Integrating geomagnetic records and cosmogenic nuclide production

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Production of cosmogenic nuclides (CNs) in geologic material is a function of the cosmic ray flux at the Earth's surface, which in turn is a function of the intensity and orientation of the Earth's geomagnetic field. Temporal variations in the intensity of the geomagnetic field and the position of the geomagnetic dipole axis (i.e. polar wander) must be considered when calculating production rates that are integrated through time. We have developed a model, based on the theoretical framework of Desilets and Zreda (2003) and a variety of geomagnetic field intensity and pole position data, that accounts for these variations in an effort to systematically determine their impact on time-integrated production of short-lived (*in situ* ^{14}C; $t_{1/2}$=5.73 ka) and long-lived (*in situ* ^{10}Be; $t_{1/2}$=1.5 Ma) CNs (Pigati and Lifton, 2004).

Our model differs significantly from previous models in that integrated production rates are normalized to the modern production rate at the geomagnetic, rather than geographic, latitude of a given site. Integrated rates that are normalized to the modern rate at a site's geomagnetic latitude explicitly account for the fact that modern production reflects the current offset between the geomagnetic and geographic poles, and that time-integrated production is affected by polar wander differently at different locations. In contrast, normalizing integrated production rates to the modern rate at a site's geographic latitude incorrectly suggests that a single correction can be applied to all sites along a given parallel.

Our modeling results show that, depending on the exposure age and location, integrated *in situ* ^{14}C production rates at sea level that account for both intensity variations and polar wander range from 27% higher to 24% lower than modern rates at the same location (modern rates are referenced to the 1945.0 Definitive Geomagnetic Reference Field). Integrated *in situ* ^{10}Be rates range from 48% higher to 26% lower than modern. Differences between integrated and modern rates for both nuclides increase significantly at higher altitudes.