SHOCK CLASSIFICATION OF ANTARCTIC ORDINARY CHONDRITES. L.M. La Croix[1] and T.J. McCoy[1], [1]Dept. of Mineral Sciences, National Museum of Natural History, Smithsonian Institution, Washington, DC 20560-0119 USA (lacroixl@si.edu).

Introduction: Shock classification provides key insights into the bombardment history of asteroids since their origin 4.56 billion years ago. While older shock classification systems [1] focused on shock veins and pockets, [2] developed a system based on shock effects in olivine and plagioclase that was designed to determine the equilibrium shock pressure. This newer scheme has been applied to 4423 ordinary chondrites by a variety of users, as recorded by MetBase. Here we report the first in what will be an ongoing study of shock classification in ordinary chondrites from the U.S. Antarctic Meteorite Program. We have several goals, including (a) to compare shock classification statistics between Antarctic and non-Antarctic meteorite populations, (b) examine differences in shock classification between chemical groups and petrologic types, and (c) provide information about shock classification that, when coupled with existing information on chemical group, petrologic type and weathering degree, will allow a more informed selection of samples for other studies.

Methods: For our initial effort, we have focused on 91 meteorites collected in the Allan Hills region during 1976 and 1977, the first two seasons of the Antarctic Meteorite Program. They should provide more robust conclusions for shock classification statistics, as nearly all meteorites were examined in thin section and studies of pairing of ordinary chondrites [3] exist for these meteorites. Results are shown in the form of histograms organized by chemical group and petrologic type in Figs. 1 and 2. We have also compared our data to similar plots for all currently shock classified meteorites as identified in MetBase. It should also be considered when viewing Figs. 1 and 2 that they include multiple samples from the same pairing group, which may also be the case with the MetBase data referred to previously, producing a bias in the histograms presented.

Results: At this early stage, we can point to a number of interesting features in our data.

First and foremost is the paucity of shock stage 1 (least shocked) and shock stage 6 (most shocked) meteorites among the ALH A76-77 population. We identified only a single meteorite as shock stage S1 (ALH A77271) and no meteorites as shock stage S6. In the larger non-Antarctic population of shock-classified meteorites, ~10% are identified as shock stage S1 and ~2% as shock stage S6. It is perhaps not surprising that S1 meteorites are rare given the extensive impact processing experienced by asteroids, although we have sampled only a small subset of the available Antarctic meteorites. The absence of shock stage S6 among the Antarctic population may be a robust conclusion, as the second author has yet to identify any high pressure minerals in any of the thousands of Antarctic meteorites he has studied.

The second finding concerns differences in shock stages between chemical groups and petrologic types. [4] suggested that a difference between H and L chondrites was beginning to emerge based on ~150 meteorites. Our data point to a modest difference between H and L chondrites, with L chondrites skewed to higher shock stages. This difference is pronounced in the MetBase data with L chondrites approximating a normal distribution centered on shock stage S3, whereas H chondrites are skewed to lower shock values with a mode at shock stage S2. As pointed out by [2,4], we also find an absence of higher shock stages among the type 3 chondrites. These authors suggested that the friable, weakly-metamorphosed type 3 chondrites might be fragmented prior to reaching shock pressures indicated for shock stages 5 and 6. In this light, it is interesting that MetBase contains indications of 7 type 3 chondrites of shock stage S5 and 3 of shock stage S6. Examination of these meteorites might prove or refute this hypothesis.

Finally, we have examined our shock classifications in the context of pairing groups for the ALH A76-77. Of those proposed by [3], 2-12 members of 12 pairing groups have been shock classified and counted individually in Figs 1 and 2. For those pairing groups where >5 members were sampled, shock classifications typically cluster within two shock stages (e.g., S3-S4). There are, however, examples where shock stages diverge by a greater margin (e.g., S2-S5). It is unclear to us whether these meteorites are, in fact, not correctly paired or whether shock stages can diverge by such a large margin within a single preatmospheric meteoritic mass. Further study of either well-documented showers or large individual stones might provide more information regarding the shock homogeneity of meteorites. It may be that shock classification can be used to refine pairing groups.

