# CALIFORNIA STATE SCIENCE FAIR
# 2005 PROJECT SUMMARY

**Name(s)**
Terik Daly

**Project Number**
**S0604**

**Project Title**
## The Derivation and Interpretation of Geochemical Ratios Generated by Meteoritic Impact

**Abstract**

**Objectives/Goals**
Much has been done to determine the effects of shock metamorphism on the mineralogical structure of target material, but little has been done to document the effects of shock metamorphism on the chemical composition of the target material. This research quantifies the trace chemical changes induced by ultrahigh temperatures and pressure in granite samples due to meteoritic impact.

**Methods/Materials**
In this study, granite from the Silver Plume batholith was subjected to hypervelocity impact, which was induced by a two-stage light gas gun, using an aluminum projectile. X-Ray Fluorescence and Inductive Coupled Plasma Mass Spectrometry analyses were used to document the chemical composition of the target material before and after the exposure of target material to impact.

**Results**
Depletion and enrichment were noted as occurring on an elemental basis, as well as determining enrichment and depletion trends throughout entire affinities and groupings of elements as defined by V.M. Goldschmidt. Statistical analysis of the data shows relative homogeneity of the sample material and is useful in determining trends in enrichment and depletion.

Data shows that enrichment is characteristic of the chalcophile elements (according to terrestrial affinity) and siderophile elements (as defined by meteoritic affinity). Ni, Cu, Ga, Pb, and Zn were each enriched in a consistent, significantly significant manner. Other elements were affected significantly, but in an inconsistent manner. Thin section analysis shows that a high silica polymorph formed, meaning that pressures of at least 170 GPa were reached, with temperatures near 1000 degrees C.

**Conclusions/Discussion**
Impact-induced shock metamorphism has a distinct and significant effect on the trace chemical composition of granite specimens. Trends of enrichment were seen in the chalcophile/siderophile affinity.

**Summary Statement**
This experiment quantifies the effect of shock metamorphism, induced by meteoritic impact, on the trace chemical composition of granite by using XRF and ICP-MS analyses to determine depletion and/or enrichment of individual elements

**Help Received**
The WSU GeoAnalytical Lab aided in performing chemical analyses; the UOH Petrology lab aided in the creation of thin sections; I used equipment at the NASA Ames Research Center under the supervision of Dr. Peter Schultz