

## Spatial variability of compound-specific $\delta D$ at the field scale: A case study from miliacin in broomcorn millet (*Panicum miliaceum*).

Nicolas Bossard, Jérémy Jacob, Claude Le Milbeau, Rachel Boscardin, Elisabeth Lallier-Vergès, Valery T. Terwilliger

### ► To cite this version:

Nicolas Bossard, Jérémy Jacob, Claude Le Milbeau, Rachel Boscardin, Elisabeth Lallier-Vergès, et al.. Spatial variability of compound-specific  $\delta D$  at the field scale: A case study from miliacin in broomcorn millet (*Panicum miliaceum*).. The 25th International Meeting on Organic Geochemistry, Sep 2011, Interlaken, Switzerland. 2p. insu-00843188

HAL Id: insu-00843188

<https://hal-insu.archives-ouvertes.fr/insu-00843188>

Submitted on 10 Jul 2013

**HAL** is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L'archive ouverte pluridisciplinaire **HAL**, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d'enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.

## *IMOG Abstract Template*

<b>Title only</b> (not Authors & Affiliations)	<b>Spatial variability of compound-specific <math>\delta D</math> at the field scale: A case study from miliacin in broomcorn millet (<i>Panicum miliaceum</i>).</b>

Nicolas Bossard, Jérémy Jacob, Claude LeMilbeau, Rachel Boscardin, Elisabeth Lallier-Vergès, Valery J. Terwilliger

*Institut des Sciences de la Terre d'Orléans (ISTO), Université d'Orléans, UMR6113 du CNRS/INSU, Orléans, France (corresponding author:jeremy.jacob@univ-orleans.fr)*

The hydrogen isotopic composition ( $\delta D$ ) of individual compounds preserved in lake sediments has been proposed as a proxy of the hydrological conditions that prevailed at time of their synthesis. Numerous parameters are susceptible of influencing this parameter, the first of them being the  $\delta D$  of environmental waters. Then, the combination of environmental (aridity, soil properties...) and biological parameters alter the  $\delta D$  of leaf water that is finally used for the biosynthesis of organic molecules that fractionate hydrogen isotopes through enzymatic reactions. Lake sediments accumulate organic matter produced at catchment scale, thus produced by various organisms developed on soils of potentially different properties. The spatial variability of  $\delta D$  in plants at a catchment scale is rarely taken into account (Hou et al., 2007), although it might represent a serious source of uncertainty on the paleoclimatic interpretation of sedimentary lipids  $\delta D$ .

In order to assess the confidence level in the  $\delta D$  of sedimentary lipids, we have measured the  $\delta D$  of miliacin (olean-18-en-3 $\beta$ ol ME), a biomarker specific of broomcorn millet (*Panicum miliaceum* L.; Jacob et al., 2008). Miliacin was extracted from the seeds of millet plants collected from 26 sites (3 replicates per site) randomly distributed in a field that shows a strong heterogeneity in soil physical and chemical properties in Mézières-lez-Cléry (Loiret, France; Figure 1). After extraction and purification, miliacin was quantified and its purity assessed by GC-MS. Miliacin was then co-injected with a series of n-alkanes of known  $\delta D$  (Arndt Schiemelmann, Indiana University) on a TraceGC chromatograph coupled to a DeltaV Advantage irMS through an Isolink interface and a Conflo IV system. Precision for n-alkanes was around 3 ‰ and accuracy of miliacin  $\delta D$  was better than 6 ‰. Reproducibility for triplicates plants at a single site was 6.88 ‰.

Miliacin  $\delta D$  values range from -90 to -140‰ V-SMOW. The distribution of  $\delta D$  values respects a gaussian law ( $p > 0.95$ ) with an average of -121.3 $\pm$ 9.1‰ V-SMOW, i.e. close to values reported for other pentacyclic triterpenes (Sessions et al., 2006).

A 50 ‰ range in compound-specific  $\delta D$  values is interpreted as a radical change of environmental conditions (i.e. savannah to tropical forest) when found in sedimentary archives (Jacob et al., 2007). However, the propagation

of this uncertainty from spatially distributed biological sources towards sedimentary archives through soils remains to be estimated.

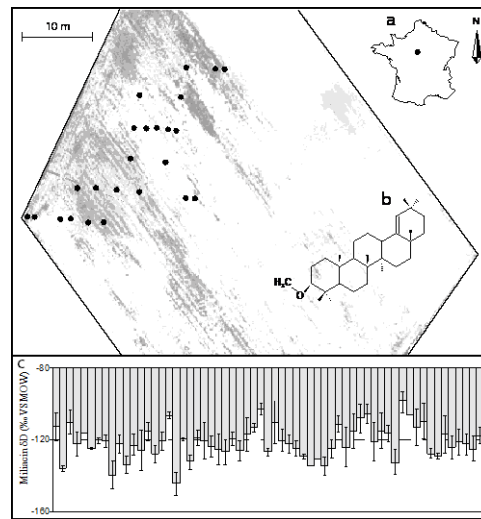


Figure 1: (a) Location of *P. miliaceum* field, heterogeneity of soil properties on aerial picture (grey scale) and location of samples; (b) Structure of miliacin (c) Distribution of miliacin  $\delta D$  values per plant.

## References

- Jacob, J., Disnar, J.R., Arnaud, F., Chapron, E., Debret, M., Lallier-Vergès, E., Desmet, M., Revel-Rolland, M. 2008. *Journal of Archaeological Science* 35, 814-820.
- Sessions, A.L., 2006. *Geochimica et Cosmochimica Acta* 70, 2153–2162.
- Jacob, J., Huang, Y., Disnar, J.R., Sifeddine, Boussafir, M., A., Albuquerque, A.L.S., Turcq, B., 2007. *Quaternary Science Reviews* 26, 1004-1015.
- Hou, J., D'Andrea W., MacDonald D., Huang Y., 2007. *Organic Geochemistry* 38, 977-984.