CALIFORNIA STATE SCIENCE FAIR
2007 PROJECT SUMMARY

Name(s)
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Project Number
S0706

Project Title
Chemical Aspects of the Impact Process

Abstract

Objectives/Goals
Impact cratering is the most important process affecting the surfaces of solid bodies in the Solar System. Though the physics of the impact process are characterized, its chemical aspects remain poorly understood.

Previously (Daly 2005, 2006) I experimentally-induced impact events using a two-stage light gas gun and studied the resulting chemical and physical changes. This work led to the development of a conceptual model describing principles governing the chemistry of the impact process. My model predicted that the chemical changes occurring during the impact process happen primarily in shock-induced melt veins.

Methods/Materials
This year, my model#s hypotheses were tested by studying the spatial distribution of trace elements in impacted samples using a spectral high-resolution ion microprobe with reverse geometry (SHIMP-RG). To eliminate sample-preparation-induced artifacts, I developed a novel technique to prepare impactite samples for SHRIMP-RG analysis. Glow discharge mass spectrometry (GDMS) analyses of the projectiles used to induce the impact events were also conducted to test my model. The effort included a statistical analysis of over 5,000 inter-elemental ratios.

Conclusions/Discussion
Analysis of the data provides substantial evidence supporting my model, confirming the composition of the melt veins is different from the composition of the surrounding matrix. The concentrations of Cu, Zn, and, particularly Ni, are distributed heterogeneously, with significantly higher concentrations found in the melt veins than in the bulk target material. This work represents the first application of the SHRIMP-RG technique to chemical studies of the impact process and demonstrates the applicability and usefulness of this approach to studying impact chemistry.

Summary Statement
Using SIMS and GDMS, I have provided convinving evidence for a model in which the chemical changes occuring during the impact process occur in shock-induced melt veins.

Help Received
The SHIRMP-RG was provided by Stanford University. I was trained by Joe Wooden and Frank Mazdab.