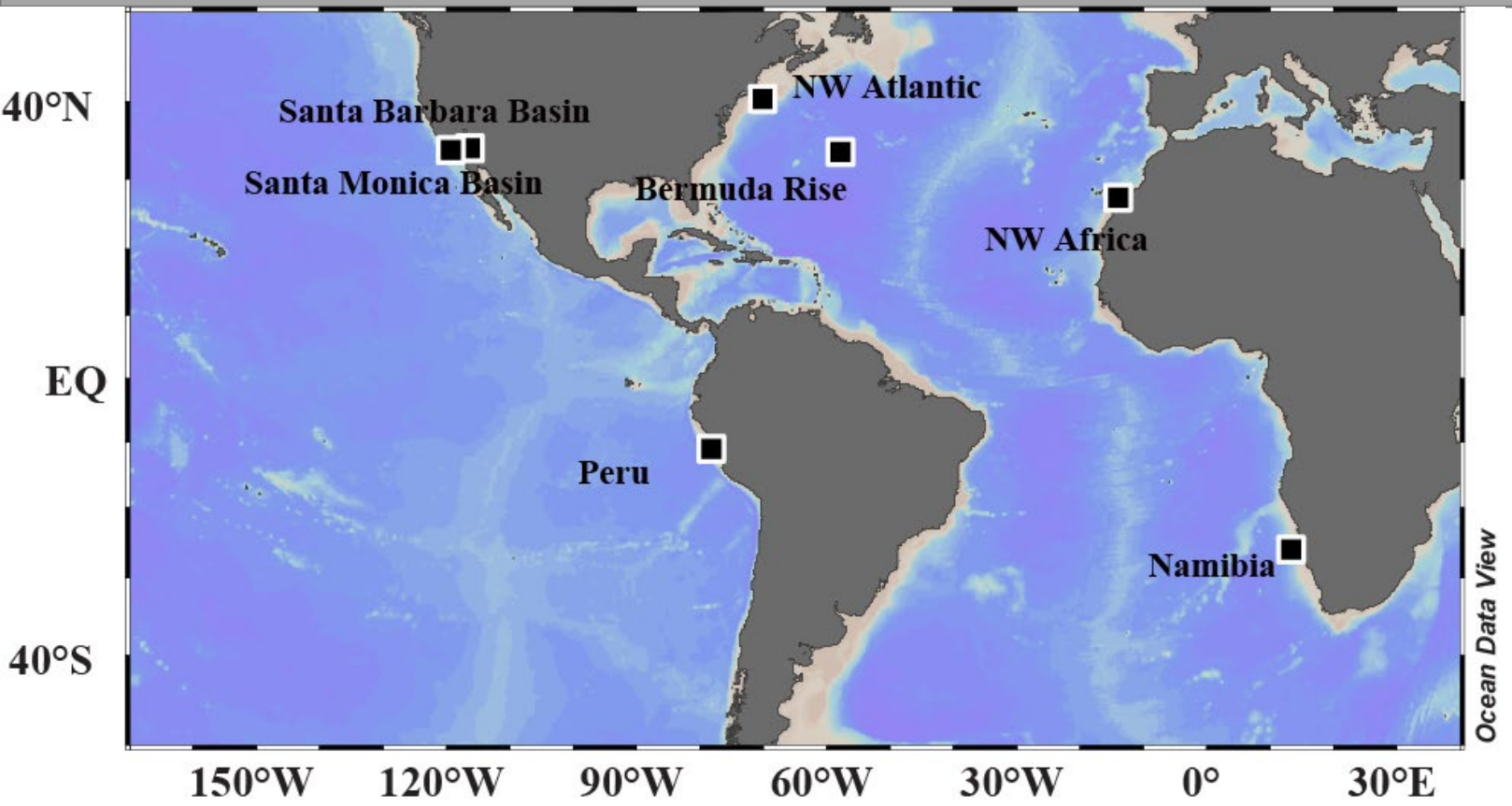
Pervasive influence of fine silt sediments on the radiocarbon age of bulk sedimentary OC, alkenones and GDGTs via hydrodynamic mineral sorting processes in continental margins

