CoForChange

The fragmentation of the African rain forests during the third millenium BP : palaeoenvironmental data and palaeoclimatic framework. Comparison with another previous event during the LGM.

Poster 1

LGM and Late Pleistocene

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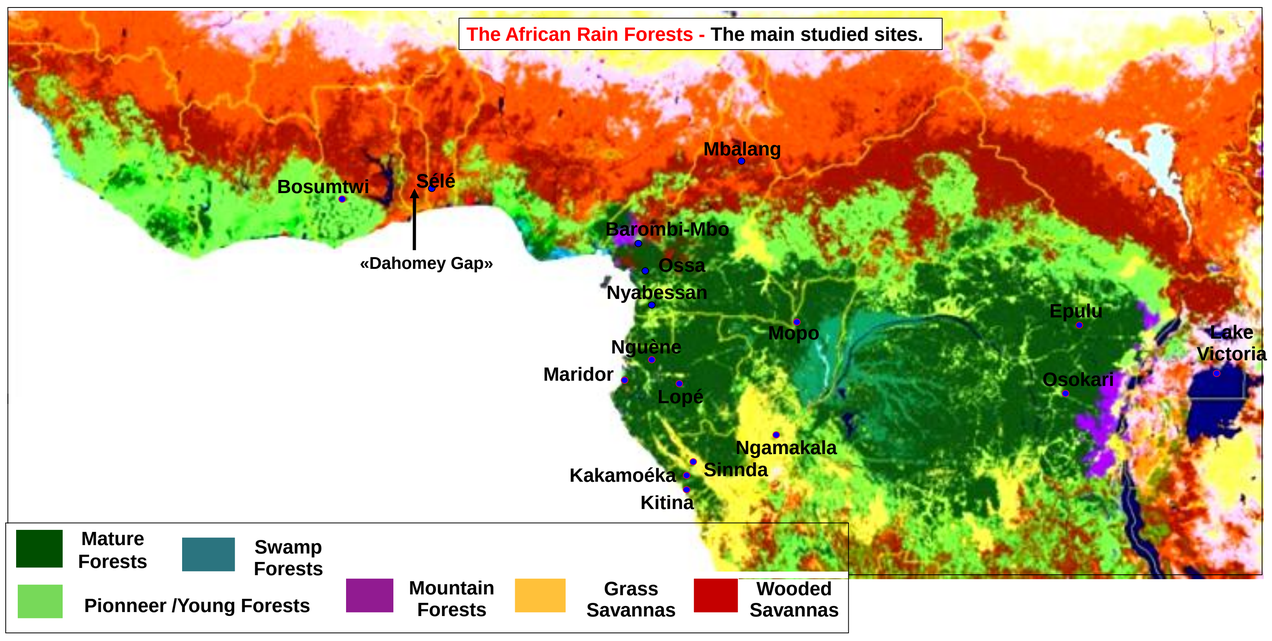
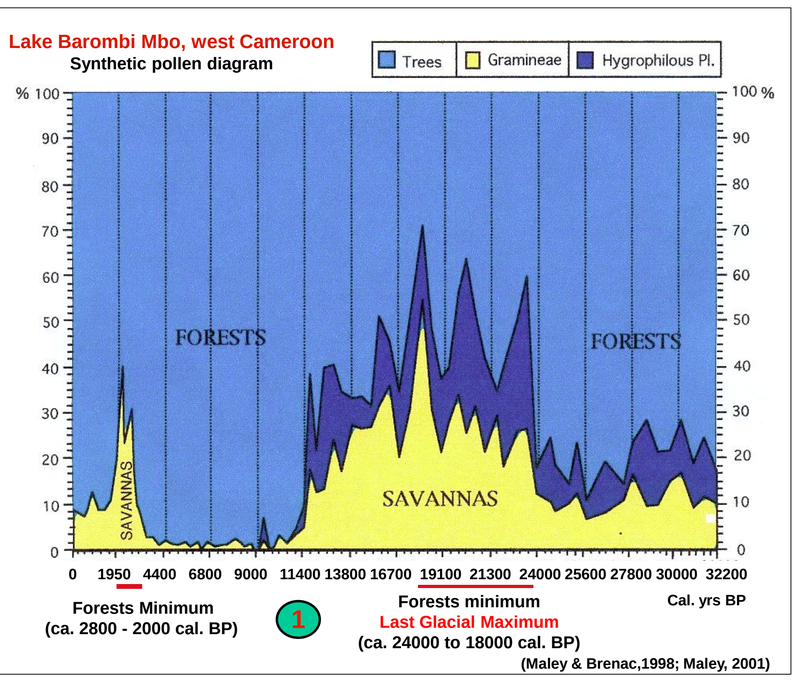
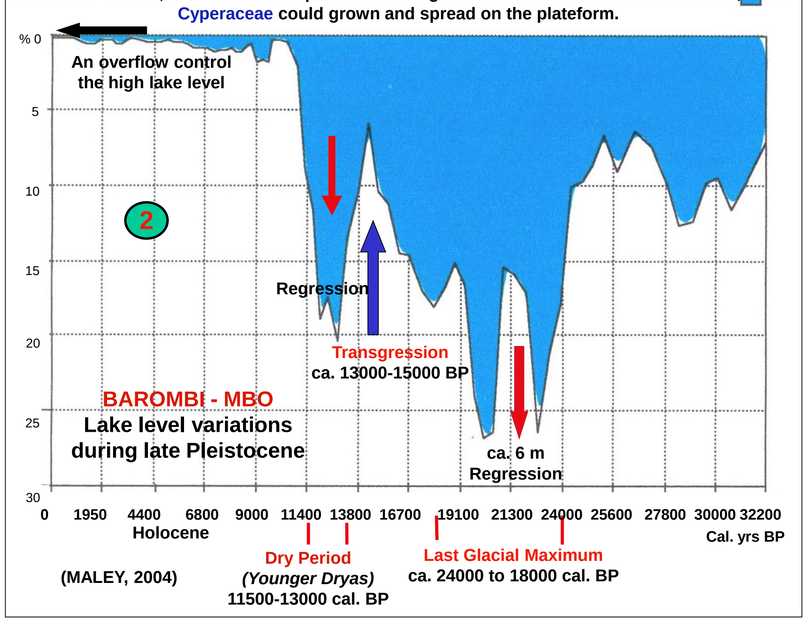
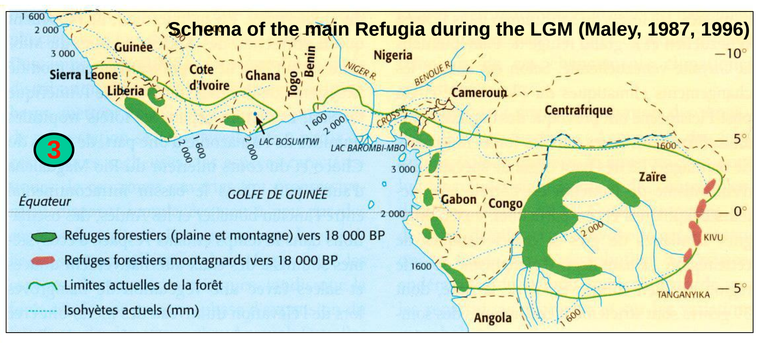
Jean MALEY (formerly DR- IRD)
Département Paléoenvironnement et Paléoclimatologie,
ISEM-UMR 5554, Université de Montpellier-2



