A new look at paired-cosmogenic nuclide: paleoaltimetry, paleodepthmetry and burial ages

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Measuring multiple cosmogenic nuclides having different half-lives in the same rock sample is an approach that has a great potential. This technique is notably widely used to determine burial durations [1].

Here we explore other potentialities of paired-cosmogenic nuclide. By solving the equations driving the cosmic-ray produced nuclides in different geomorphological contexts, we show that techniques based on multiple cosmogenic nuclides have the potential to determine paleoaltitudes or paleodepths with reasonable uncertainties, over time scales ranging from thousands ($^{14}C/^{10}Be$ pair) to several million years ($^{10}Be/^{21}Ne$ pair) (Fig. 1) [1,2].

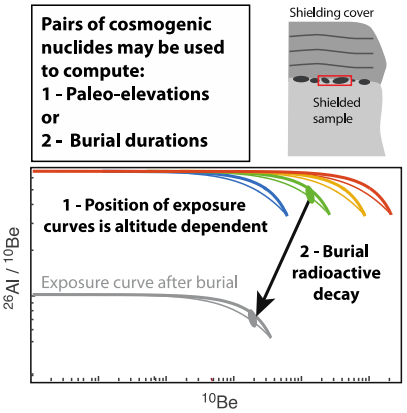

Fig. 1 - Methods based on paired cosmogenic-nuclides(^{26}Al-^{10}Be).

Case 1: Burial age is known and paleoaltitudes can be computed.

Case 2: Paleoaltitude of exposure is known and burial ages can

In the case of the commonly used application of burial duration, the altitude of exposure may have an impact on the computed ages (Fig. 1). If the prexposure duration is long (> 100 ka), or the preburial erosion is low (<1 $m.Ma^{-1}$), the preburial cosmogenic nuclides ratios does not necessarely equal the production ratio (Fig. 1). We present two Matlab codes: "Paleoaltitude.m" (Case 1, Fig. 1) permitting to compute paleoelevations, and "Burial.m" (Case 2, Fig. 1) to compute burial durations [2,3].

[1] Granger and Muzikar, 2001 – EPSL, 188, p. 269-281.

[2] Blard et al., 2019 – EPSL, in press.

[3] Blard et al., 2019 – MethodsX, in press.