

Mass Consumed Associated with Carbonaceous Chondrite Thin Section Making: Experience from the U.S. Antarctic Meteorite Collection

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Introduction

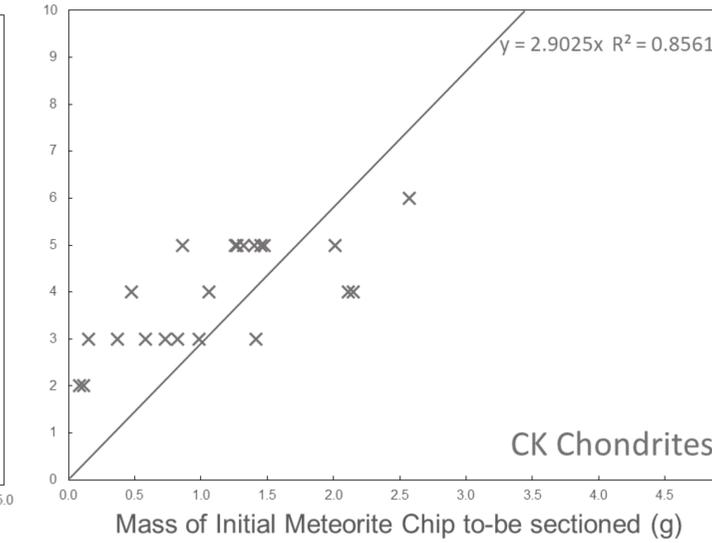
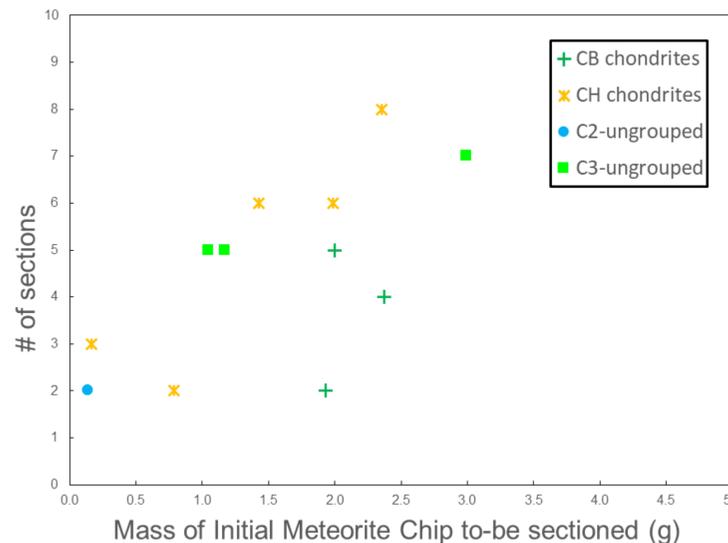
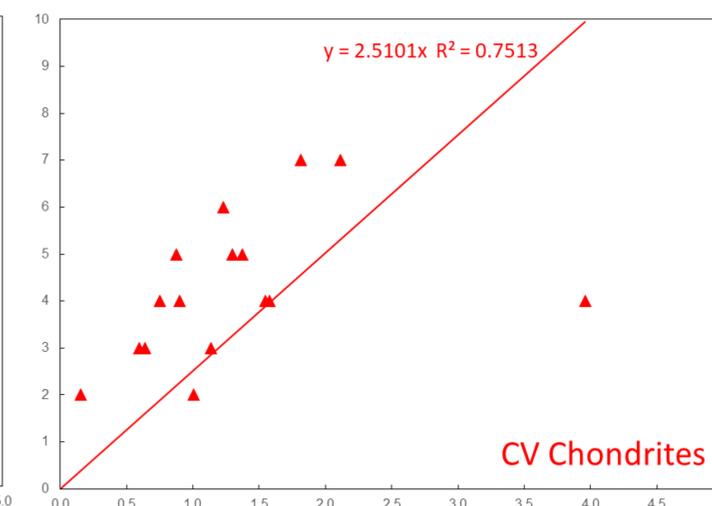
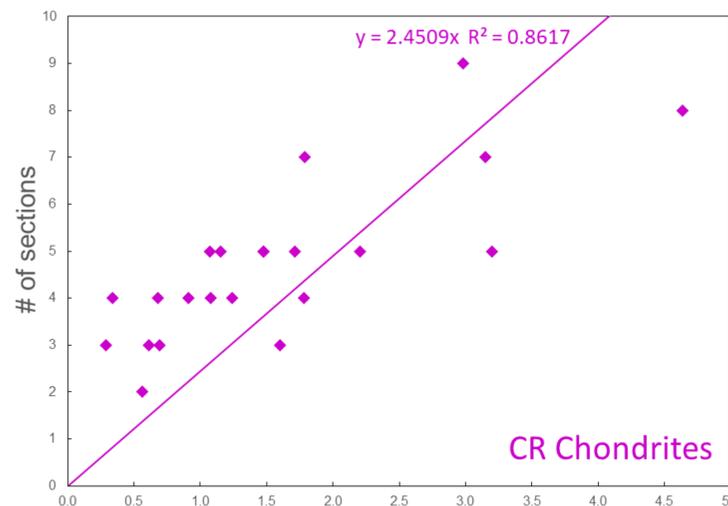
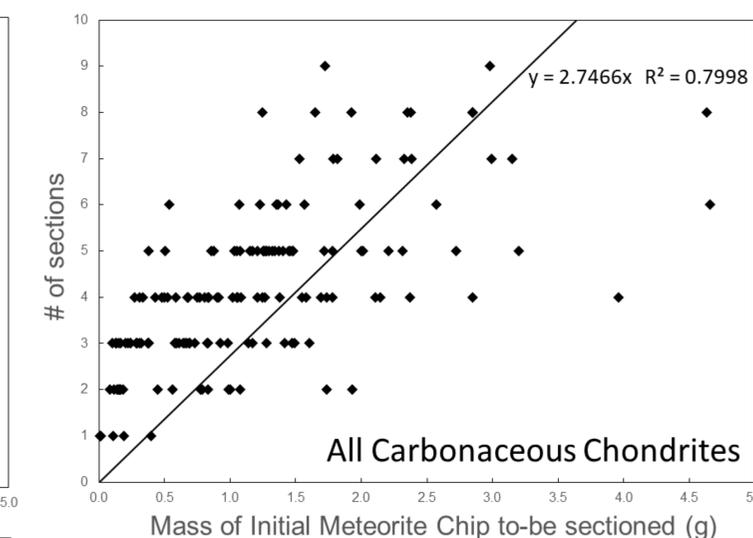
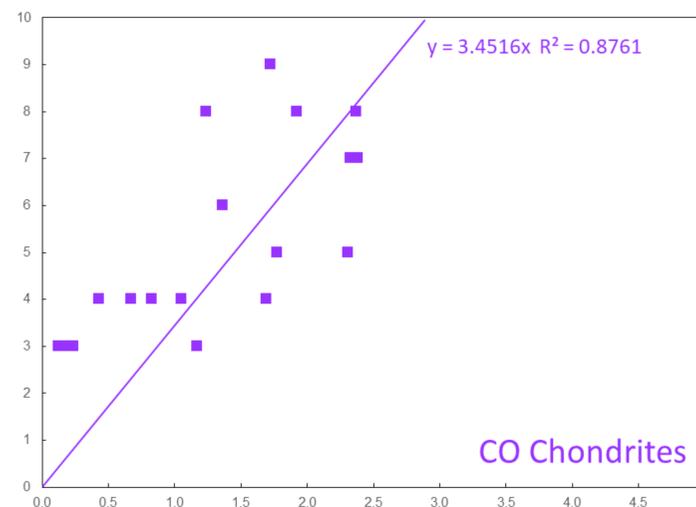
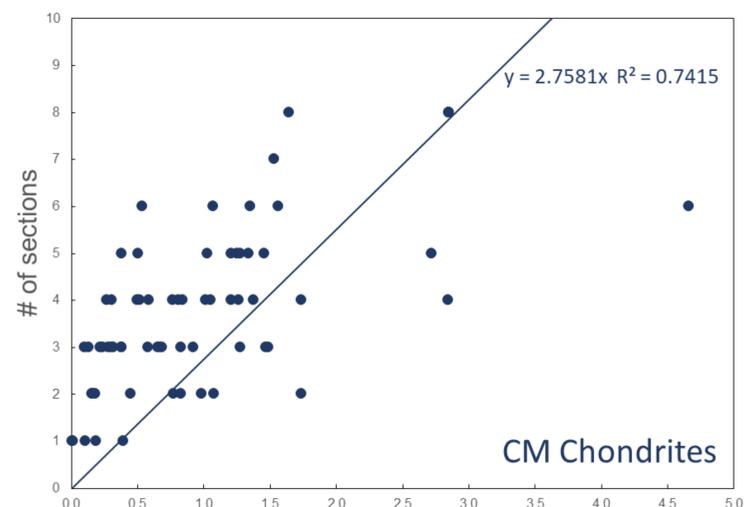
In addition to the tremendous scientific value of Antarctic meteorites to the planetary science community, the curatorial documentation of the U.S. Antarctic Meteorite collection is useful as a reference for planning distribution and allocation of other astromaterial collections, including future returned sample collections. Since the U.S. Antarctic Meteorite collection's formation—as part of the U.S. Antarctic Search for Meteorites (ANSMET)—the mass of meteorites, masses of subsplits of meteorites, and the parent-child relationships among subsplits of meteorites have been carefully tracked and documented [1]. This documentation enables us to use past experience to answer new questions as they arise. Here, we use this documentation from the U.S. Antarctic Meteorite Collection to examine the mass consumed on average in making thin and thick sections for several carbonaceous chondrite groups.

