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Climate of the Past Discussions

Interactive comment on "Palynological evidence for gradual vegetation and climate changes during the "African Humid Period" termination at 13° N from a Mega-Lake Chad sedimentary sequence" *by* P. G. C. Amaral et al.

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This new pollen spectrum LT1 from a Mega-Lake Chad sedimentary sequence spanning ca. 1700 years, between ca. 6700 and 5000 cal. BP is very welcome. Indeed there is now the necessity to complete and precise the pioneer pollen spectrum done by Maley (1981, 2004, 2010) on a 7,80 m long Holocene sequence collected in Tjeri near the center of the former Mega-Lake Chad, ca. 200 km NE of the LT1 sequence.

One of the goal specified by the authors of LT1 spectrum is to study " the transition

from the *green Sahara* to the present hyperarid desert that occurred during the mid-Holocene, ca. 6000 – 5000 yr ago ". However in the northern part of Chad basin at Ounianga Kebir, Kropelin & al. (2008) showed that the ouadi stopped flowing from Tibesti at ca. 4300 cal. BP and a large increase in lake paleosalinity intervened around 4000 cal. BP when the lake shifted from fresh to hypersaline. So in Chad basin the hyperarid Saharan conditions intervened only around 4000 cal. BP and not at 5500 cal. BP. Moreover the Figure 3 with the depth-age model of core LT1 shows in the last ten centimeters a chronological hiatus between ca. 5000 and 3700 cal. BP which could tentatively correspond to the hyperarid period around 4000 cal. BP. Indeed at this date on the Tjeri sequence, the diatom curve (Servant-Vildary, 1978) exhibit a large regression of Mega-Lake Chad, synchronous to an abrupt fall of the Sahelian pollen element and also to a large diminution of Soudano-Guinean pollen element which was linked to fluvial input from the south of the basin (Maley, 1981; 2004, fig.5).

About this last point and in order to try to characterize the importance of the fluvial influx, one can refert here to the pollen analysis done on a short core, 60 centimeters long, collected in Lake Chad close to Baga-Sola (site JM3 in Figure 2) and near the " Grande Barrière ", an area covered by aquatic vegetation separating Lake Chad quite in two parts. Stratigraphical correlations with 3 other similar short cores collected near Bol, in northern part of the Archipel (close to site JMC, Latir, in Figure 2), were possible by referring to their sedimentological character, corresponding either to low, or relatively heigh lacustrine levels. The low levels were characterized either by remains of dessication cracks with fragments of burned vegetation, or calcareus crust, or level rich in organic matter – and the heigh lacustrine levels by clays. Moreover 2 radiocarbon datations on two of these low levels permitted to show that these cores covered the last millenium (Maley, 1981; 2004, fig. 8). From historical data it was deduced that Lake Chad level was particularly heigh during the first centuries of the last millenium because the account of an Arab traveller indicated that the Bahr el Ghazal, a north-eastern emissary of Lake Chad, flowed again during the 13nd century (Lange, 1980). This precision meant a level close to 286 m (see Maley, 1981, 2004, 2010), more 2 me-

ters heigher than the heighest 20nd century levels. Other historical informations, linked to several geological data indicated a short drying phase of Lake Chad in the middle of 15nd century, and another very low level in the middle of 16nd century (Maley, ibidem).

In reference to the Lake Chad hydrological equilibrium during the 20nd century, during which its feeding was due to the inflow of the Chari river for about 80% (Olivry & al., 1996)(and until 90% during the 2 last decades), one observe in the Baga-Sola core that for such inflow the pollen percentage of the Soudano-Guinean element – bring from the southern part of the Chad basin – is ca. 25%. However during the early part of the last millenium, when the lake was very heigh, the percentage of this southern element was only close to 10%. At the same time, the pollen percentage of the Sahelian element, linked to the regional vegetation around lake Chad, was 63%, but in the contemporary sample it was only 28%. So it is possible to deduce from these results that during the first centuries of the last millenium, the Lake Chad hydrological equilibrium seems to have been very different from the presentday, with a large water input coming mainly from the regional rainfalls in the Sahelian zone, and a relatively much less important river input from the Chari river, although the volume of the lake was much higher than during the 20nd century. Another parameter of the hydrological equilibrium was also probably modified in early last millenium, i.e. a lowering of the evaporation, because the yearly duration of the cloud cover could have been much longer due to a longer rainy season and with possibly another source of rainfall linked to extra-tropical depressions (Maley, 2010; Maley & Vernet, to be published). The more important regional rainfalls in the early last millenium are also indirectly confirmed by several historical data indicating the large development of the Kanem Empire, beginning in 7nd century, which ruled the region until the Bodelé in the northern " Pays-Bas du Tchad " where an Arab geographer reported their first main city, Manam (Lange, 1980). In the late 11nd cent. their main city moved south in Njimi, north of Mao. And it was only in 1470 AD, after the main drought period of middle 15nd cent., whend Lake Chad dried up, that their main city moved south of the lake, at Gasregomo in Bornou (Bivar and Shinnie, 1962).

From these pollen and other historical data one can deduce that the water input in Lake Chad, and also in the larger MegaChad, can be rather variable with different origins, either by distant riverborne or by regional rainfalls, or a combinaison of the two. Such interpretations were already put forward to interpret the pollen and diatom results from the Tjeri sequence (Maley, ibidem). It is hoping that new researchs done on longer cores taken in Lake Chad could bring new data to afford more precisions on these important questions.

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