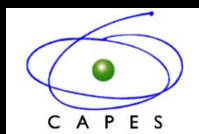


DISTRIBUCIÓN EN ESPACIO Y TIEMPO DE LOS ISÓTOPOS DE HIERRO EN EL MATERIAL EN SUSPENSIÓN DEL RÍO AMAZONAS Y SUS PRINCIPALES AFLUENTES

DISTRIBUTION IN SPACE AND TIME OF IRON ISOTOPES IN PARTICULATE MATTER FROM THE AMAZON RIVER AND ITS MAIN TRIBUTARIES

RÉPARTITION DANS L'ESPACE ET LE TEMPS DES ISOTOPES DE FER DANS LA FRACTION PARTICULAIRE DU FLEUVE AMAZONE ET SES PRINCIPAUX AFFUENTS

*Giana Márcia dos Santos Pinheiro; Franck Poitrasson; Francis Sondag;
Lucieth Cruz Vieira; Jean-Michel Martinez; Márcio Martins Pimentel*

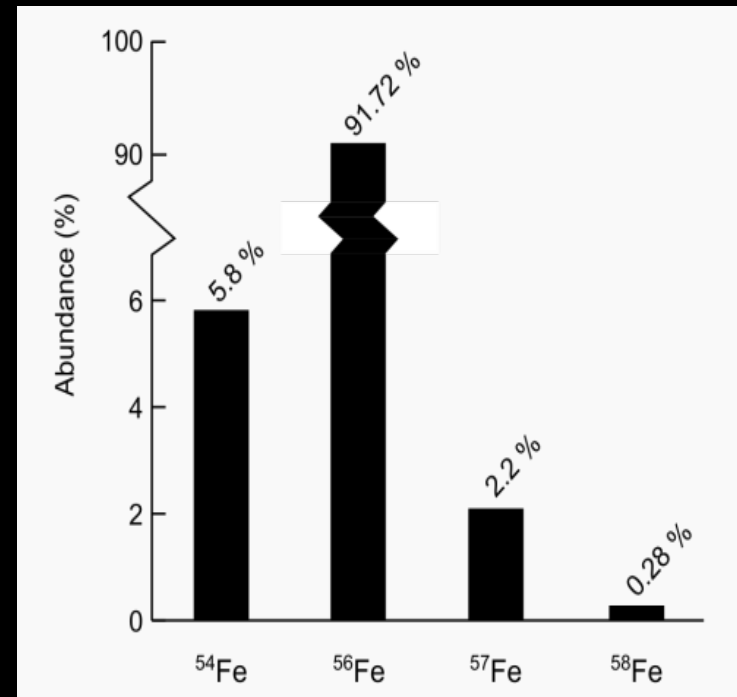


OBJECTIVES

- ✓ Study potential variations of iron isotopes in the Amazon River and its tributaries, relative to various parameters, such as:
 - different locations;
 - different climates / periods of hydrological cycle;
 - different levels of water column (depth profiles);
 - different types of water (white, black, clear).
- ✓ Compare results to river systems located in different areas of the world, both boreal and intertropical

IRON


- ^{54}Fe : 5.80%
- ^{56}Fe : 91.72%
- ^{57}Fe : 2.20%
- ^{58}Fe : 0.28%



$$\delta^{57}\text{Fe}(\text{‰}) = \left(\frac{{}^{57}\text{Fe}/{}^{54}\text{Fe}_{\text{ech.}}}{{}^{57}\text{Fe}/{}^{54}\text{Fe}_{\text{IRMM-14}}} - 1 \right) \times 1000$$

IRON ISOTOPES

- ✓ Sensitive to redox states
- ✓ Tracers of different sources
- ✧ Rivers (tributaries, soils, vegetation)
- ✧ Oceans (from rivers, aerosols, fluids of sediments' pores)



SAMPLING & METHODS

SAMPLING



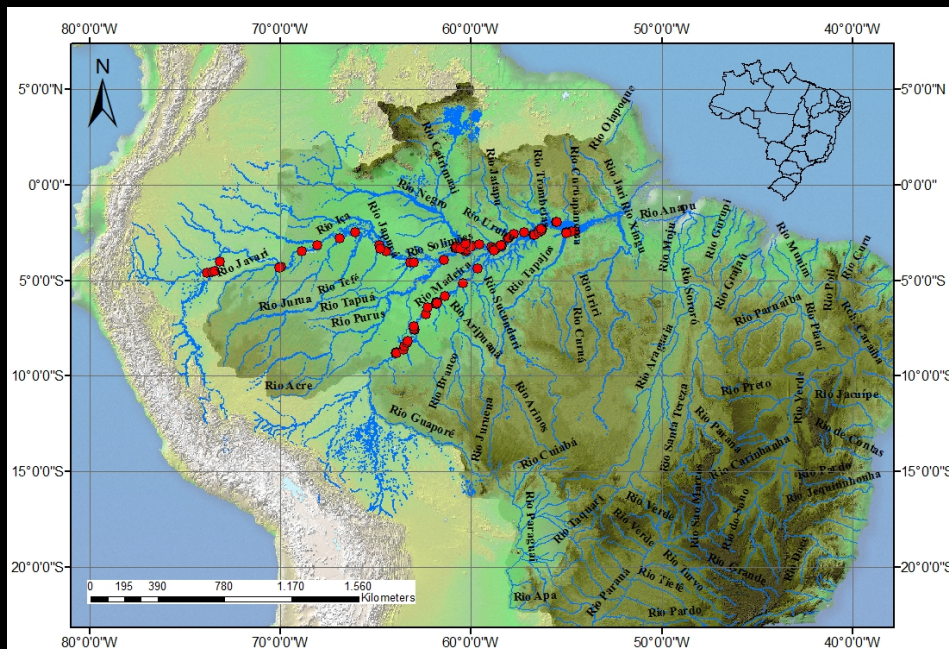
16/06/2010



Three field campaigns:

