Scaling factors for in-situ cosmogenic production, an attempt to reach a working consensus

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The recent discussion on alternative approaches to derive scaling factors for exposure dating clarified some important issues but is also a source of confusion in the field. I will summarise what the old and new approaches have in common and what the differences are.

The new approaches share the idea of a proper treatment of atmospheric pressure. In practice this means that the assumption of a standard atmosphere should be replaced by more realistic descriptions of the actual pressure-altitude relationship. There is also a growing consensus that newly derived lower values for muogenic production should be used. Failure to incorporate these amendments may, in some places, give rise to 20-30% systematic deviations from actual ages of dated geomorphological surfaces.

Differences persist in the choice of parameters that are used to order cosmic ray flux measurements that are the basis of all currently used scaling factors. Geomagnetic latitude, inclination and cutoff rigidity, the latter either analytically or numerically derived, are used for ordering. Also the discussion on the choice of data describing the decrease of cosmic ray flux with increasing atmospheric depth is ongoing as well on how the spectral sensitivity of cosmic ray flux monitors should be incorporated into scaling factors. These contentious issues have varying effects on the results obtained with scaling factors. In the case of inclination vs. latitude the results can be different by up to ~20%. On the other hand calculated ages derived via *consequent* application of either analytically or numerically derived cutoff rigidities will differ by less than 2%.

The consequences for dating arising from the use of the different approaches will be illustrated. Possible strategies for testing present and/or future scaling factors will be briefly discussed.

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Compositional diversity in mafic Andean arc magmas generated by assimilation of amphibole- and phlogopite-bearing cumulates

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Assimilation of hydrous mineral-bearing cumulates by basaltic magma (50 % SiO_2; 6 % MgO; 0.6 % K_2O) at the Tatara-San Pedro complex (36°S, Chile; Dungan *et al.*, 2001) has imposed compositional diversity on 20-30 closely related lavas. Correlated variations in compatible *and* incompatible elements (MgO=5.4-8.9 %; Cr=20-180 ppm; Rb=8-26 ppm), and a *decrease* in $^{87}Sr/^{86}Sr$ (0.70409-0.703905) with increasing Rb, Th, and K are not due to assimilation of significantly older upper crustal lithologies, mantle heterogeneity, magma mixing, or fractional crystallization. These lavas contain xenocrystic clots of olivine and augite in which relatively coarse-grained patches of sodic plagioclase-Kspar-opx-mgt-phlog-amph fill embayments and channels within and between xenocrysts. Xenocrysts are refractory residues from partially melted xenoliths of hydrated cumulate (Costa *et al.,* 2002), wherein hornblende and phlogopite have fused and these melts have blended with the host magmas, dramatically modifiying their trace element signatures. Such cumulate lithologies, while seemingly refractory in bulk composition, are highly susceptible to grain boundary melting, disaggregation, and dispersion if incorporated in basaltic magma (Heliker, 1995). The alkali-rich, dominantly feldspsathic mineral aggregates within and among xenocrysts are products of syn-eruptive crystallization in protected pockets of melted hydrous minerals that lost most of their volatiles at low pressure.

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