



Cosmogenic nuclide dating of *Australopithecus bahrelghazali* and *Sahelanthropus tchadensis*: Plio-Miocene Hominids from Chad

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Concentrations of atmospheric cosmogenic nuclide ^{10}Be measured using accelerator mass spectrometry (AMS) were normalized to the concentrations of its stable isotope ^9Be in the authigenic component leached from continental deposits in order to quasi-continuously date siliceous sediments deposited during the lower Pliocene and the upper Miocene in the north Chad basin [1].

Firstly, the authigenic $^{10}\text{Be}/^9\text{Be}$ ages, calculated using an initial authigenic ratio deduced from Holocene diatomites deposited in environmental conditions similar to those prevailing during the deposition of the sediments of interest, obtained in or close to fossiliferous levels were compared with biochronological estimations established using the evolutive degree of fossil mammal assemblages. This is indeed the sole independent dating method available in the study area which, until now is devoid of volcanic deposits appropriate for isotopic and/or radiogenic dating methods.

The demonstrated systematic strong agreement between the biochronological estimations and the calculated authigenic $^{10}\text{Be}/^9\text{Be}$ ages strongly suggests not only that the initial authigenic $^{10}\text{Be}/^9\text{Be}$ ratio can be constrained using appropriate Holocene de-

posits, but also that this ratio remained relatively constant over the studied time period. In addition, the validity of the calibration demonstrates that the sedimentary levels deposited in the Chadian Basin during wet periods [2] accompanied by major lacustrine extension in an area otherwise characterized by a recurrent desert climate since at least 8 Ma [3] have remained closed to gain or loss of beryllium other than by radioactive decay in spite of cycles of inundation and desiccation.

Deposition ages were determined at two important hominid localities from the Chad Basin in the Djurab Desert (Northern Chad): 1) In the Koro Toro fossiliferous area, where *Australopithecus bahrelghazali* (Abel), the first australopithecine found west to the Rift Valley, was unearthed at the KT 12 locality (16°00'N, 18°53'E) [4]. 2) In the Toros Menalla fossiliferous area, where *Sahelanthropus tchadensis* (Toumaï), the oldest hominid, was discovered at the TM 266 locality (16°15'N, 17°29'E) [5].

The KT 12 authigenic $^{10}\text{Be}/^9\text{Be}$ age points to the contemporaneity of *Australopithecus bahrelghazali* (Abel) with *Australopithecus afarensis* (Lucy). The twenty-eight $^{10}\text{Be}/^9\text{Be}$ ages obtained within the Anthracotheriid Unit (A.U. [2] from TM 266 and TM 254) containing Toumaï bracket, by absolute dating, the age of *Sahelanthropus tchadensis*.

Finally, in the favorable environmental conditions encountered in the north Chad basin since 8 Ma, the use of the authigenic $^{10}\text{Be}/^9\text{Be}$ geochronometer allows reconstructing a global sequence evidencing successive paleoenvironments.

By demonstrating that authigenic $^{10}\text{Be}/^9\text{Be}$ ratio may be used, in specific environmental conditions, as a dating tool of continental sedimentary deposits over the time period 0.2-14 Ma, this study may have fundamental implications on important field research such as paleontology, human evolution and may provide cornerstones for new calibrations for the molecular clock.

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.

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