Napo, Ucayali, Marañon (Peru)
Negro, Solimões, Amazonas,
Madeira, Tapajós (Brasil)

October and November 2009; July
2010



Samples filtered in field with
0.45 μm membranes
(celulose acetate) –
Dissolution of membranes
for recovery of suspended
matter (SM) – HNO_3 , H_2O_2 ,
 HF & HCl 6N

IRON IN SUSPENDED MATTER (SM)

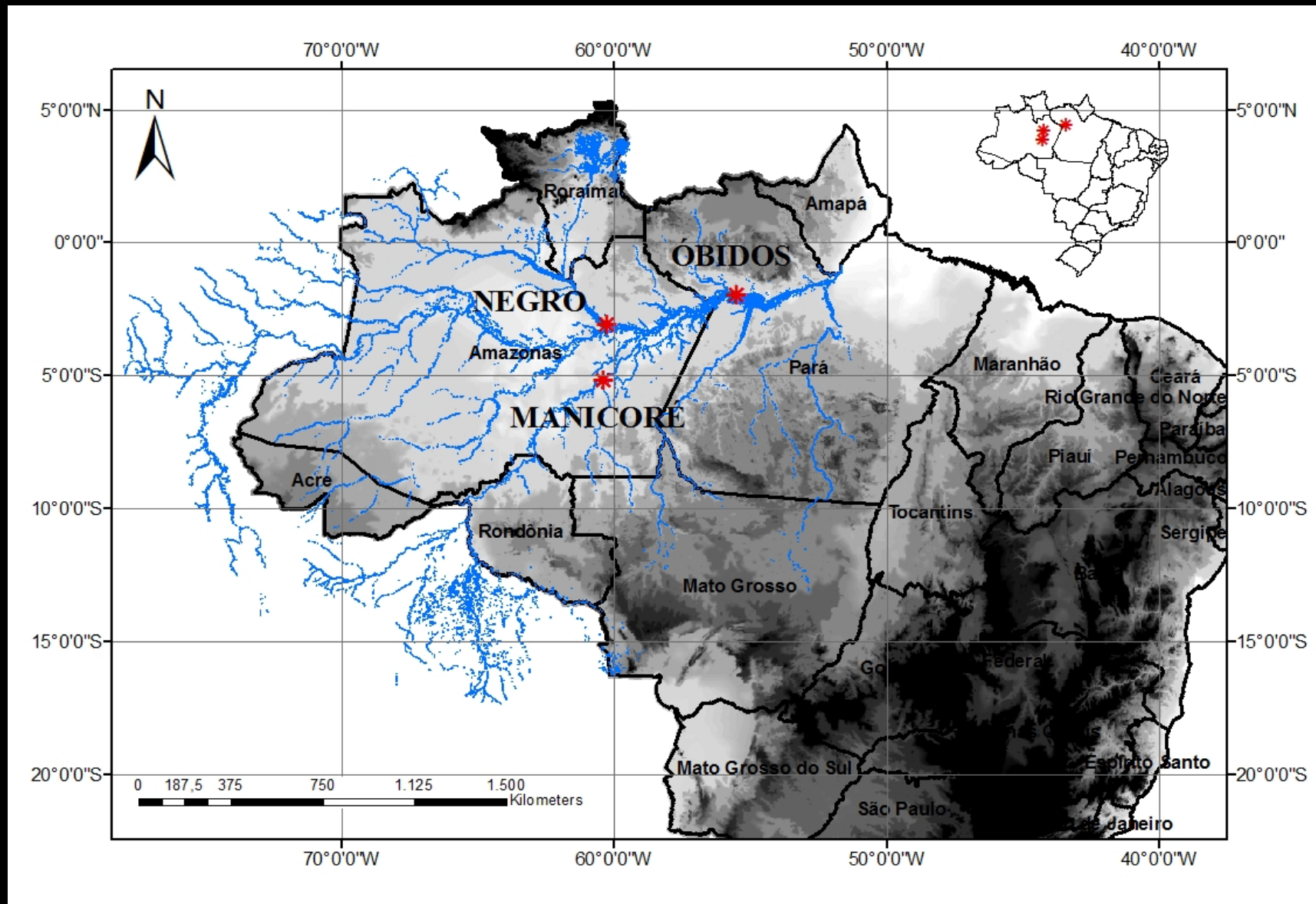
- ✓ purified by anion chromatography
- ✓ analysed by MC-ICP-MS (Geochronology Laboratory – University of Brasília & GET, Toulouse)
- ✓ Ni-doping technique applied to correct for mass bias during MC-ICP-MS measurements (Poitrasson and Freydier, 2005)
- ✓ Milhas hematite standard - $\delta^{57}\text{Fe}$ value of $0.757 \pm 0.067\text{‰}$ (2SD), relative to the IRMM-14 isotopic standard – good agreement with previous published data (0.746 ± 0.062 , Poitrasson & Freydier, 2005) - good stability AND accuracy of the equipment



