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Pleistocene geomagnetic and paleoclimatic variations: methodological and fundamental links.

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Paleomagnetic and cosmogenic Beryllium geochemistry studies performed along Pleistocene sedimentary sequences provided new evidences that geomagnetic excursions and polarity reversals are intimately linked with geomagnetic dipole collapses. Weak relative paleointensities (RPI), generally accompanied by sharp directional deviations, and strong authigenic $^{10}Be/^{9}Be$ ratio are coeval all along the studied cores (Thouveny et al. 2004; Carcaillet et al. 2003, 2004a,b), respecting the theoretical relationship between cosmogenic nuclide production and geomagnetic dipole moment. Such results strengthen the accuracy of the methodological applications and fundamental implications of short paleomagnetic events. They support the use of RPI lows linked with excursions as global correlation or dating markers. For example in the Portuguese margin core MD95-2042, the RPI minimum and the ^{10}Be enhancement of the "Laschamp dipole low" are recorded 30-40 cm beneath Heinrich layer 4 i.e. they occurred prior 39.2 $\pm$ 0.33 ka BP (average age computed from 12 ^{14}C calibrated ages of HL4). The dipole moment minimum is precisely located between 40.75 and 41.5 ka BP [polynomial fit between ^{14}C ages calibrated by tuning the MD95-2042 alkenone curve with the GRIP delta^{18}O record (Bard et al. 2004)]. This refines the average age of 40.4 $\pm$ 2 ka BP computed from Ar/Ar and K/Ar ages obtained on the Laschamp and Olby lavas by Guillou et al. (2004). The dating of ^{10}Be and/or ^{36}Cl peaks, recorded in the Greenland ice cores within interstadial 10, is thus independent from ice laminae counting or ice accumulation models. Using this age for the ^{10}Be peak in the Vostok ice core will allow accurate inter-hemispheric synchronization of paleotemperatures and CO2 time series. Other low dipole field events [Blake event at $\sim$117 ka BP (end of MIS 5e), the Icelandic basin event at $\sim$190 ka BP (transition MIS7a/MIS6)...] will help correlating paleoclimatic signatures of marine or lacus-

trine sediments, loess/soil sequences, speleothems and ice cores.Such coupled studies evidence that RPI indexes and authigenic $^{10}Be/^{9}Be$ ratio both record the geomagnetic dipole lows associated with excursions and reversals. The similarity with the ocean-floor magnetization record of the S.E Pacific (Gee et al. 2000) leads to exclude the major influence of climatic biases and allows critical comparisons: geomagnetic dipole lows and excursions of the last 800 ka occurred mostly in an interglacial climatic context, while geomagnetic dipole highs occurred in a glacial context. Complex wavelet analyses of geomagnetic moment and delta ^{18}O records of the last 800 ka evidence common main periodicities in the 80-120 ka band.