Comparison of age pairs derived from cosmogenic ^{21}Ne and ^{10}Be

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Currently, the precision of absolute production rates for the cosmogenically produced noble gases ^{3}He and ^{21}Ne is under debate. Elemental production rates from modelling [1] disagree with natural sample calibrations (see [2]). Furthermore, an altitudinal dependent scaling of stable and radioactive cosmogenic nuclides has been suggested, in particular for the pair ^{3}He-^{10}Be [3, 4] measured in various minerals (garnet, zircon, apatite, kyanite). In contrast, studies of ^{3}He and ^{21}Ne in artificial quartz targets suggest no altitudinal dependent attenuation length coefficients for stable nuclides [5]. A compilation of ^{21}Ne-^{10}Be exposure ages (in quartz, >120 pairs) covering altitudes from 0-5500m (latitudes of 20 - 90º) is presented. Excluded are pairs where either the ^{21}Ne concentration was biased by nucleogenic/ trapped components, exposure histories revealed a complex exposure (using the pairs technique), or samples where not taken for dating purposes. The remaining 65 ^{21}Ne-^{10}Be pairs yield a 1:1 (1.05±0.18) age correlation with altitude and suggest that (1) absolute production rates for both nuclides match very well (2) muogenic production for noble gases is not significant on the observed ages and respective erosion rates, (3) for some settings, ^{21}Ne concentrations are difficult too acquire (young ages in old rocks), and (4) no nuclide dependent scaling procedure is observed for the ^{21}Ne-^{10}Be pair - though such an effect was only observed for ^{3}He-^{10}Be pairs of latest Pleistocene ages at high elevations [3, 4].

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Deriving and simulating the coupled biogeochemical and hydrologic processes governing Arsenic transport within evolving sedimentary basins of Southeast Asia

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Weathering of As-bearing rocks in the Himalayas has resulted in the transport of sediments down the major river systems such as the Brahmaputra, Ganges, Red, Irrawaddy, and Mekong. Groundwater in these river basins commonly has As concentrations exceeding the World Health Organization's recommended drinking water limit (10 μg/L) by more than two orders of magnitude. Understanding the reason(s) for these elevated concentrations of As within the sediments of Southeast Asia has remained a challenge, owing to the difficulty of separating mechanisms responsible for As release (e.g. As and Fe reduction) and local to region hydrology. We deciphered, using a combination of field and laboratory measurements of biogeochemical and hydrologic factors, dominant mechanisms of As release and transport within surficial soils/sediments within an As-afflicted field area of the Mekong delta. Our results illustrate that clay (0-12m deep) underlying oxbow and wetland environments are subjected to continuously reducing conditions due to ample carbon input and saturated conditions. Ensuing reductive dissolution of As-bearing Fe (hydr)oxides releases As, which then migrates to the underlying sandy aquifer (>12 m deep). Reactive transport modeling using PHREEQC and MIN3P was constrained with chemical and hydrologic field measurements, and provides a calibrated illustration of As release and transport within our field site. Our resulting simulations indicate that As release occurs within the clays underlying organic-rich, permanently inundated locations providing sufficient As to the aqueous phase for widespread contamination of the aquifer, and that release occurs for several thousand years prior to depletion of As from the solid phase.