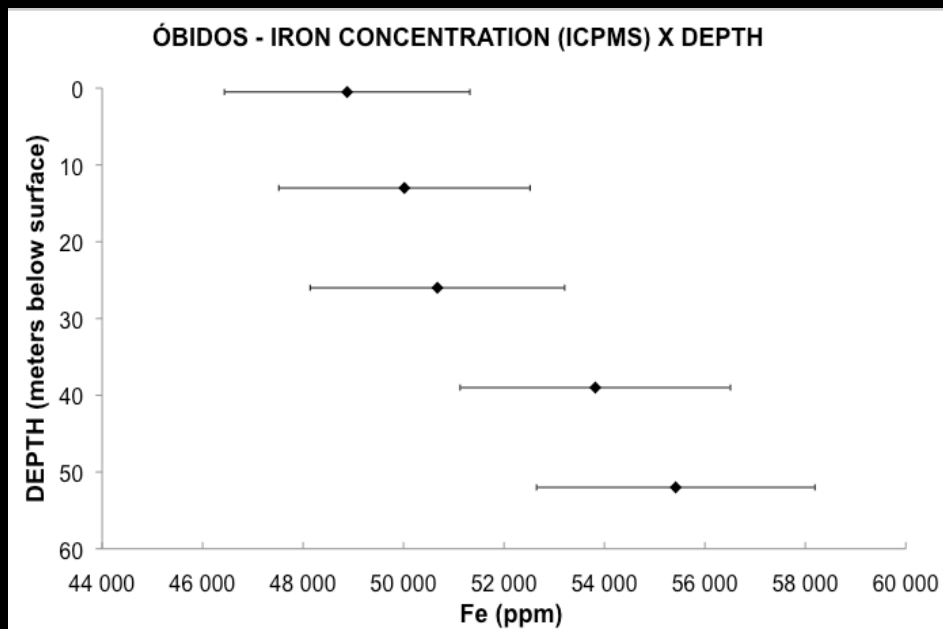
Multicollector – Inductively Coupled Plasma Mass Spectrometer (MC-ICP-MS) – Geochronology Laboratory – University of Brasília

RESULTS

Studied Sites:



