



Cosmogenic ^3He and ^{36}Cl determinations from lava flows from Fogo (14°N) and Stromboli (38°N): Implications for production rates and scaling grids

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Surface exposure dating utilising Terrestrial Cosmogenic Nuclides (TCNs) has emerged as a powerful tool in deciphering exposure histories, erosion rates, landscape evolution, etc. The CRONUS-EU network aims to tackle the two main uncertainties that hamper accurate application of TCNs to these processes: (i) accurate knowledge of production rates and (ii) the scaling of the production rates with altitude and latitude. While the production rate of cosmogenic ^3He is one of the best established, the cosmogenic ^{36}Cl production rate is poorly constrained mainly due to the uncertainties in the relative contributions of the various target elements (mainly Ca and K, but also Fe and Ti) as well as production pathways. Both cosmogenic nuclides can be measured on the same rock type (e.g. basalt), and therefore allows inter-calibration of these two TCNs. Basalt flows that have been independently dated (e.g., $^{40}\text{Ar}/^{39}\text{Ar}$ or ^{14}C) allow ^3He and ^{36}Cl production rates to be established while the $^3\text{He}/^{36}\text{Cl}$ of lava flows allow the production rate of ^{36}Cl to be normalised.

Here we present new cosmogenic ^3He (pyroxene and olivine) and ^{36}Cl (basalt whole rock) data from 2 lava flows from Fogo (Cape Verdes, 14°N) and Stromboli (Italy, 38°N). Cosmogenic ^3He concentrations in pyroxene separates from the Fogo and Stromboli yield $8.28 \pm 0.4 \cdot 10^6$ (4.4%, n = 11) and $2.27 \pm 0.4 \cdot 10^5$ (5.0%, n = 10)

atoms/g ^3He respectively. These correspond to exposure ages of 120 ± 4 ka and 7.2 ± 0.3 ka. Preliminary ^{36}Cl data from 4 of the samples replicates to $\sim 7\%$. The Fogo lava flow will be dated by $^{40}\text{Ar}/^{39}\text{Ar}$ and will yield accurate ^3He and ^{36}Cl production rate determinations. Comparison of $^3\text{He}/^{36}\text{Cl}$ between the Fogo and Stromboli lava flows, combined with newly published $^3\text{He}/^{36}\text{Cl}$ data from Iceland (64°N , Licciardi et al., 2008; Licciardi et al., 2006) will allow a first test of whether isotope-specific scaling factors are required.

.Licciardi, J.M., Denoncourt, C.L., and Finkel, R.C., 2008, Cosmogenic ^{36}Cl production rates from Ca spallation in Iceland: *Earth Planet. Sci. Lett.*, p. In Press, Available online.

Licciardi, J.M., Kurz, M.D., and Curtice, J.M., 2006, Cosmogenic ^3He production rates from Holocene lava flows in Iceland: *Earth Planet. Sci. Lett.*, v. 246, p. 251-264.