Blanca Ausín[1,2], Elena Bruni[1], Negar Haghipour[1,3], Caroline Welte[1,3], Hannah Geis[1], Stefano M. Bernasconi[1], Timothy I. Eglinton[1]
[1]Geological Institute, ETH Zürich, [2]Geological Department, Salamanca University, [3]Laboratory of Ion Beam Physics, ETH Zürich

Corresponding author: ausin@usal.es



Organic matter (OM) association with mineral surfaces is the main control of organic carbon (OC) preservation in marine sediment.

Considering that mineral particles might behave in a cohesive or in a sortable manner depending on their size, we aim to:

1) assess whether OC and two organic biomarker based paleothermometers (i.e., alkenones and GDGTs) preferentially associate with specific mineral grain-size fractions and thus,

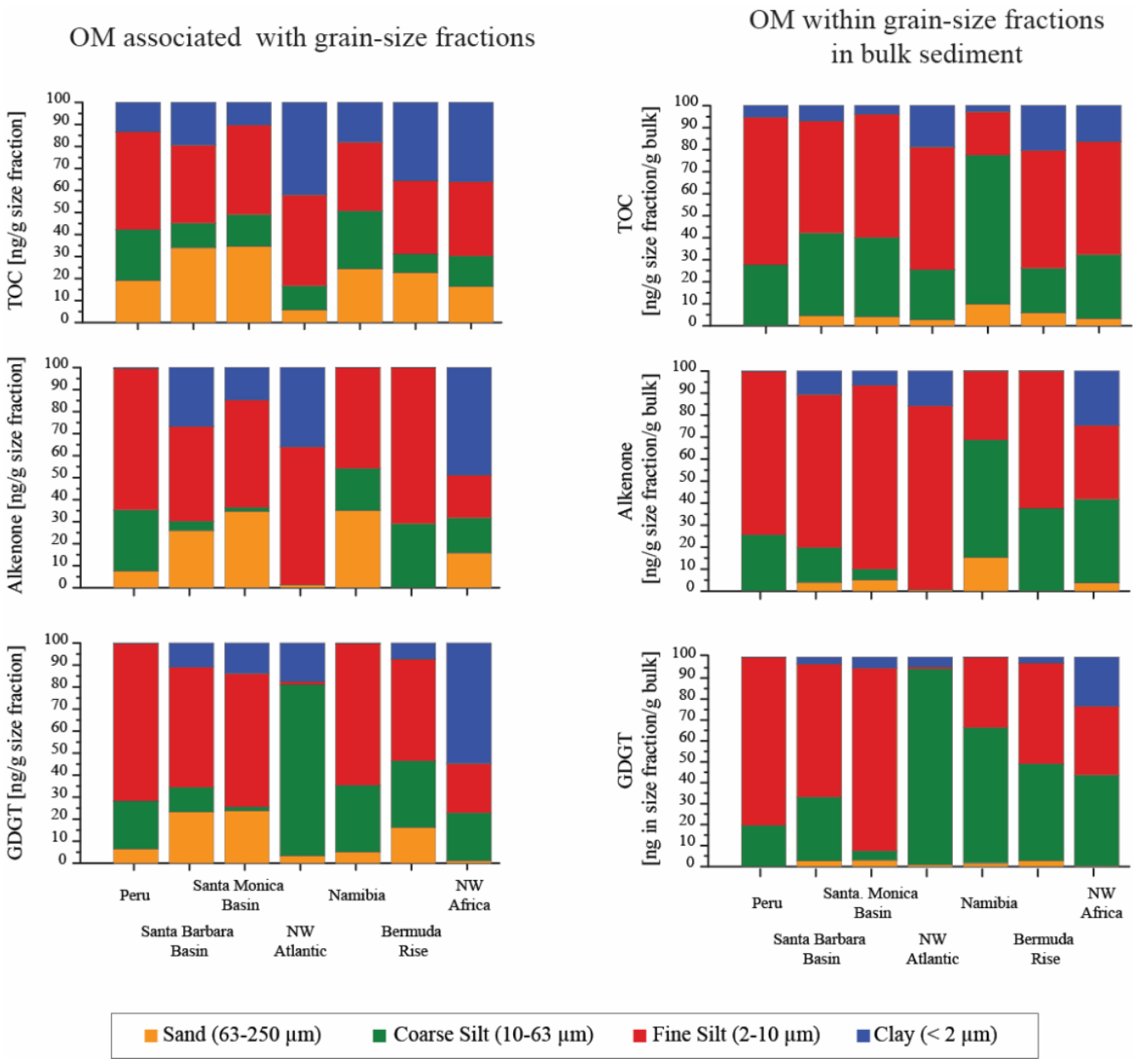
2) evaluate whether the governing hydrodynamic conditions may determine their transport pathways and influence the recorded proxy-signal

