INTRODUCTION

Impact deformation of chondrites results in metal grain shape foliation and a decrease in porosity [1-5]. We re-examine evidence for these processes in light of additional data for ordinary chondrites, including micro-computed tomography (µCT) data for metal grain fabric in three dimensions, olivine shock stages [16] by optical microscopy (OM), and olivine microstructures by transmission electron microscopy (TEM). Some samples were measured for porosity using bead methods and He pycnometry.

Ordinary chondrites of various groups (H, L, LL) were studied. Meteorites included both “reference” or baseline L6 chondrites of different shock stages, and H6 and LL6 chondrites identified previously as either post-shock-annealed or hot-deformed.

We conclude based on all available data that:
1) metal grains in ordinary chondrites behaved in a ductile fashion during shock deformation, allowing them to become progressively flattened with an increase in shock pressures;
2) there is support for the idea that shock deformation could have caused porosity reduction in some meteorites;
3) some apparently weakly shocked chondrites with low metal grain flattening and low optical strain have anomalously low porositie...

CONCLUSIONS

We conclude based on all available data that:
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2) there is support for the idea that shock deformation could have caused porosity reduction in some meteorites;
3) some apparently weakly shocked chondrites with low metal grain flattening and low optical strain have anomalously low porosities, most of which show evidence for having been annealed, and some of which show evidence for having been deformed at elevated temperatures;
4) for annealed chondrites, elevated temperatures would have permitted additional compaction and porosity reduction during deformation, and annealing and microstructural recovery could have obliterated strain and caused a reduction in shock stage;
5) annealed chondrites probably formed at depth below an impact crater on an already warm body; heated planetesimals were impact-processed.


Abstract 1544, 46