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Final Technical Report

Cosmochemical Studies: Meteorites, Asteroidal Processes, Chondrules

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Summary of research

Our research mainly concerned the asteroidal processes involved in the formation of meteorites and meteoritic chondrules. We continued to generate large amounts of instrumental-neutron-activation analysis (INAA) data, both for irons, chondrites and primitive achondrites. Major themes of our chondrule research were (1) the temperature and crystallization history of individual chondrules, and (2) the evolution of the solar nebula during the period within which chondrule formation occurred. Much of our chondrule research was focused on the highly primitive CO3.0 chondrites. We initiated a study of the cooling history of high-FeO chondrules by characterizing the overgrowth layers on relict grains..

We also continued our studies of the composition and the formation of iron meteorites and the evolution of their parent planets. The large data sets that we have generated at UCLA allows systematic comparisons of the large magmatic groups both in terms of fractional crystallization (including rough estimates of nonmetal contents of the parental melts) and in terms of the effects of variable contents of trapped melt. We have completed a preliminary study of group IIIAB in which we developed a trapped-melt model and more detailed studies of group IVA (Wasson and Richardson, 2001 [attached]) and the main-group pallasites (Wasson and Choi, 2002). By comparing these large groups and modeling them by a combination of crystallization and melt trapping, we are able to better define both the formation processes and the nature of the solid/liquid elemental partitioning.

We helped maintain the excellent neutron-activation facilities at UCLA, a major resource for the cosmochemical community.

Supported Publications

NASA grant NAG5-10421 (J.T. Wasson, P.I.) COSMOCHEMICAL STUDIES

Research papers and abstracts mainly funded by this grant; submission dates during the period 01 Feb 2001 31- Jan 2002

Wasson J.T. and Kallemeyn G.W. (2002) The IAB iron-meteorite complex: A group, five subgroups, numerous grouplets, closely related, mainly formed by crystal segregation in rapidly cooling melts. *Geochim. Cosmochim. Acta* **66**, 2445-2473.

Rubin A.E., Kallemeyn G.W. and Wasson J.T.(2002) A IAB-complex iron meteorite containing low-Ca clinopyroxene: Northwest Africa 468 and its relationship to Iodranites and formation by impact melting. *Geochim. Cosmochim. Acta* **66**, in press.

Chizmadia L., Rubin A.E. and Wasson J.T. (2002) Mineralogy and petrology of amoeboid olivine inclusions in CO3 chondrites: Relationship to parent-body aqueous alteration. *Meteorit. Planet. Sci.*, submitted.

Nelson V.E. and Rubin A.E. (2002) Size-frequency distributions of chondrules and chondrule fragments in LL3 chondrites: Implications for parent-body fragmentation of chondrules. *Meteorit. Planet. Sci.*, submitted.

Wasson J.T. and Choi, B.G (2002) Pallasites-chemical composition, relationship to IIIAB irons, origin. *Geochim. Cosmochim. Acta,* submitted

Wasson J.T. and Rubin A.E. (2002) Ubiquitous relict grains in type-II chondrules, narrow overgrowths, and chondrule cooling rates following the last melting event. *Geochim. Cosmochim. Acta,* submitted.

Copies of the first two papers are attached.

Abstracts:

Rubin A. E., Wasson J. T., Kallemeyn G. W., Clayton R. N. and Mayeda T. K. (2001) Ungrouped iron NWA468: An impact-melt product with low-Ca clinopyroxene-bearing silicate inclusions. *Meteorit. Planet Sci.* **36**, A178-A179.

Wasson J. T. and Kallemeyn G. W (2001) The IAB iron-meteorites: A group, three subgroups and two subgrouplets, mainly formed by melting and mixing on one or more carbonaceous chondrite asteroids. *Meteorit. Planet Sci.* **36**, A220.

Wasson J. T. and Rubin A. E. (2002) Ubiquitous relict grains in type-II chondrules, narrow overgrowths, and chondrule cooling rates following the last melting event. *Lunar Planet. Sci.* 33, abs. 1141.

Wasson J. T. (2002) Large aerial bursts; an important class of terrestrial accretionary events. *Impacts and the Origin, Evolution, and Extinction of Life Rubey Colloquium*, 61-63.

Wasson J.T. and Choi B.G. (2002) Main-group pallasites: Relationship to IIIAB irons, role of magmatic gases *Meteorit. Planet. Sci.*, in press.

No copies of the abstracts are included.

Patents and Inventions

No patents or inventions resulted from the research effort supported by this grant.