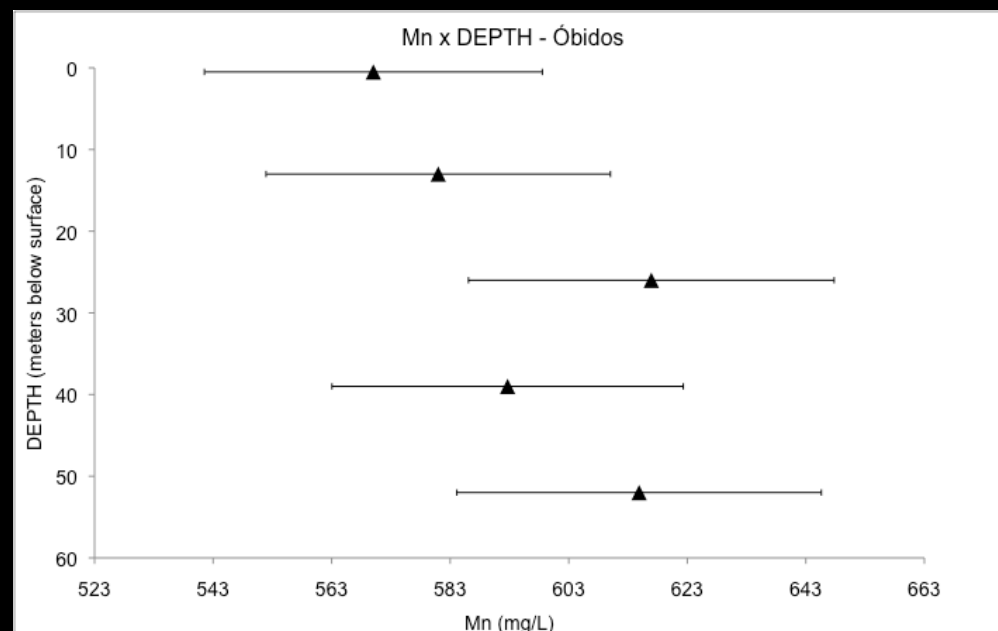
Depth Profile - ÓBIDOS



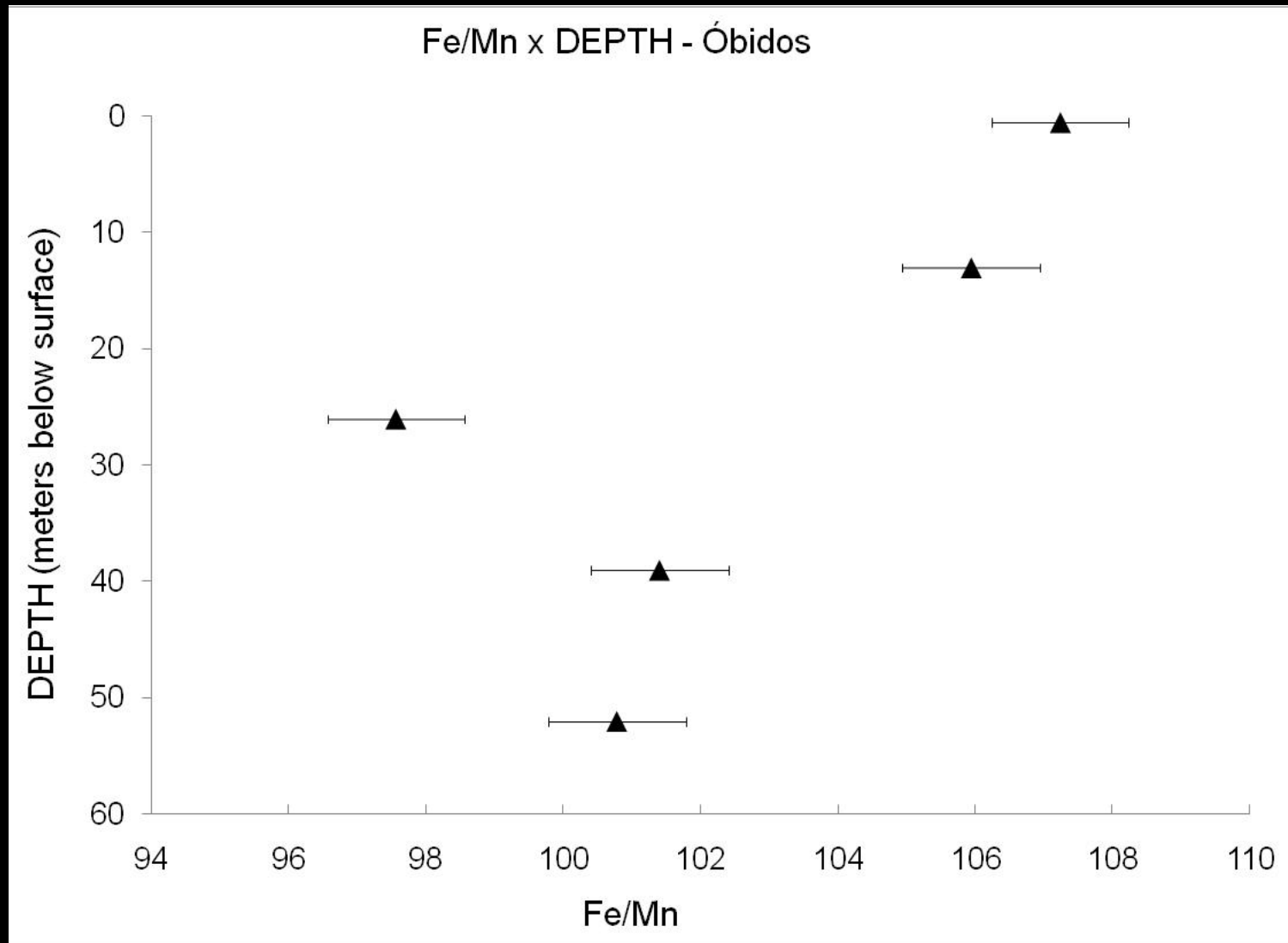
MC-ICPMS

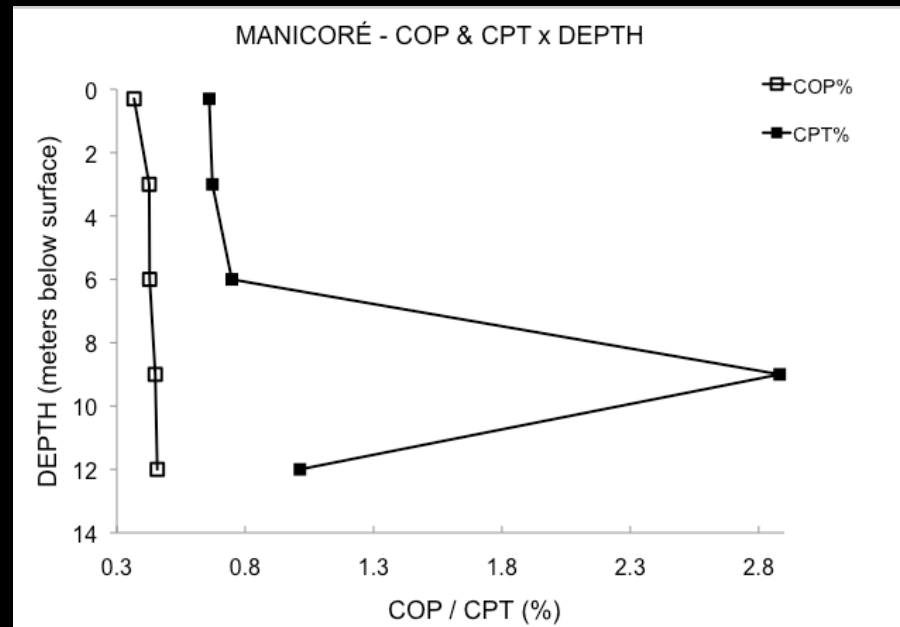
Fe - behavior
in suspended matter

ICP-AOS
Mn - behavior
in suspended matter