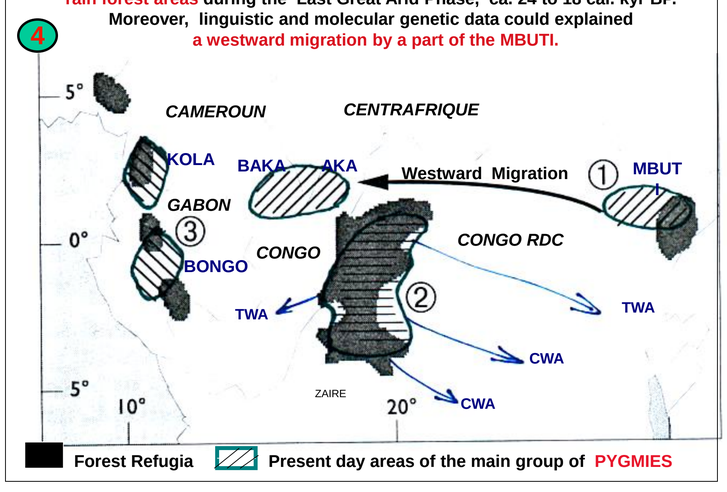


The relative variation of Cyperaceae pollen, aquatic plants, is a «proxi» data of lacustrine level variations. Indeed, more the deltaic plateform emerged when the lacustrine level lowered, more Cyperaceae could grown and spread on the plateform.





