39Ar-40Ar study of Allan Hills Meteorite 77005, a unique achondrite.

Schaeffer, O.A. and R. Warasila, Dept. of Earth and Space Sciences, State University of New York at Stony Brook, Stony Brook, NY 11794.

The achondritic meteorites in many ways resemble breccias from the lunar regolith. Probably, they are derived from the regolith of a large asteroid. Achondrites should be a fruitful source of information about the evolution of planetary bodies in the solar system. At some time in the past the parent body was broken up by collision. Either as a result of that collision or subsequent collisions of the large pieces, material was thrown into an earth crossing orbit and finally a meteorite arrived recently on the earth's surface. The collisional or volcanic processes while in the parent regolith as well as subsequent collision may be recorded in a 39Ar-40Ar release pattern as different ages for different mineral phases.

We report here the results of a careful 39Ar-40Ar study of Allan Hills Meteorite 77005. This meteorite has been classified as a "unique", Ca-poor achondrite by Mason (1). The olivine composition is similar to cassignites while the pyroxene is similar to diogenites.

The temperature release pattern is shown in Fig. 1. The low temperature releases contain a large amount of extra 40Ar with little 39Ar. These points do not appear in Fig. 1. The first fraction to contain significant 39Ar is the 7750 fraction. The "age" of this fraction is 3.95 GY. If all the 36Ar is ascribed to air, the age becomes 1.0 GY. From the 8000 to 10000 fraction (one fraction each 250) the age rises steadily from 0.32 to 1.38 GY. Between 9750 and 11000 (one fraction each 250) there is the suggestion of a plateau with a plateau age of 1.1+0.1 GY. After 11000 the age rises steadily to a high value of 3.4 GY at 13500 (one fraction each 500 in the 11000-15000 range). The 14000 fraction is lower at 1.6 GY followed by a high value at 14500 of 3.2 GY. The 1500, 1600 and 17000 fractions contain little 39Ar about 0.6% of the total.

It would appear that 77005 suffered a major metamorphic event about 1.1 GY ago. This event did not completely degas the high temperature minerals. Subsequent to that event there was appreciable gas loss from the sites represented by the low temperature releases. Atmospheric argon almost certainly influences the low temperature releases. We have shown (2) that exposure to the atmosphere can introduce argon which is released as high as 1000°C.

References
Figure 1: Temperature release pattern for Antarctic Meteorite 77005, a "unique" Ca-poor achondrite.