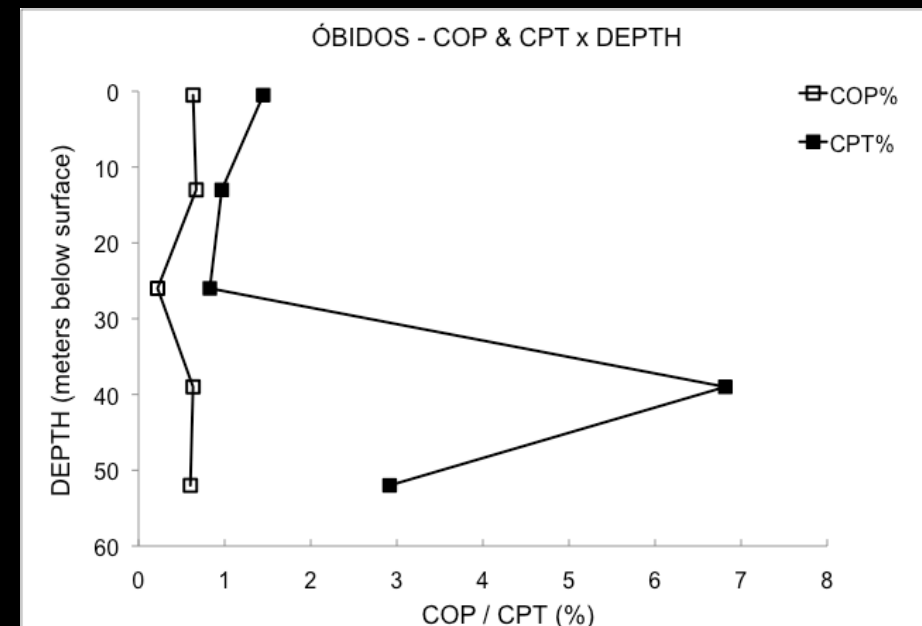
Fe/Mn ratios – behavior in suspended matter



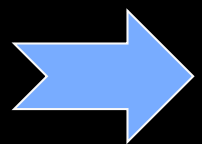
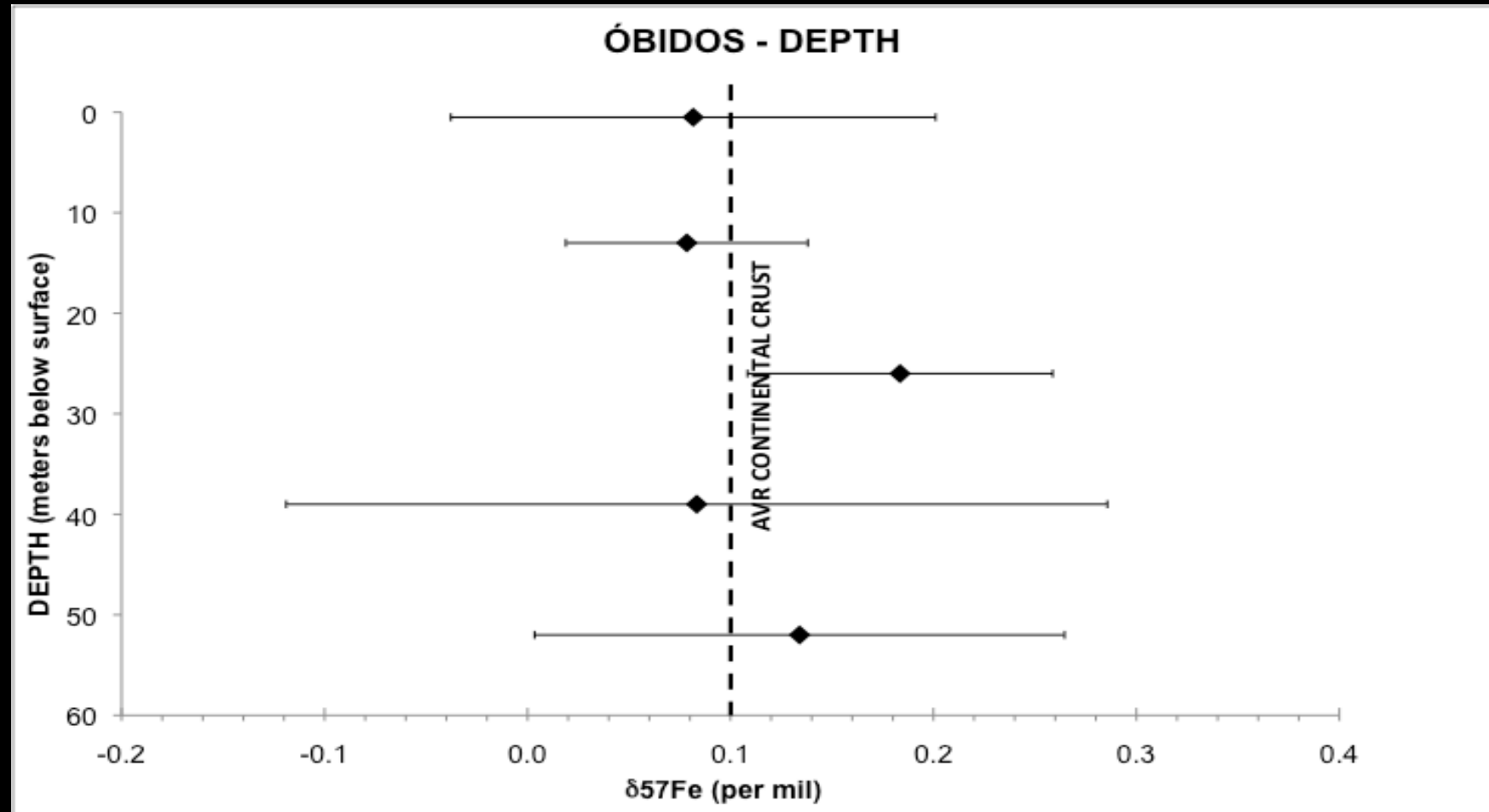


Total Particular Carbon & Organic Particular Carbon

Similar pattern for
Santarém Station!

