Meteoritics & Planetary Science 37, 151–154 (2002)
Available online at http://www.uark.edu/meteor

From the Editors

Concentrating Antarctic meteorites on blue ice fields— The Frontier Mountain meteorite trap

The collection of meteorites in Antarctica has greatly stimulated advancement in the field of meteoritics by providing the community with significant numbers of rare and unique meteorites types and by yielding large numbers of meteorites that sample older infall epochs (Grady *et al.*, 1998). The majority of Antarctic meteorites are found on blue ice fields, where they are thought to be concentrated by wind and glacial drift (cf., Cassidy *et al.*, 1992). The basic "ice flow model" describes the concentration of meteorites by the stagnation or slowing of ice as it moves against a barrier located in a zone with low snow accumulation. However, our limited knowledge of the details of the actual concentration mechanisms prevents establishing firm conclusions concerning the past meteorite flux from the Antarctic record (Zolensky, 1998).

The terrestrial ages of Antarctic meteorites indicate that their concentration occurs on timescales of tens to hundreds of thousands of years (Nishiizumi *et al.*, 1989). It is a challenge to measure a mechanism that operates so slowly, and since such timescales can span more than one glacial epoch one cannot assume that the snow accumulation rates, ice velocities and directions, *etc.* that are measured today are representative of those extant over the age of the trap. Testing the basic "ice flow model" therefore requires the careful measurement of meteorite locations, glacialogical ice flow data, ice thicknesses, bedrock and surface topology, ice ablation and snow accumulation rates, and mass transport by wind over an extended period of time in a location where these quantities can be interpreted in the context of past glacialogical history.

In a paper in the current issue, the team of Folco, Capra, Chiappini, Frezzotti, Mellini, and Tabacco describe the Frontier Mountain blue ice field, an Antarctic meteorite trap that has yielded 472 meteorite specimens since 1984. They combine Landsat Thematic Mapper remote sensing data, measurements obtained from on-site field campaigns from 1993 to 1999, and meteorite locations and ages to describe the nature of the concentration mechanism at this site. They find that the Frontier Mountain ice field lies upstream from shallow subsurface barriers and that horizontal flow velocities decrease over tenfold as the ice approaches the barrier. The ice fields have significant mean ablation rates (6.5 cm/year) and are located in low snow accumulation zones that extend ~20 km upstream. These are all consistent with the basic "ice flow model" being the mechanism operating in the Frontier Mountain meteorite trap. Furthermore, it appears that the trap can be explained in terms of the current glacialogical situation; paleo-glaciological scenarios are not necessary to explain the observed meteorite concentrations.

The work of Folco and colleagues provides a valuable tool for using the Frontier Mountain meteorite population to address the past arrival rates of meteorites. The general success of the "ice flow model" for the Frontier Mountain meteorite trap gives hope that additional portions of the Antarctic meteorite collection could be used for this purpose if similarly detailed investigations are made of their source ice fields.

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Chondrules and nebular shocks

Beneath the fusion-encrusted surfaces of the most primitive stony meteorites lies not homogeneous rock, but a profusion of millimeter-sized igneous spheres (see Hewins, 1996 and other articles in the excellent compendium edited by Hewins, Jones, and Scott). These *chondrules*, and their centimeter-sized counterparts, the *calcium-aluminum-rich inclusions* (CAIs), comprise more than half of the volume fraction of chondritic meteorites. They are the oldest creations of the solar system; the oft-quoted age of the solar system of 4.566 ± 0.002 Ga refers to the crystallization ages of CAIs as determined from radioactive isotope dating. Their chemical composition matches that of the solar photosphere in all but the most volatile of elements, reflecting their condensation from the same pristine gas that formed the Sun. Their petrology is consistent with their being heated to super-liquidus temperatures for a period of a few minutes; their roundness suggests that the heating

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