Evaluation of cosmogenic $^3$He and $^{21}$Ne concentrations in an olivine-rich Pleistocene basalt flow, western Grand Canyon National Park, Arizona, USA

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The Bar Ten lava flow is a Pleistocene basalt flow located in the western margin of the Uinkaret Volcanic Field in Grand Canyon National Park (AZ, USA). It was chosen as a calibration site for the production of cosmogenic $^3$He and $^{21}$Ne ($^3$He$_c$ and $^{21}$Ne$_c$) to investigate the reliability of different methods of scaling production rates for altitude and latitude. The lava flow erupted between 80 and 140 ka based on a previously reported $^3$He$_c$ age (88 ± 6 ka) and a thermoluminescence (TL) age of 108 ± 29 ka. The presence of excess Ar and abundant glass in this basalt flow made it difficult to obtain a reliable $^{40}$Ar/$^{39}$Ar age; there is one reported age of 190 ± 390 ka. Now, two samples yield preliminary $^{40}$Ar/$^{39}$Ar ages of 80 ± 25 and 117 ± 32 ka. In this study, cosmogenic samples were collected from stable, primary surfaces at elevations from 1180 to 1820 m along a vertical transect between 36.2239 to 36.2417° N. He, Ne, and Ar were analyzed by stepwise heating of olivines and $^3$He$_c$ and $^{21}$Ne$_c$ components have been determined. Initial results show that $^3$He$_c$ in olivine of new samples is higher than $^3$He$_c$ concentrations in samples from the earlier study. Samples collected in the earlier study may have experienced more erosion. We also evaluated $^{21}$Ne$_c$/$^3$He$_c$ values, hypothesizing that eruption age and erosion should have no effect on the ratio, if $^3$He$_c$ and $^{21}$Ne$_c$ are produced at constant rates relative to each other. $^{21}$Ne$_c$/$^3$He$_c$ varies from 0.17 to 0.31 in these olivine and may be due to differences in mineralogy. Production rates and scaling methods produce cosmogenic ages that are bracketed by the $^{40}$Ar/$^{39}$Ar and TL ages. Samples will be analyzed for chemical composition and evaluated using different scaling factors and production rates.