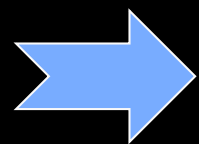
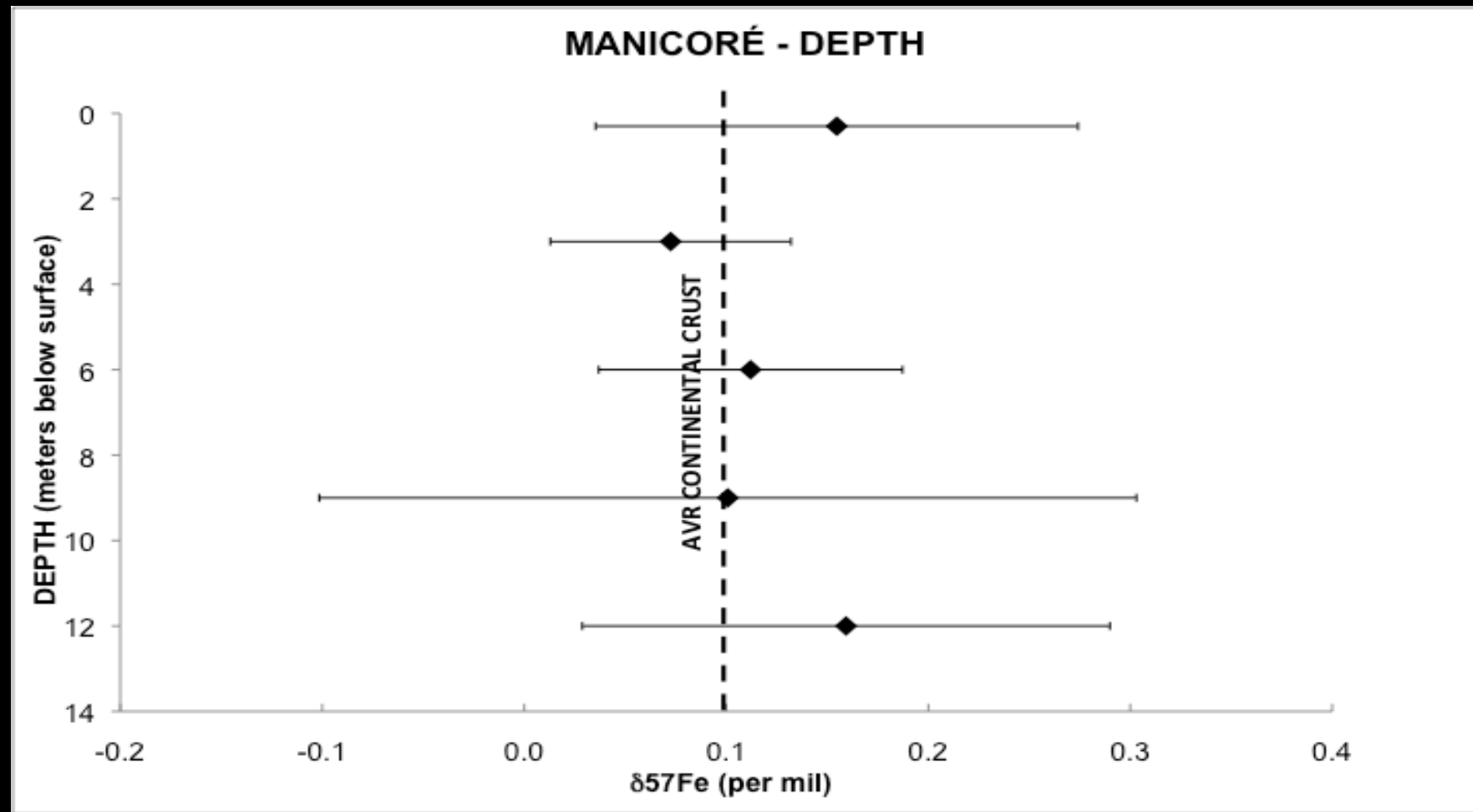


