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Methods to improve data quality when creating meteorite databases
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The purpose of our research is to obtain statistics of bulk analyses for meteorite groups/subgroups to help refine a more accurate understanding of near-earth asteroids (NEA). If laboratory and other database errors are not controlled then they can have a dramatic and adverse impact on how representative meteorites are, and whether they can be used to analyze NEA. Thus, we need to understand the various types of errors and eliminate them, correct for them, or modify any conclusions.

Many meteorites are already classified, so it makes sense to use previously published analyses. A number of authors have compiled lists to help subdivide and classify meteorites into groups/ subgroups based on chemistry and petrology [1-6]. Our database includes 26,661 bulk-analyses from 1195 meteorites, sourced from 112 journal articles published between 1953 and 2010.

To try to improve the quality of the analyses we preferentially used the most recent values on the assumption that they have lower laboratory precision errors. Analyses were tagged so they can be traced back to their source. Data was checked multiple times for errors. Precision errors of sourced analyses were analyzed. Some data were replaced where possible, especially where rounding errors > precision errors.

The results were then compared to other datasets to confirm: 1) that meteorite classifications are correct, 2) whether results differ from previously published works, and 3) whether any bias exists between Antarctic and non-Antarctic meteorites.

The results show that: 1) a close match exists between our database and other authors, 2) minimizing database errors helps to reduce dispersion, and 3) the majority of differences between Antarctic and non-Antarctic meteorites may be explained by: a) an insufficient number of samples, b) distributions with high skew or kurtosis (peakedness), and c) normal variability between samples.

We discuss ways to improve database quality by considering the following: 1) laboratory precision, 2) quality of analyses, 3) data entry and conversion errors, 4) over-rounding of analyses, and 5) potential misclassification of meteorites.

We conclude that the most efficient way to improve data quality is to replace older analyses with more recent ones. However, the assumption that the most recent analyses have lower precision does not always hold. Although laboratory precision has gradually improved over time, our results suggest it is also influenced by how well individuals follow standard laboratory procedures.

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