of pure solid hydrogen, and the presence of impurities, of course, changes the vapour pressure of the pure substance. But it is highly unlikely that the presence of ~1 per cent of metallic impurities that one can get in dust clouds can change the vapour pressure by a few orders of magnitude. It therefore seems that it is not possible to increase considerably the time scale of evaporation of the solid hydrogen mantle from the values in Table 1, although it may be considerably reduced because of less efficient far infrared emission. This poses a real dilemma for the graphite core–solid hydrogen mantle model for grains in interstellar space.

One of us (K. S. K. S.) is an NAS–NRC research associate.

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Motion of Phobos

THERE have been several attempts to explain the large secular acceleration of the motion of Phobos (the closer of the two satellites of Mars) that was derived by Sharpless[1] by fitting a quadratic expression for the mean longitude to five selected groups of orbital elements covering the period 1879 to 1941. An analysis[2] of all suitable visual observations made during the period 1877–1929 failed, however, to confirm this secular acceleration. The orbital elements obtained in this analysis, taking the secular acceleration as zero, were subsequently[3] shown to fit these visual observations and also positions obtained by Sharpless in 1941 and, photographically, by Kuiper in 1956 to within about ±2° in the value of the constant term in the linear expression for the mean longitude. This uncertainty is believed to be due partly to the errors of the observations and partly to the approximations in the orbital model used to fit the observations.

Two pairs of observations made at the Pulkovo Observatory in 1956 and 1967 have recently been made available in a personal communication by Professor G. A. Chebotarev. Again I have found that the same orbital elements fit these observations with residuals of only ±2° in mean longitude. On the other hand, the quadratic term given by Sharpless would have contributed some 8° to the mean longitude in 1967. I conclude that any secular acceleration of Phobos is much less than that given by Sharpless, but unfortunately we are not at present able to specify a value that could be used meaningfully in estimating the relevant physical properties of Phobos and Mars.

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Allende Meteorite : Some Major and Trace Element Abundances by Neutron Activation Analysis

THE Allende (Chihuahua, Mexico) meteorite of February 8, 1969 (ref. 1 and unpublished report of R. S. Clarke, jun., E. Jarosewich, B. Mason and J. Nelen), is of great interest because it belongs to a group of relatively rare carbon containing meteorites known as the carbonaceous chondrites and because the amount of material collected so far already exceeds the total weight of all other carbonaceous chondrites in museum collections.

We suggest that sufficient material is now available (estimates of a fall of more than one ton have been made) for this meteorite to serve as a source of a "standard meteorite" powder of the same type as the standard rocks provided by the US Geological Survey. Interlaboratory comparisons of meteorite analyses have always been hampered by the scarcity of most types of meteorites and the tendency merely to extract a chip from the bulk specimen rather than to prepare an adequate amount of homogeneous powder. We feel that many of the abundance discrepancies in the meteorite literature may be due to the inadequacies of sampling. It is hoped that one of the institutions holding a large amount of the Allende fall would consider preparation of a homogenized powder in sufficient amounts to provide for meaningful interlaboratory comparisons for those involved in meteorite studies.

In the hope that this meteorite will become important in the interlaboratory comparison of analytical techniques, members of the radiochemistry group at the University of Kentucky have analysed for fourteen elements in homogenized powders derived from three individual stones of the Allende fall. The elements cover a wide range of geochemical affinities. Interior fragments of 4 to 5 g from two different stones were powdered individually in an agate mortar and designated specimens S-5207*a* and S-5207*b*. Two interior fragments of a third stone were powdered separately in the agate mortar. These latter two powders were designated S-5211*a* and S-5211*b*. Hence comparisons between data for S-5211*a* and S-5211*b* are for different fragments of the same stone while comparisons of data for S-5207*a*, S-5207*b* and the mean for both S-5211 powders are for three separate stones. Detailed descriptions of the experimental techniques have been published previously or will be published elsewhere and are not given here. The data obtained are presented in Table 1. The error limits expressed in the last column represent the standard deviation for the mean, based on all aliquants analysed.

Reference to the compilation of elemental abundances in carbonaceous chondrites by Mason[7] suggests that the observed elemental abundances in Allende are closely similar to those in type III carbonaceous chondrites, as defined by Wiik[8]. This suggestion has been made previously by King *et al.*[1] and in an unpublished report by Clarke, Jarosewich, Mason and Nelen. The abundances found here for the strongly siderophilic elements such as Ni, Co, Ir, Au and Pt are among the highest reported for analyses of carbonaceous chondrites. Allende contains only minute amounts of free metal phase and much of the Ni and Co occurs as pentlandite (unpublished report of Clarke *et al.*). Possibly some Ir, Au and Pt may also be present in the sulphide phases.

Clarke *et al.* also suggest that Allende is very similar in gross chemical and mineralogical composition to the carbonaceous chondrite Mokoia. Mokoia was classified as a type III carbonaceous chondrite by Wiik[8], but a more recent classification by Van Schmus and Wood[9] based on chemical composition, textural and mineralogical features places Mokoia in a group designated C2 which contains most of the carbonaceous chondrites of type II as defined by Wiik. Some specific comparisons of the elemental