DEPTH PROFILE – ÓBIDOS – suspended matter



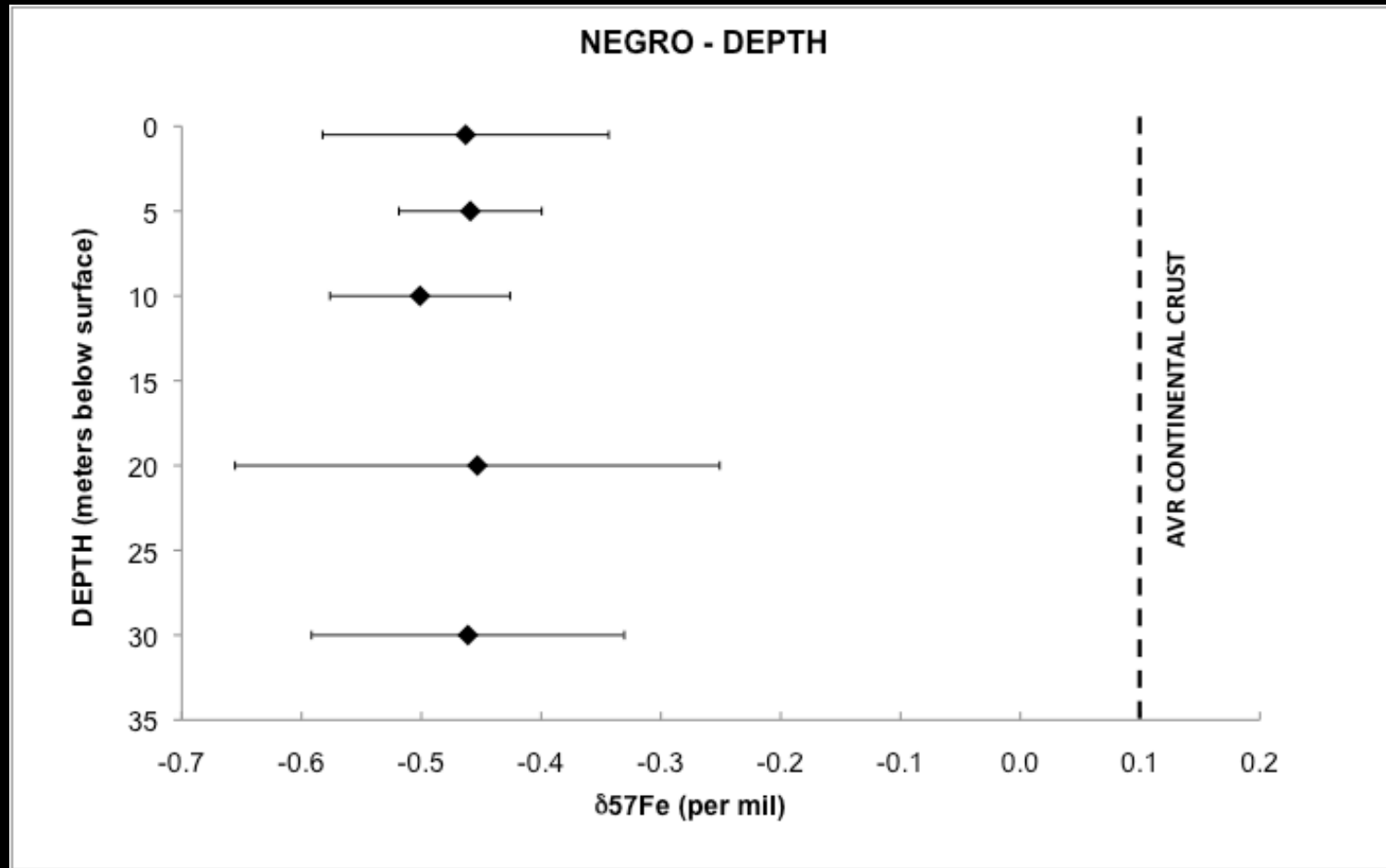
Surface samples represent the whole section

DEPTH PROFILE – MANICORÉ - suspended matter



Surface samples represent the whole section

DEPTH PROFILE – NEGRO - suspended matter

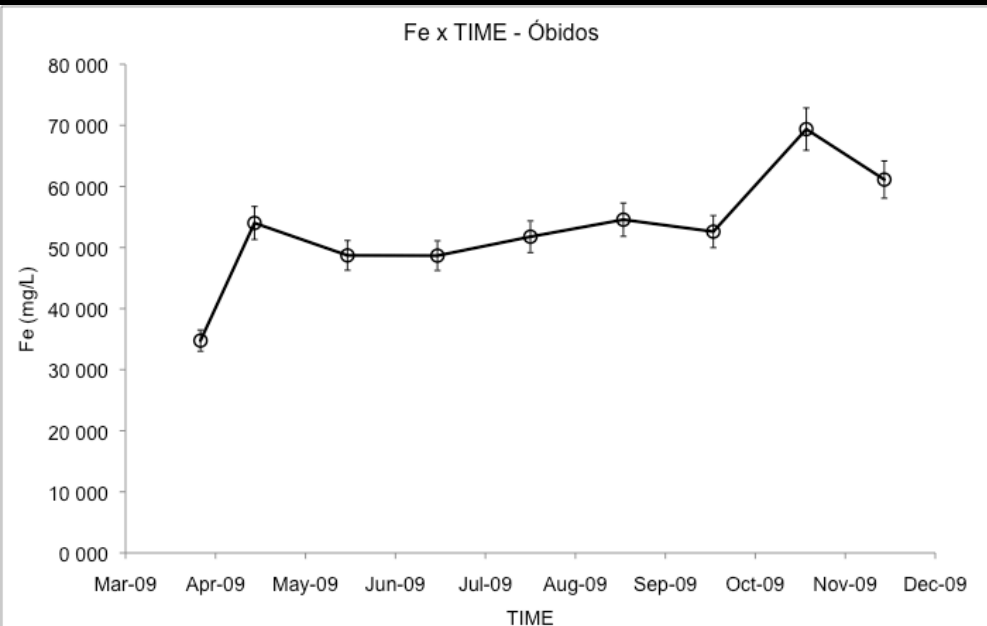


- ✓ Black waters – more humic, acid pH – organic matter signature
- ✓ upper soil horizons, rich in organic matter – similar isotopic signatures

