\(^{39}\text{Ar}-^{40}\text{Ar}\) ‘AGE’ OF BASALTIC SHERGOTTITE NWA-3171.

Jisun Park\(^1\) and Donald D. Bogard, ARES, NASA-JSC, Houston, TX 77058. \(^1\)NASA Postdoctoral Fellow, JISUN.PARK@NASA.GOV

North-West-Africa 3171 is a 506 g, relatively fresh appearing, basaltic shergottite with similarities to Zagami and Shergotty, but not obviously paired with any of the other known African basaltic shergottites [1,2]. Its exposure age has the range of 2.5-3.1 Myr [3], similar to those of Zagami and Shergotty [4]. We made \(^{39}\text{Ar}-^{40}\text{Ar}\) analyses of a “plagioclase” (now shock-converted to maskelynite) separate and of a glass hand-picked from a vein connected to shock melt pockets. Plagioclase was separated using its low magnetic susceptibility and then heavy liquid with density of \(<2.85\ \text{g/cm}^3\).

The \(^{39}\text{Ar}-^{40}\text{Ar}\) age spectrum of NWA-3171 plag displays a rise in age over 20-100\% of the \(^{39}\text{Ar}\) release, from 0.24 Gyr to 0.27 Gyr. The first 20\% of the \(^{39}\text{Ar}\) release involves terrestrial weathering products characterized by adsorbed terrestrial Ar and likely terrestrial K contamination. Over the last 80\% of the \(^{39}\text{Ar}\) release, constant values of the \(^{36}\text{Ar}/^{37}\text{Ar}\) ratio indicate that essentially all \(^{36}\text{Ar}\) released is cosmogenic. An isochron plot (\(^{39}\text{Ar}/^{36}\text{Ar}\) vs. \(^{39}\text{Ar}/^{36}\text{Ar}\)) of these data (R\(^2\)=0.996) has a slope corresponding to an age of 225 ± 4 Myr. Essentially the same age is obtained whether we use total \(^{36}\text{Ar}\) or correct for trapped \(^{36}\text{Ar}\). A radiometric formation age for NWA-3171 has not yet been reported. However, the \(\text{Ar-Ar}\) age spectrum of NWA-3171 closely resembles that of Zagami, and the Arrhenius diffusion plots of \(^{39}\text{Ar}\) for the two shergottites also are similar. Thus, the “true” age of NWA-3171 may be similar to the Zagami age (177 ± 3 Myr; [5]). This implies NWA contains an extra component of \(^{40}\text{Ar}\), not accompanied by significant trapped \(^{36}\text{Ar}\), an inference that we have made for Zagami as well (Bogard & Park, this volume). We suggest this excess \(^{40}\text{Ar}\) was inherited from the basaltic melt.

The \(^{39}\text{Ar}-^{40}\text{Ar}\) age spectrum for the glass inclusion is very different and shows apparent \(\text{Ar-Ar}\) ages ranging between 0.3 and 1.9 Gyr. Variations in the \(^{36}\text{Ar}/^{37}\text{Ar}\) ratios indicate release of trapped \(^{36}\text{Ar}\) throughout most of the extraction. An isochron plot of \(^{36}\text{Ar}/^{40}\text{Ar}\) vs \(^{39}\text{Ar}/^{36}\text{Ar}\) suggests the release of terrestrial Ar in the first ~30\% of the \(^{39}\text{Ar}\) release, and high K/Ca ratios in these extractions also suggest terrestrial weathering. We used trapped \(^{36}\text{Ar}\) in the isochron by subtracting a cosmogenic \(^{39}\text{Ar}_{\text{cos}}\) component obtained from average data reported for Zagami and Shergotty whole rock [4, 6-8]. Measured \(^{39}\text{Ar}/^{37}\text{Ar}\) ratios were used to apportion this \(^{39}\text{Ar}_{\text{cos}}\) over individual releases. The temperature extraction data of 780-1160 °C (corresponding to ~37%-93\% of the \(^{39}\text{Ar}\) release) define a mixing line between a radiogenic component and Martian atmospheric Ar with \(^{40}\text{Ar}/^{36}\text{Ar} \cong 1800\), consistent with previously reported values for Mars atmospheric Ar [9]. Like other impact glasses in shergottites, NWA-3171 glass contains martian atmosphere incorporated at the time of impact formation, and does not directly yield a formation age.