Geophysical Research Abstracts
Vol. 12, EGU2010-3090, 2010
EGU General Assembly 2010

Application of the authigenic 10Be/9Be dating method to continental sediments: reconstruction of the Mio-Pleistocene sedimentary sequence in the early hominid fossiliferous areas of the northern Chad Basin.

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Concentrations of atmospheric cosmogenic nuclide 10Be measured using accelerator mass spectrometry (AMS) were normalized to the solubilised fraction of its stable isotope 9Be in the authigenic component leached from continental deposits in order to date siliceous sediments deposited since the upper Miocene in the Djurab Desert in the northern Chad Basin. The demonstrated systematic strong agreement between the biochronological estimations and the calculated authigenic 10Be/9Be ages strongly suggests not only that the initial authigenic 10Be/9Be ratio can be constrained using appropriate Holocene deposits, but also that this ratio remained relatively constant over the studied time period (i.e. $\sim$ 1 to 8 Ma). In addition, the validity of the calibration demonstrates that the sedimentary levels deposited in the Chadian Basin during wet periods accompanied by major lacustrine extension in an area otherwise characterized by a recurrent desert climate since at least 8 Ma have remained closed to gain or loss of beryllium other than by radioactive decay in spite of cycles of inundation and desiccation.
Fifty-five new or revaluated (using the new published 10Be half-life) authigenic 10Be/9Be deposition ages were obtained along twelve logs distributed out of two West-East cross sections that encompass best representative Mio-Pliocene outcrops including paleontological localities. These authigenic 10Be/9Be deposition ages show a systematic stratigraphic decrease when considering all studied sedimentary facies extending from the Pleistocene up to 8 Ma and allow performing geologic correlations otherwise impossible in the studied area. The resulting global sequence evidences and temporally specifies the succession of the main paleoenvironments that have developed in this region since the Miocene.
Under the special conditions encountered in the northern Chad Basin, this study demonstrates that the authigenic 10Be/9Be ratio may be used as a dating tool of continental sedimentary deposits from 1 to 8 Ma. The half-life of 10Be theoretically allowing dating up to 14 Ma, it may have fundamental implications on important field research such as paleoclimatology and, through the dating of fossiliferous deposits in paleontology and paleoanthropology. Similar studies conducted in different continental context may in addition provide valuable information on the influence of environmental parameters on the biogeochemical behavior of the beryllium isotopes.

Acknowledgments: This research was supported by: Chad Minist. Enseign. Sup. et Rech. (N'Djamena Univ. & CNAR); French Minist. Aff. Etrang. (Ambassade de France N'Djamena ; DCSUR, Paris) & Minist. Educ. Natl. et Rech. (CNRS, ECLIPSE, ANR, Univ. of Poitiers); NSF/RHOI. MPFT members are thanked for their supports.