References: [1] Dodd R.T. and Jarosewich E. (1979) *EPSL* **44**, 335-340. [2] Stoffler D., Keil K., and Scott E.R.D. (1991) *Geochim. Cosmochim. Acta* **55**, 3845-3867. [3] Scott E.R.D. (1989) *Smithsonian Contributions to the Earth Sciences* **28**, 103-111. [4] Stoffler D., Keil K., and Scott E.R.D. (1992) *Meteoritics* **27**, 292.

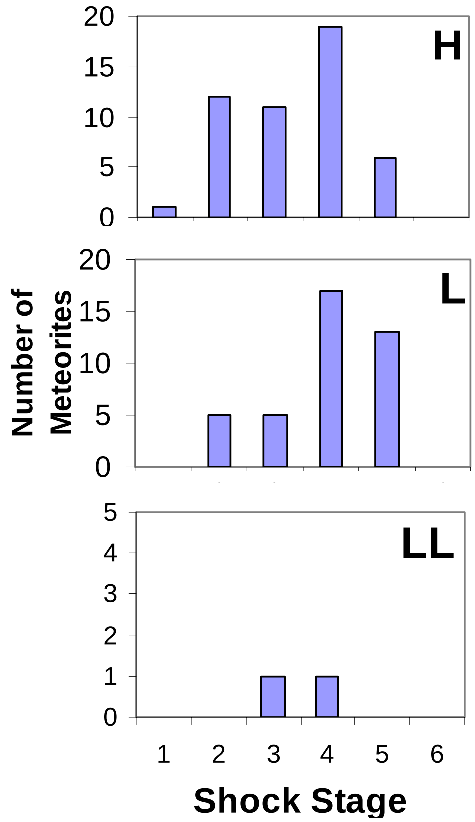

Fig. 1. Frequency distribution of shock stages by chemical groups

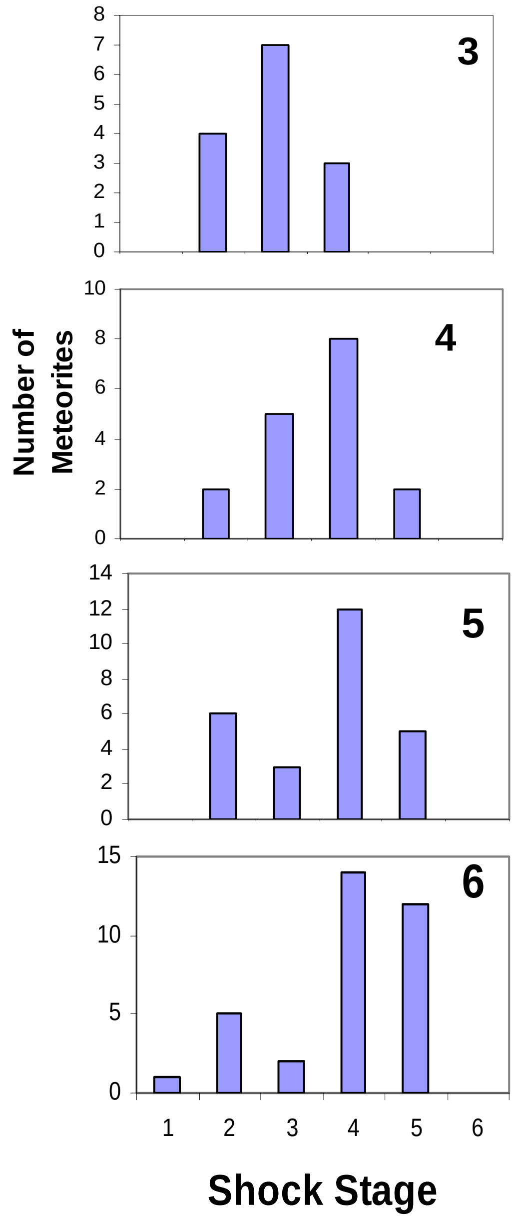

Fig. 2. Frequency distribution of shock stages by petrologic type