OM-Grain-size mineral associations

OC and biomarker preferentially concentrate in fine grain minerals (<10 µm), especially within FS (left pannel).

Given > 80 % of the sediment mass is comprised by CS and FS, OC and biomarkers associated with these two fractions, especially FS, have a large impact on proxy-signals derived from bulk sediment.

As OC and biomarkers are expected to respond to the hydrodynamic properties of their mineral hosts, hydrodynamically-driven sorting processes may affect the fate and signatures of OC, alkenones and GDGTs in bulk sediments.

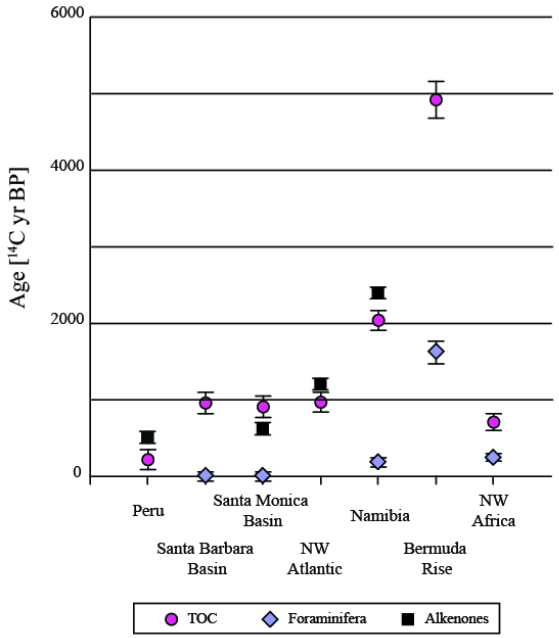


Specific compound radiocarbon ages from bulk sediments

OC and alkenone from bulk sediments are always younger than co-eval planktonic foraminifera