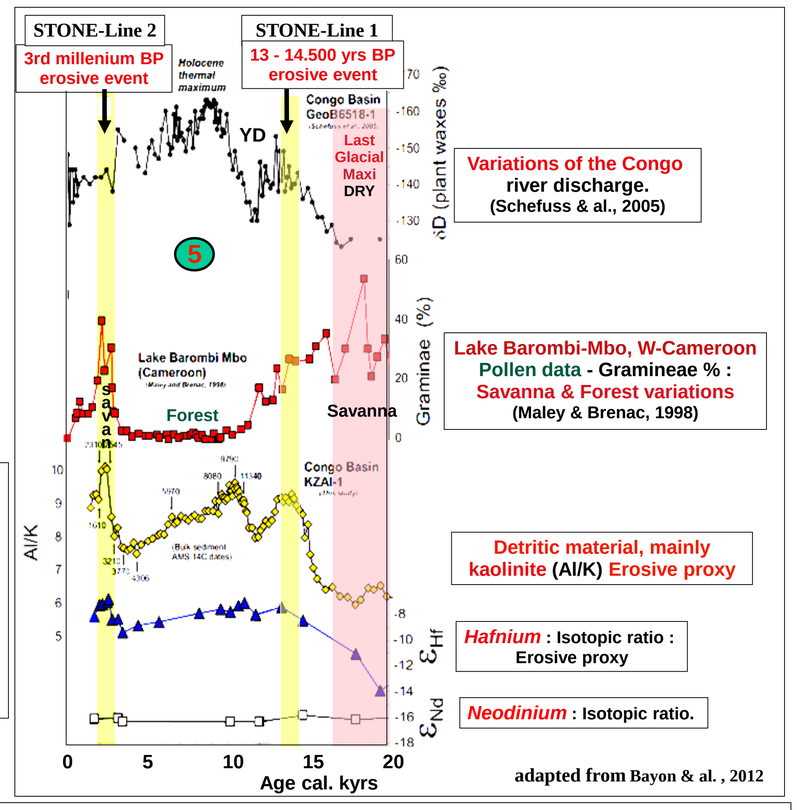
The ethnologist S. Bahuchet (1993) estimated that the present day repartition pattern of 3 main groups of Pygmies could be explained by their long stay in the relictual rain forest areas during the Last Great Arid Phase, ca. 24 to 18 cal. kyr BP. Moreover, linguistic and molecular genetic data could explained a westward migration by a part of the MBUTI.



Poster in collaboration with the European program CoForChange :
Predicting the effects of global change on forest biodiversity in the Congo Basin.
www.coforchange.eu

Core KZAI-1 collected in the Congo deep-sea fan sediments.
Two proxy data (Al/K, Hf/*isotope*) exhibit the general character and importance of detritic influx. The stability of the *Neodiinium* isotopic ration is linked to the catchment area stability during the last 20 kyr.

The general character of these variations are linked to wide climatic changes.



Many data show that a very dry phase occurred in Equatorial Africa during the **Last Glacial Maximum** (LGM) (ca. 24 to 18 cal. kyr BP): for instance low lake levels at Barombi Mbo (1, 2) & Bosumtwi and the spread of savannas near these lakes (Maley, 1996, 2001; Shanahan, 2006); dead trees dated to this period in a soil section from the eastern part of the Congo basin (Runge, 1997) (9) and minimum Congo River discharge (Schefuss, 2005) (5) .From this, a great diminution of the monsoon rains can be deduced, and it was concluded that the African rain forest became greatly fragmented at this time. The remaining forests appear to have been restricted to distinct refugia (Maley, 1987, 1996) (3, 4) However, this very dry phase was not an erosive phase because strong erosion only occurred later, as indicated by features such as the thick **"Stone-Line"** (9) which was deposited ca. 2 metres above dead trees dated to ca. 18 cal kyr BP in the eastern Congo.

Moreover an important detrital period, synchronous with a large increase of the Congo river discharge, was dated from ca. 14,5 to 13 kyrs BP in the deposits of the Congo deep-sea fan (Bayon, 2012) (5) ,so this **« Stone-Line 1 »**, the first one reported in this work (9) can very probably be dated to this period. After ca. 13 kyrs and until ca. 11 kyrs BP, the detrital sediments greatly diminushed in the Congo deep-sea fan, synchronous with lowering of the river discharge (5) ,so one can conclude that the erosion reduced greatly at this time. This reduction intervened in the same time as the cold **Younger Dryas period** (YD) in the northern Hemisphere (5, 6) . However a similar pattern is evident at lake Barombi Mbo by using the Cyperaceae pollen as proxy data for reconstructing the lacustrine variations until the beginning of Holocene (2) .In this lake wich exhibit a 110 metres maximum depth, the Cyperaceae pollen increased sharply during the LGM indicating relatively low levels of ca. 6 metres (2) .Then, between ca. 15 and 13 kyrs BP the lake transgressed strongly, quite synchronous with the Congo river flow increase and so, during the erosive phase characterized by the **« Stone-Line 1 »**. Also synchronous with the YD period, intervened a strong regression in the lake Barombi Mbo (2) .It is important to observe that the intermediary warming phase, i.e. the Bölling-Allerod, corresponded to the main erosive phase linked to the **« Stone-Line 1 »**. Moreover the SST variations in the Gulf of Guinea (Weldeab, 2007) (6) exhibit similar trends : low SST during the LGM, a strong increase during the **Bölling-Allerod** period, and a marked lowering during the YD period.

