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CHARACTERIZING WATER/ROCK INTERACTIONS IN SIMULATED COMET NUCLEI VIA
CALORIMETRY: TOOL FOR *IN-SITU* SCIENCE, LABORATORY ANALYSIS, AND SAMPLE
PRESERVATION.

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Introduction. Although results from the *Giotto* and *Vega* spacecraft flybys of comet P/Halley indicate a complex chemistry for both the ices and dust in the nucleus [1], carbonaceous chondrite meteorites are still regarded as useful analogs for the rocky component [2]. Carbonaceous chondrites mixed with water enable us to simulate water/rock interactions which may occur in cometary nuclei. Three general types of interactions can be expected between water and minerals at sub-freezing temperatures: (a) heterogeneous nucleation of ice by insoluble minerals; (b) adsorption of water vapor by hygroscopic phases; and (c) freezing- and melting-point depression of liquid water sustained by soluble minerals.

Samples and Methods. Two series of experiments were performed in a differential scanning calorimeter (DSC) with homogenized powders of the following whole-rock meteorites and comparison samples: Allende (CV3), Murchison (CM2), Orgueil (CI), Holbrook (L6), and Pasamonte (eucrite) meteorites as well as on peridotite (PCC-1, U.S.G.S.), saponite (SapCa-1, CMS), montmorillonite (STx-1, CMS), and serpentine (Franciscan Formation, California)[3,4]. In Series 1 experiments, approximately equal masses of mineral/rock powder and deionized water were blended into mud at room temperature and crimp-sealed in an aluminum container; a physically separate droplet of deionized water, overhanging the mud, served as an internal standard. Series 2 used the same procedure except that a dry mineral/rock sample was exposed only to water vapor from the overhanging droplet. Each sample container was placed in a Perkin-Elmer DSC-2 instrument and cooled at 10 K/min to ≤ 200 K, followed by re-heating at 10 K/min, under a continuous argon gas purge of 20 cm³/min. DSC heat-flow data were acquired during multiple freeze/thaw cycles.

Results. Series 1 experiments indicate that the freezing of water in water/rock mud mixtures is heavily influenced by heterogeneous nucleation. Because the aluminum container is a relatively poor nucleator, liquid water undercools substantially before freezing in the absence of minerals. Only Orgueil deviated from a nucleation trend-line, consistent with the additional influence of freezing- and melting-point depression by dissolved salts, which are more abundant in CI chondrites [5]. Whereas freeze/thaw cycling of Series 1 samples revealed little, if any, systematic change with time, data for Series 2 samples showed pronounced changes with successive thermal cycles. Freezing and melting peaks controlled by mineral/rock samples grow during successive freeze/thaw cycles, presumably as water vapor is progressively adsorbed and condensed on the initially dry samples. Mineralogical effects on condensation and freezing are seen in all three carbonaceous chondrites but are most pronounced for Orgueil, probably as a consequence of its more abundant hygroscopic phyllosilicates and sulfates [5]. Individual melting peaks in Orgueil appear to correlate with peaks in pure-substance comparison samples, but further work is needed for confirmation.

Implications for in-situ cometary analyzers, laboratory analysis, and sample preservation. Besides identification of volatile ices, DSC-type experiments could help diagnose the rocky component of a comet nucleus. Based on our freezing/melting data, we could expect (at the minimum) eucrites could be distinguished from ordinary and carbonaceous chondrites and that CI chondrites could be distinguished from other chondrites. Additional experimental work would be necessary to establish the nucleation, dissolved species, and adsorption effects or other interactions of carbon dioxide, ammonia, and methane ices, additional minerals, and organic matter. DSC data taken *in-situ* can be compared with laboratory measurements on returned samples to check the quality of sample preservation. Current mission planning for sample preservation requirements leans heavily on phase transition temperatures of pure substances [6]. To assure sample preservation, transition temperatures for mixtures should be experimentally determined.

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ABOUT DISTRIBUTION AND ORIGIN OF THE PECULIAR GROUP OF SPO→
 RADIC METEORS; V.V.ANDREEV, Kazan University, Engelhardt Astro -
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The group of the peculiar meteors are picked out from ana-
 lysis of meteor catalogues obtained from radar observations in
 Mogadisho and Kharkov. For these meteors inclinations of orbits
 i are equal or more than 90° and

$$T = a^{-1} + 2 A_J^{-3/2} \sqrt{a (1 - e^2)} \quad \text{Cos } i \geq 0.5767,$$

where A_J is the Jupiter's semi-major axis.

Semi-major axes of the meteor orbits are equal or more
 than 1.73 AU for these conditions. Distributions of radiants,
 velocities and elements of orbits were derived. A possible sour-
 ce of meteor bodies of this peculiar group is the long-period
 comets, in particular, the comets of the Kreutz's group.

PHOBOS AND DEIMOS ARE SOURCES OF METEORIDS. ANDREEV V.V.,
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Data of Pioneer 10 meteoroid penetration detectors were revised
 taking into account the orientation of detectors and the spacecraft
 velocity relative of the sporadic meteor flux. The meteor flux density
 increases exponentially to the orbit of Mars for six times and then
 decreases after the orbit. Ejections of secondary meteoroid particles
 are the possible explanation of the increase of the meteoroid flux.