Introduction

NWA 2975, an enriched martian basaltic shergottite, is highly shocked and relatively unweathered. The maskingelized plagioclase in its groundmass is homogenous and usable for geochronological studies. We use NWA 2975 maskelynite to address the conundrum of martian Ar-Ar ages that are older than Sm-Nd ages. Our approach uses smaller samples to study the Ar-Ar systematics of this meteorite.

Experimental Conditions

We chose 7 grains based on relatively high [K] as found by semi-quantitative energy dispersive spectroscopy (EDS) work. The grains were irradiated (with Cd shielding) for 80 h at the USGS Triga reactor and heated in 7-10 steps with a CO₂ laser ($T_{\text{max}} = 1400 \degree C$). Ar isotopes were analyzed using a MAP 215-50 spectrometer operated in pulse-counting mode. A typical system blank (10⁻¹⁷ mol) is: $^{40}Ar = 8.21; ^{39}Ar = 0.37; ^{38}Ar = 0.03; ^{37}Ar = 1.35; ^{36}Ar = 0.13$. Fish Canyon sanidine (28.2 Ma) was used as a flux monitor.

Grains

Backscatter electron images and energy dispersive spectra of single maskelynite grains.

Plateau Diagrams

Apparent ages range from 294 to 410 My. Wtd. avg. is 314 ± 7 My. Ages are concordant with total fusion ages.

All samples give apparent ages older than Sm-Nd values of ~180 My.

Isochrons

A standard isochron, with no corrections (left graph), yields an age of 352 ± 20 My. The inset shows the same isochron without the high outlying point, in which case, the age decreases to 304 ± 29 My. In both cases, the intercept is 0, within error [1σ]. Calculating the cosmogenic $^{36}Ar, ^{38}Ar$ by assuming that the minimum measured $^{36}Ar/^{38}Ar$ represents purely cosmogenic $^{38}Ar$, we can fit the isochron by using only the trapped component of $^{36}Ar$ for both ratios (right graph). This decreases the age slightly to 337 ± 92 My, yet retains an intercept of zero, indicating no trapped $^{40}Ar$ (points with unreliable $^{36}Ar/^{38}Ar$ are omitted).

Summary

$^{40}Ar/^{39}Ar$ ages of maskelynite grains are ~325 My. Cosmogenically corrected isochron shows no evidence of excess $^{40}Ar$ and gives an age of 337 My.

Conclusions

- A shock event reset the maskelynite grains sometime before 290 My.
- This event is not the same as the launching impact event.
- The discrepancy between the Ar-Ar and Sm-Nd systems is real, but not yet understood.
- Smaller samples capture fine-scale heterogeneity within martian meteorites.