Two profiles, one in Mayombe close to the Guinea Gulf (8) ,and another in the eastern part of Congo Basin (9) ,**contain similar and contemporary units** showing that these two erosive phases are linked to large climatic changes. Data obtained for the Holocene in the lake Victoria (Stager, 1997)**(Poster 2, n° 10)** enlarge this conclusion and link the phenomena **to major variations in the African monsoon**. To better understand monsoon dynamics during these diverse phases, one can observe that **the Fragmentation 1, without erosion, was linked to a lowering of SSTs in the Guinea Gulf** (6) **and the Fragmentation 2, associated with erosion (« Stone-Line 2 »)** (7, 8) **,occurred during a period of abrupt increasing SSTs** (6) .These SST variations could have induced **changes in the structure of the monsoon**

- **Firstly**, **more stratiform types of cloud could have been more common during Fragmentation 1,** and also during the following phase of evergreen rain forest taxa development,
-**and second, more cumuliform types of cloud could have developed during Fragmentation 2**, linked probably to a seasonal increase of precipitation.

These hypothetical changes in the monsoon **may also applied to the late Pleistocene phases** described above, which were also linked to SST variations, particularly **with an important decrease of SSTs during the LGM, for the period of the main Forest Refugia (Fragmentation 1) and then increase of SSTs for the period of the « Stone-Line 1 ».** (6)

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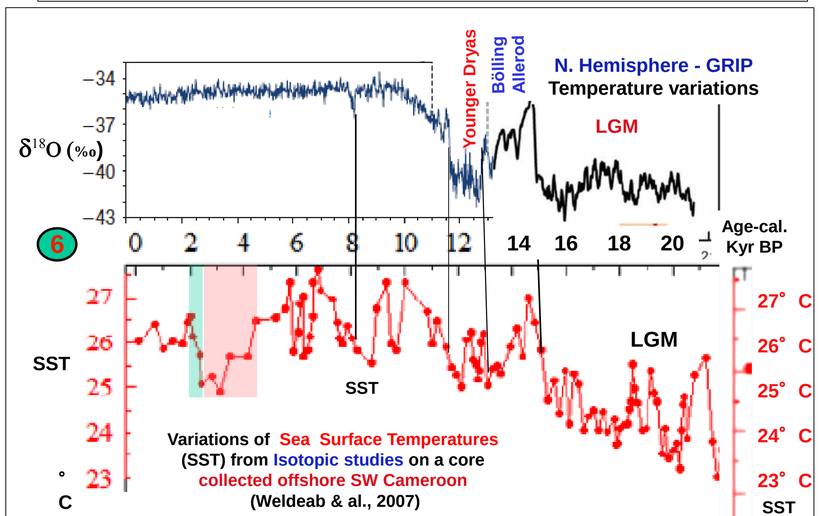


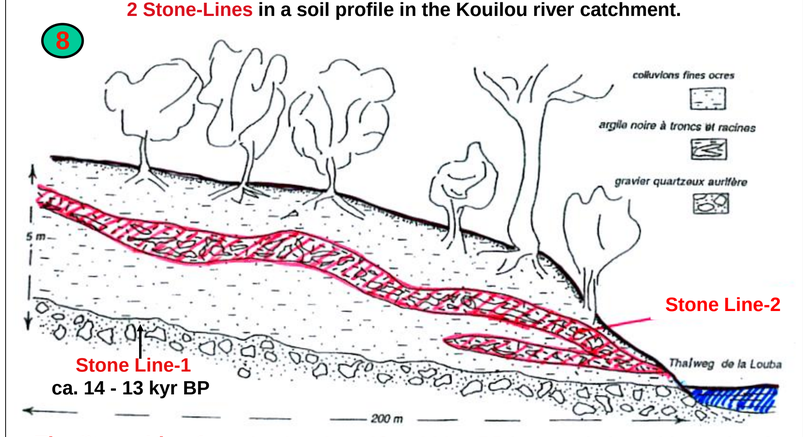
One Stone-Line at the bottom of a soil profile. La Lopé, central Gabon

