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# Pyrogenic carbon quantification from lacustrine, oceanic, and glacier records.

**F. Thevenon** (1,2), F. S. Anselmetti (1), S. Bernasconi (1), D. Williamson (2), M. Sigl (3) and M. Schwikowski (3)

(1) ETH Zurich, Department of Earth Sciences, Switzerland (Florian.Thevenon@yahoo.fr), (2) CEREGE/CNRS Université Aix-Marseille 3, Aix-en-Provence, France, (3) PSI Villigen, Department of Analytical chemistry, Switzerland

The determination of combustion-derived products in natural archives is a key issue for reconstructing major changes in biomass burning and aerosol fallout through time, and to further improve quantification and understanding of global carbon budgets. New methods have been developed, calibrated, and applied to paleoclimate archives, in order to reconstruct 1) natural and human-induced biomass burning activity, 2) relationships between human activities, climate, vegetation, and fire, 3) fossil-fuel combustion impact on the environment, 4) spatial- and temporal-scale pyrogenic carbon influxes in a variety of depositional environments (oceanic, lacustrine, and ice-core).

For this purpose, black particles have been counted by automated image analysis (pixel resolution of 0.2 $\mu$m), while carbon remaining after oxidative(s) treatment(s) has been quantified as elemental carbon (quantification limit $<$0.5 $\mu$g of C).

All the study sites show that the pyrogenic carbon emissions were especially sensitive to the coupling between climate and anthropogenic changes. This is especially shown from (1) the increases in pyrogenic carbon influx around 53-43 and 12-10 ka BP in the Indo-Pacific region, (2) the striking synchronicity between Late Holocene to Anthropocene charcoal peaks, climate change and major settlement or societal changes in Central Switzerland, (3) the changes in fire regimes as associated to both drier conditions and settlement of Iron-Age cultivators in southern Tanzania, and (4) aerosol emissions from fossil-fuel combustion in Central Europe since the eighteen century.

Theses results highlight the necessity to build data sets using calibrated analytical techniques that can improve the quantification of the pyrogenic carbon cycle and the

understanding of biomass burning impact on the environment (e.g. vegetation, soils), by considering the sources, the transport mechanisms, and the impact of human activities.