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Determining in situ cosmogenic ^{3}He production rates using basalts from the Canary Islands

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The use of terrestrial cosmogenic nuclides (TCNs) as a tool for quantitative geomorphology has rapidly increased over the last decade. Production rates are poorly understood and are perhaps the biggest constraint on their use as absolute chronometers. The CRONUS-EU network aims to improve TCN production rates. In this particular study we are focusing on potential calibration sites on Fuerteventura in the Canary Islands (29˚N) because sets of scaling factors used for determining production rates so far diverge most prominently at low latitudes below 40˚ (Dunai, 2000) and to date most production rates are of late Pleistocene or even Holocene age making them susceptible to the influence of short-term variations in the Earth's magnetic field.

The production rate of cosmogenic ^{3}He is conventionally determined from the analysis of olivine and pyroxene phenocrysts from well-preserved flow tops of independently-dated basaltic lava flows. We have identified several suitable flows from the most recent Series IV volcanic units from the north side of Fuerteventura. ^{40}Ar/^{39}Ar incremental heating experiments of 9 flows yield eruption ages of 61-408 ka. The preservation of ropey structures on all flows suggests that they may prove to be useful for calibration for short- to mid-term production rates at low latitude, as well as allow a comparison of elemental control on cosmogenic ^{3}He production. Cosmogenic ^{3}He has been measured in olivine phenocrysts from three samples to date. The cosmogenic ^{3}He concentration is reproducible in several samples from the 61 ka flow.

However, the exposure age of the older flows appear to be significantly lower than $^{40}Ar/^{39}Ar$ ages. Further work is being done to assess the source of this discrepancy, and to determine production rates on younger flows.