^{26}Al PRODUCTION PROFILE AND MODEL COMPARISONS IN CANYON DIABLO;

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The large preatmospheric size of the Canyon Diablo meteorite, a radius of about 15 m, makes it especially suitable for systematic studies of cosmogenic nuclide production rates of iron objects in a 2π geometry. To reconstruct the exposure history of the meteoroid, Heymann *et al.* (1) investigated several fragments recovered from known geographic locations around the crater for their shock features and cosmogenic noble gases. They applied the Signer-Nier noble gas production rate model (2) to establish the preatmospheric depth of the specimens in the meteoroid. Cosmic ray exposure ages suggested a multi-episodic irradiation, with 170 or 540 Ma being inferred for most of the samples studied while two anomalous specimens indicated a possible third exposure age at 940 Ma. ^{10}Be and ^{36}Cl have been measured in a number of these same samples (3) by accelerator mass spectrometry (AMS), with use being made of the preatmospheric depths determined in (1) to construct production profiles. The present study extends the cosmogenic radionuclide data to ^{26}Al and compares the results with both the production rate model of Reedy and Arnold (4) and production rates determined from the cross sections used by the Reedy-Arnold model (for the major nuclear reactions making ^{26}Al) in combination with differential fluxes calculated using the Los Alamos High Energy Transport (LAHET) Code System. Model calculations for ^{10}Be and ^{36}Cl have also been obtained and will be presented. All AMS measurements were made at the PRIME Lab facility at Purdue University.

Figure 1 shows the ^{26}Al results. Production rates were calculated by correcting activities to the 50 ka terrestrial age (5,6). The half-attenuation length of the profile is 85 g/cm^2 (10.8 cm). Three samples anomalously low in ^{26}Al are seen around d = 27 cm. These samples are correspondingly low in ^{10}Be and ^{36}Cl: their noble gases are being re-measured. A sample with no measurable noble gas content was analyzed to give an estimate of the lower discrimination level (0.03 dpm/kg). A comparison of data for the 3 measured radioisotopes yields a production rate ratio of P(^{10}Be)/P(^{26}Al) and P(^{36}Cl)/P(^{26}Al) of 1.46±0.06 and 7.5±0.4 dpm/kg respectively, in good agreement with values cited in (7) and references therein from studies of small irons.

The results of the model calculations are also shown in Figure 1. The composition of the Canyon Diablo matrix was taken to include 7.1% Ni, 0.4% Co and 0.2% P. The Reedy-Arnold model curve is very similar in half-attenuation length to the experimental result, but a factor of 3 lower in magnitude. By contrast, production rates calculated from LAHET results yield a profile in relatively good agreement with experiment. This suggests that the build-up of the secondary particle flux in the iron-nickel matrix of Canyon Diablo may be significantly different from that seen in silicate matrices, where the Reedy-Arnold model has heretofore been applied. Such bulk composition dependence on flux development has previously been reported in (8).

We calculated cosmic ray exposure ages using the ratio ^{26}Al/^{21}Ne and the relative production rate of R = 0.51± 0.03 determined in (9) from a calibration of ^{26}Al/^{21}Ne ratios with ^{41}K/^{40}K exposure ages in several meteorites. These age estimates include only one (CD 4337) which seems to belong to the 170 Ma group proposed in (1). The remaining samples have ages which are generally consistent with 540 Ma. The results fail to confirm the existence of the 940 Ma group.

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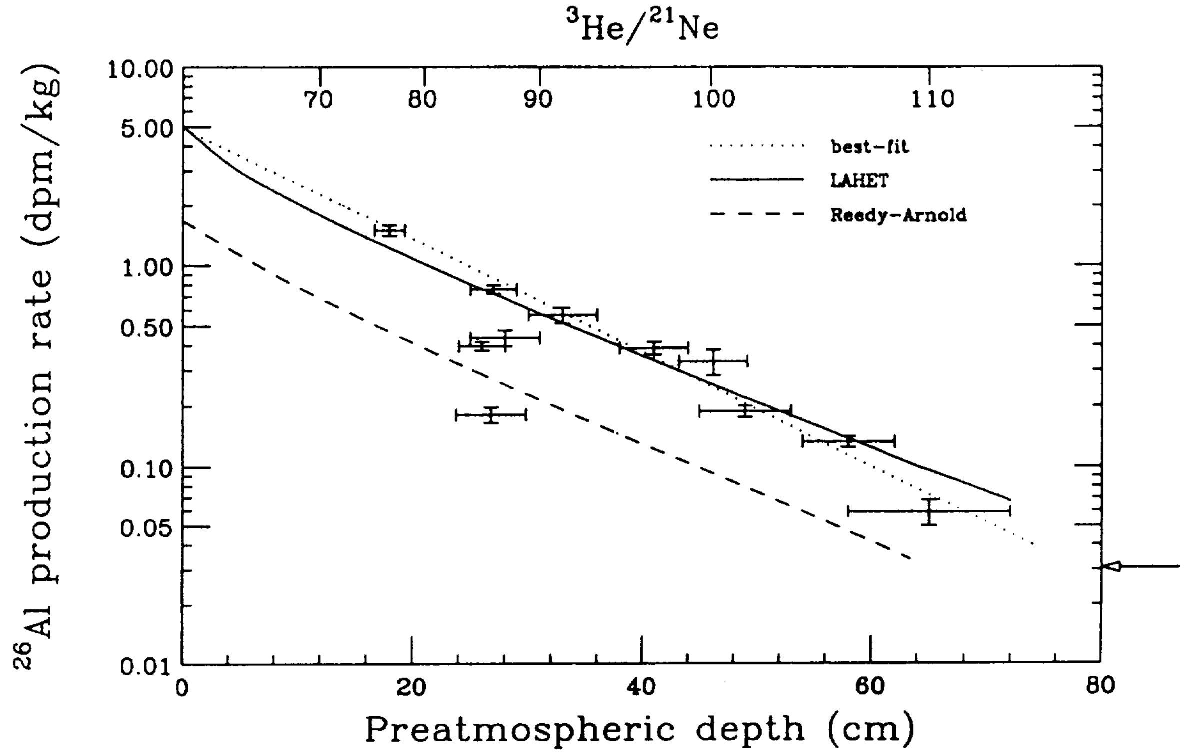

Figure 1 . Production rate of ^{26}Al vs. preatmospheric depth in Canyon Diablo. The arrow indicates the result of the sample with no cosmogenic gases.

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