and rare gas methods) and on natural and artificial meteors and fireball observations in the atmosphere.

Using the ablation parameter values, we have established the following criteria for the identification of irons among the fireballs: i) Agreement within +/- 1.5 km of the corrected end height for each fireball with respect to the "calibrated" iron end height line for a standard set of reference conditions as a function of the deduced mean dynamical mass (from deceleration data); ii) Agreement within a factor of two between the corrected photometric mass and the mean dynamical mass.

Additional criteria that were previously considered have not been included in the current identification process. Both the safe deceleration to low velocities and the "smoothness" of the light curve were not used as criteria since the large ablation that is predicted for these bodies (with respect to that of chondritic material) is likely to produce both a natural "flaring" of the light curve and an end height at significantly higher velocities due to the significantly smaller terminal mass.

As a result of the above criteria, we would expect that small irons could be found among the previously identified Ceplecha-McCrosky Group II (Carbonaceous Chondrites) fireballs whereas the larger irons would be among the Group I type (Ordinary and Bronzite Chondrites). Criteria ii) above is especially useful in sorting out the irons in the former case, since on the basis of bulk density and ablation parameter alone, the predicted end heights of the two materials are within the quoted end height tolerance used in criteria i).

We have reanalyzed all available data and found 16 fireballs that satisfied criteria i). Of these only 4 fireballs also satisfied criteria ii). Both the atmospheric data and the corresponding orbital elements of these fireballs will be discussed. The latter are especially relevant given the recent discovery of Tedesco and Gradie of earth-crossing M type asteroids.

*This work was supported through the NASA Summer Faculty Fellowship Program at JPL.