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## **MILLET CULTIVATION HISTORY IN THE ALPS DURING THE LAST 6000 YRS AS REVEALED BY A SEDIMENTARY BIOMARKER.**

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Lacustrine sedimentary archives provide clue information on past Human-climate-environment interactions in order to predict the future responses of societies and ecosystems to global climate change. Within a multidisciplinary project aiming at documenting these interactions during the Holocene in the French Alps, we have examined by gas chromatography-mass spectrometry the lipid content of a sedimentary series covering the last 6 ka, drilled in Lake le Bourget (core LDB04, Fig. 1A).

Miliacin (Fig. 1B), a pentacyclic triterpene methyl ether (PTME) originating from gramineae (Jacob et al., 2005), was found in significant amounts in some levels, whereas no other PTME was detected. Due to the resistance of PTME to diagenesis (Jacob et al., 2005), miliacin was most probably the only PTME produced in the watershed.

The list of gramineae reputed to exclusively synthesize miliacin as a PTME was confronted to an archaeobotanical survey realised on the Grésine site (Fig. 1A), dated back to the Bronze Age. This inventory gave a comprehensive panorama of the vegetation assemblage in the region for this period (Bouby and Billaud, 2001). Since *Panicum miliaceum* (common millet) is the only miliacin-exclusive producer reported, we conclude that miliacin attests to its presence in the catchment. This is further supported by the first occurrence of miliacin in the record at ca. 1500 BC that matches the known introduction of millet in the region (Marinval, 1995).

The comparison of miliacin relative abundances with local hydrology (Fig. 1C and D) emphasizes the interactions between climate and agriculture. For example, the lower values of

miliacin relative abundances during the La Tène period are related to the hydrological crisis that forced the abandonment of lake-dwelling habitats (Magny, 2004). The final decrease and disappearance of miliacin in more recent samples can be either attributed to hydrological changes or to the replacement of millet by other crops.

These results provide the first continuous record of agricultural activities from a sedimentary archive in the French Alps. The refinement of the temporal resolution is in progress and this approach will be extended to other sites. As a matter of fact, other PTME are produced by economically important cereals such as rice (Jacob et al., 2005). Applying this method worldwide will give invaluable insight on the coupled dynamics of agriculture, climate and environment through time.

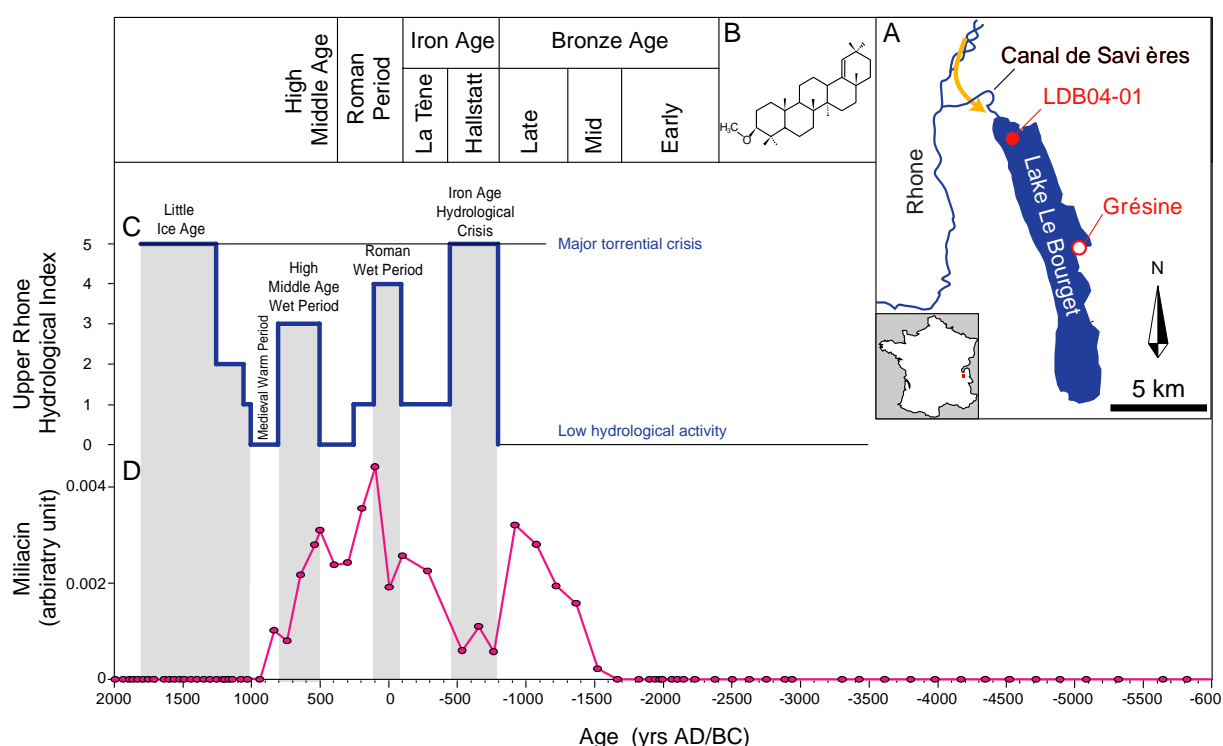


Figure 1: A- Location of Lake le Bourget, the coring site and the Grésine archaeological site; B- Structure of miliacin (olean-18-en-3 $\beta$ -ol methyl ether); C- Evolution of the Upper Rhone Hydrological Index (Arnaud et al., 2005); D- Evolution of miliacin relative abundance.

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