minerals other than calcite, however. Assuming a Fermi-Teller ("z-law") distribution of muon captures between Ca, C and O in calcite, we derive an α-emission probability following muon capture of 0.033 ± 0.004, well within the range of existing measurements and calculations ($0.004 < P\alpha < 0.15$).

3. *^{36}Cl production from K*: So far only surface samples of K-feldspar have been measured, precluding a breakdown of total production from K (PK) into component reactions. Samples from glacial pavements in the Sierra Nevada, Scotland and Antarctica have been measured. Assuming t_{exp}=13.1 ka, samples from the Sierra Nevada give PK=1460 ± 88 atom (g K)$^{-1}$ a^{-1} at 3000 m and λ_{eff}=37.4°. Concordant results (χ^2/n=0.8, n=10 measurements) are obtained from samples at 4 sites, at elevations between 3000 and 3600 m and with chloride concentrations from 10–310 ppm. Reactions on K account for 76–99% of production in the samples. Consistency between samples with low and high Cl contents is obtained assuming a surface neutron capture rate of 2450 n g^{-1} a^{-1} at 3000 m and 37.4°, close to the scaled value of Zreda *et al.* (1991: EPSL 105: 94–109). Assuming 5% of K production at sea level is due to muon capture, these data give PK = 180 ± 11 atom (g K)$^{-1}$ a^{-1} at sea level and high latitude. Samples from pavements exposed by retreat of Loch Lomond (Y. Dryas) Stage ice (t_{exp} = 11.5 ± 0.3 ka) in Scotland give PK = 313 ± 25 atom (g K)$^{-1}$ a^{-1} at 520 m and λ =58.5°. Neutron capture corrections are 18–22% for these samples. Again assuming 5% of total K production due to muon capture, these data give PK = 189 ± 15 atom (g K)$^{-1}$a^{-1} at sea level and high latitude, in excellent agreement with results from the Sierra Nevada. Two samples of K-feldspar from the Trans-Antarctic Mountains (λ = 77.5°), apparently saturated with ^{36}Cl, give production rates of 1350 ± 50 atom (g K)$^{-1}$ a^{-1} at 2050 m and 1230 ± 40 atom (g K)$^{-1}$ a^{-1} at 2000 m, with negligible (<2%) corrections for neutron capture on ^{35}Cl. Equivalent rates at sea level, scaled as above, are PK = 239 ± 10 and 227 ± 8 atom (g K)$^{-1}$ a^{-1}. The samples have been measured repeatedly to confirm that the 25% discrepancy with the scaled values from Scotland and the Sierra Nevada is real and must be accounted for either by the scaling procedure, or secular variation in the cosmic ray flux.

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TEMPORAL VARIATIONS IN GLOBAL ATMOSPHERIC ^{14}C AND ITS PRODUCTION

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The atmospheric radiocarbon record of the past 20,000 yr is an integrated response to climatic, solar and geomagnetic forcing. The time dependencies of the forcing functions play an important role in shaping the atmospheric ^{14}C profile. Geomagnetic forcing manifests itself mainly on millennia time scales, whereas solar forcing is more restricted to decadal and century time intervals. Oceanic thermohaline circulation change (and associated climate perturbation) sufficiently large to induce atmospheric ^{14}C change operates on decadal to millennia time scales.

^{14}C age calibration is needed because conventional ^{14}C dates do not take atmospheric ^{14}C variability into account. Use of our knowledge of forcing factors in carbon reservoir models will generate "hypothetical" calibration curves, but the limitations of our knowledge, especially of solar and oce-