7

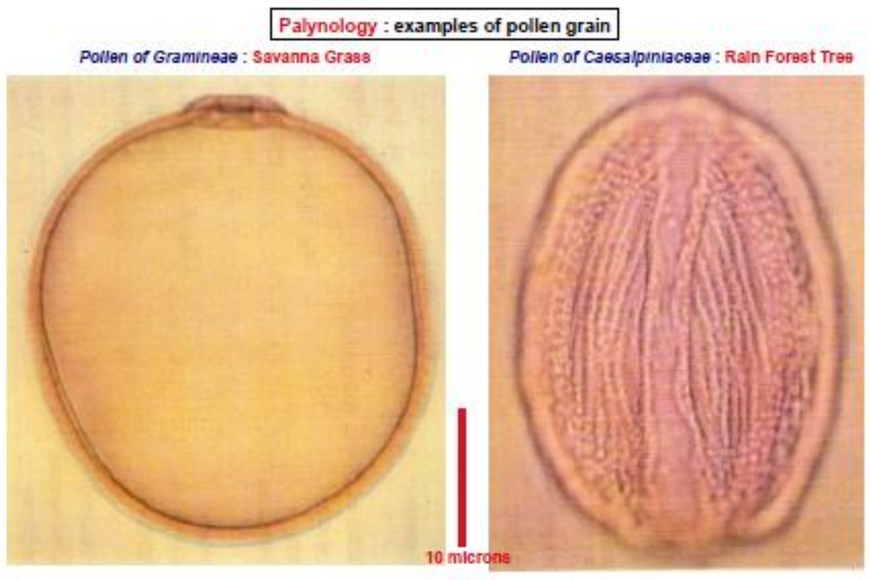
Examples of erosion in Gabon : Stone-Lines in soil profiles

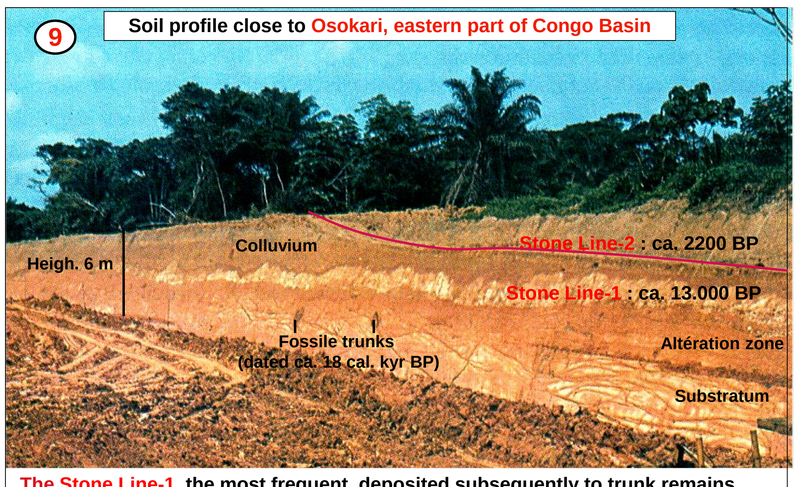
2 Stones-Lines in a soil profile.
- one in the middle,
- one at the bottom.
Ndjolé, Gabon

Kakamoéka - Forest of Mayombe (West Congo).
2 Stone-Lines in a soil profile in the Kouilou river catchment.



The Stone-Line 1 can be dated ca. 13 to 14 kyr BP by correlation with erosive data from the core KZAI-1 collected in the Congo deep-sea fan sediments.
The Stone-Line-2, made of pieces of broken tree (boles, branches) in a silty-clay sediment, resulted from a catastrophic gullying phase which pulled down a pre-existing forest - following intense and stormy rains. A piece of wood was dated to ca. 2700 years BP, thus corresponding to a tree growing there before this erosive phase, which so occurred later, and probably after ca. 2500 BP. (Maley & Giresse, 1998)





The Stone Line-1, the most frequent, deposited subsequently to trunk remains dated of ca. 18.000 cal. BP - the main dry phase of Late Pleistocene - must be dated to ca. 13.000 - 14000 BP by refering to a strong increase of detritic sediments in the Congo deep-sea fan. The upper part of the soil was eroded by the Stone Line-2 dated ca. 2200 BP on included charcoals. *(adapted from J. Rünge, 1997)*