This suggests input of allochthonous material via lateral advection

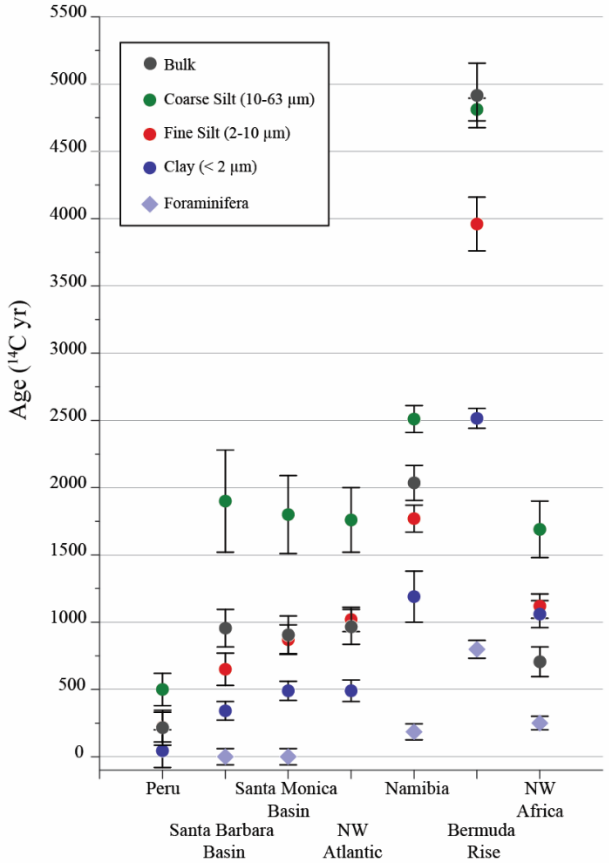
Definitive evidence for this hypothesis requires in-depth investigations at the mineral grain-size level in order to attribute effects to hydrodynamic sorting.

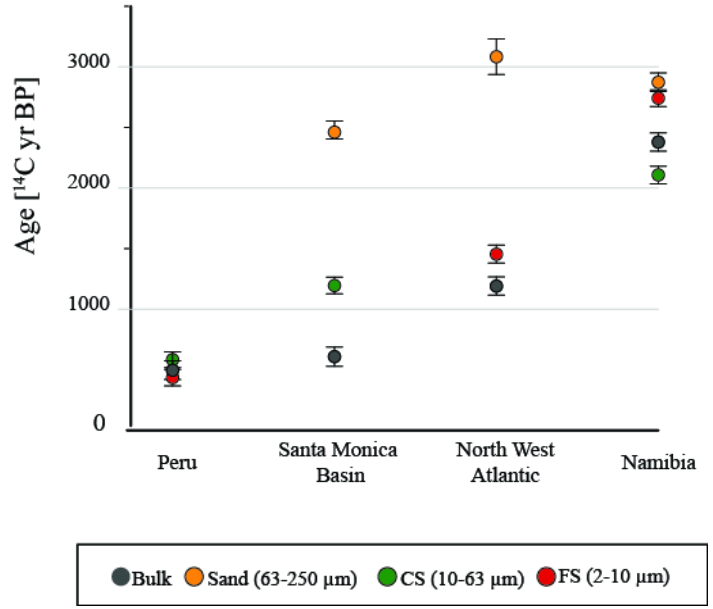


Specific compound radiocarbon ages from grain-size sediment fractions

The OC hosted in Clay is the youngest, followed by FS and CS, in that order (lower panel).

This pattern is attributed to the effect of hydrodynamics as, unlike clay, FS and CS exhibit low cohesiveness and are more prone to mobilization.





Despite a more limited data set, a similar age-grain size relationship is observed for alkenones, being sand the oldest fraction (upper panel).

GDGT-^{14}C ages from bulk sediment and corresponding grain-size fractions are ongoing work.

CONCLUSIONS AND ONGOING WORK

- OC, alkenones, and GDGTs preferentially associate with fine silt sediments, which are highly susceptible to hydrodynamic sorting.
- Organo-mineral interactions exert a dual influence on sedimentary OC, with respect to both OM protection and its propensity for mobilization and redistribution.
- Specific compound ^{14}C dating from grain-size sediment fractions demonstrates hydrodynamically-driven processes exert a pervasive influence on the content and age of OC and specific organic biomarkers of continental margin sediments
- Given its propensity to resuspension and advection under strong currents, advected OC, alkenones and GDGTs associated with fine silt minerals may distort primary signals originating from overlying surface waters preserved within continental margin sediments.
- Ongoing work is focused on the assessment of organo-mineral interactions and hydrodynamic sorting processes on alkenone and GDGT-derived sea surface temperature from continental margin sediments

Acknowledgements
This study was supported by the project 200021_175823 funded by Swiss National Science Foundation granted to B.A. and T.I.E