Methods

In this project, we identified all the CM, CO, CV, CR, CK, CH, CB, and ungrouped carbonaceous chondrite meteorite chips (subsplits) that have been mounted (into potted butts) and then fully subdivided/consumed to make either thin or thick sections. The initial masses of the potted meteorite chips (the 'parent' chips) and the number of sections (the 'child' thin or thick sections) were then compared to calculate the average mass per section for these meteorite groups. This empirical dataset includes sections made at both Johnson Space Center (JSC) [2] and the Smithsonian Institution (SI) by over twenty separate thin section makers over the four-decade-long history of the U.S. Antarctic Meteorite Program.

Results

On average 3-4 sections were made from a gram of carbonaceous chondrite material from the U.S. Antarctic meteorite collection. There are not strong systematic variations between different carbonaceous chondrite groups – particularly when variability within each group's dataset is considered and the occurrence of outliers in several groups (CM, CR, and CV) that required substantially more mass per section than the rest of their group.



Discussion

The dataset presented here can be used to roughly estimate the number of sections that could be made from a given mass of meteorite or returned sample. But only roughly because other factors not included in this study, such as the shape of the chip to-be sectioned and the orientation at which it is sectioned, may substantially influence how many sections a chip of sample yields.

The U.S. Antarctic meteorite collection does not have any CI chondrites or fully subdivided C1-ungrouped chondrite chips. Based on the properties of CI chondrites, they may be more difficult to polish and yield fewer section per a given mass. In addition, CI chondrite thin sections are rarely requested from SI by researchers.

Acknowledgements

The scientific work that uses U.S. Antarctic meteorite thin and thick sections is possible due to sample preparation experts. Thank you to the all the thin section makers from over the years! *JSC-based thin section makers:* Bill Satterwhite, Carla Lerma Reed, Robbie Marlowe, Jimmy Holder, Michelle Crush, Kathleen McBride, Penny Bernhard, David Mann, David Mittlefehldt, KR, and many made by RH. *SI-Based thin section makers:* Tim Gooding, Tim Rose, Chris Anders, Jon Cooper, Richard Johnson, Frank Walkup, Grover Moreland, and NL.

References

[1] Righter K. et al. (2015) 35 Seasons of U.S. Antarctic Meteorites. AGU/Wiley Sp. Pub. 68: 43-64. [2] Harrington R. & Righter K. (2017) Annual MetSoc 80, Abstract #6304.