Past fire reconstructions in ice core through the determination of specific molecular markers

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The reconstruction of the chemical composition of aerosol during the past is important for understanding the organic component contribution of biomass burning emissions to the atmosphere and complements existing data on the signatures of direct organic emissions from biomass sources. Compounds from biomass burning include monosaccharide anhydrides (MAs), and the most important tracer compound among them is levoglucosan. This is a specific molecular tracer utilized for the assessment of particulate matter composition from biomass burning in the atmosphere because it cannot be generated by non-combustive processes or by non-wood combustion. Molecular markers such as levoglucosan are important tools in tracking the transport of particles produced by biomass burning.

In order to the current concentrations of levoglucosan in the atmosphere in prespective, it is important to quantify the fluxes of this compound during the past by examining environmental archives such as snow and ice cores. Polar ice core studies have extensively documented large changes in the content of aerosol constituents such as ionic species, dust, trace elements, and organic compounds during the late Quaternary period.

The study of past fire activity using ice core records opens regions of the world where no paleofire data previously exited. Polar and low-latitude, high-altitude ice cores provide data for regions which are not represented in the global charcoal database. The available temporal resolution matches that of the ice core, with the longest temporal resolution being that of the EPICA Dome C ice core that extends back approximately eight glacial cycles. The spatial resolution of chemical markers in ice cores depends on the location of the core itself. Low-latitude ice cores primarily reflect regional climate parameters, while polar ice cores reflect a global signal. Here, we present levoglucosan flux measured across the past 600,000 years in the EPICA Dome C ice core (75°06'S, 123°21'E, 3233 masl) ice core, during the past 4000 years in the Kilimanjaro (3°04.6'S; 37°21.2'E, 5893 masl) ice core, and the applicability for determining levoglucosan in the NEEM, Greenland (77°27' N; 51°3'W, 2454 masl) ice core.

Short term environmental reconstruction from rich CO_2-spring deposits (Massif Central, France)

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Our work focuses on the understanding of the hydrogeochemical processes related to carbo-gaseous springs relation with recent environmental changes (0-20 yr), including evolution of recharge areas and fluxes for surrounding aquifers. A 80-cm sequence has been cored from carbonated travertines in order to document recent environmental fluctuations (0-20 yr) and the related geochemical parameters that control isotopic signatures of modern carbonate deposits [1]. The core was drilled on a flat zone approximately located 200-m under the emerging spring in the Limagne Plain (French Massif Central). Sediments consist of indurated carbonate, ideal for the reconstruction of hydrological fluctuations at very high resolution as they are fine, laminated deposits. Samples were taken every 1 to 2 cm according to the induration degree of the core.

The chronology of these finely laminated deposits has been determined through $^{210}Pb/^{226}Ra$ radiometric method [2,3]. Deposits accumulation rate is of 5.5 cm/yr excepted for events at 30 cm and 60 cm depth that display gaps of carbonates accumulation. Those events correlate precisely with two historical main heat waves, 2003 and 1998 [4], that confirms the indirect records of both the recharge decrease and the drying-up of the springs.

While solid carbonates precipitating along the surface flowpath originate from water with a nearly constant ^{18}O composition, highlighting the inertia of the system that gives rise to the springs, the ^{13}C signatures of those carbonates have likely registered past meteorological conditions [4]. Moreover, this environmental record offers a significant correlation between ^{13}C signal and the East Atlantic Pattern of the North Atlantic Oscillation. Higher mean temperatures can be identified by an enriched ^{13}C content, because of prominent fractionating geochemical processes involved, such as degassing and carbonate precipitation.

[1] Assayag *et al*. (2009) *Energy Procedia*, 2361–2366. [2] Condomines & Rihs (2006) *EPSL* **250**, 4-10. [3] Condomines *et al*. (1999) *CRAS Serie II*-A **328**-1, 23-28. [4] METEO FRANCE Data.