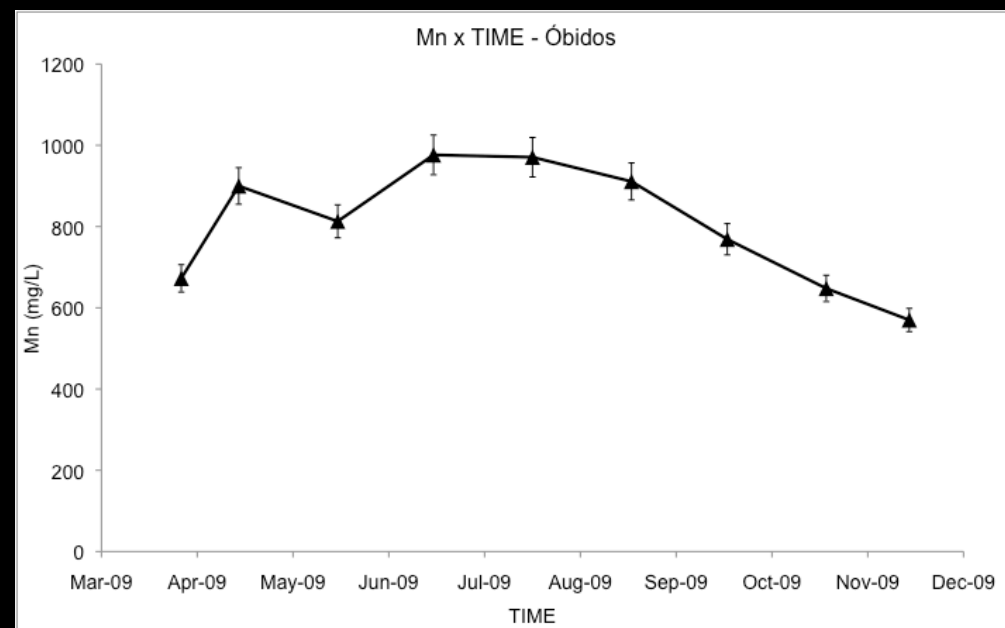
Temporal Series ÓBIDOS

ICP-AES

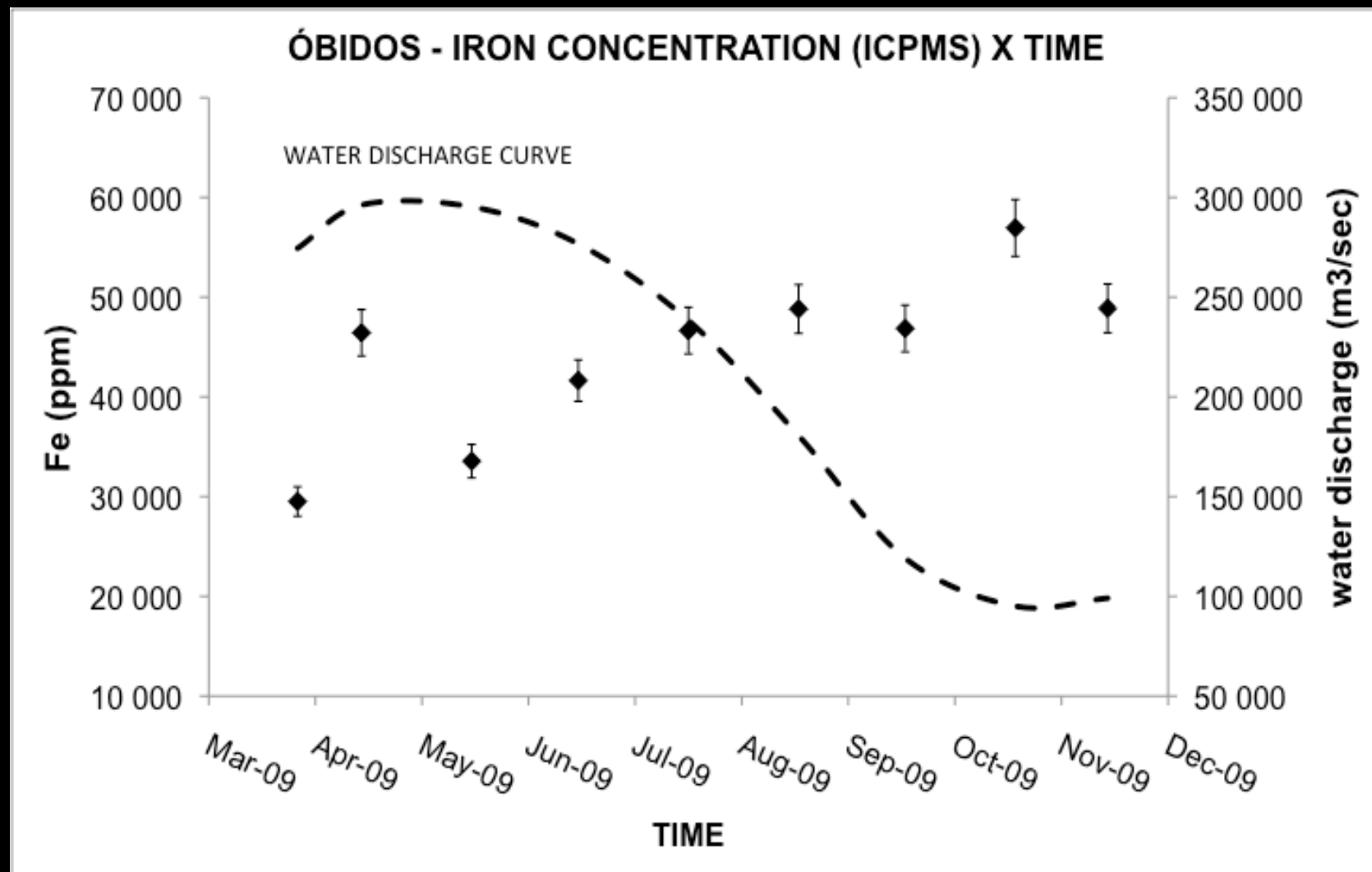
Fe, Mg, Al - behavior
in suspended matter

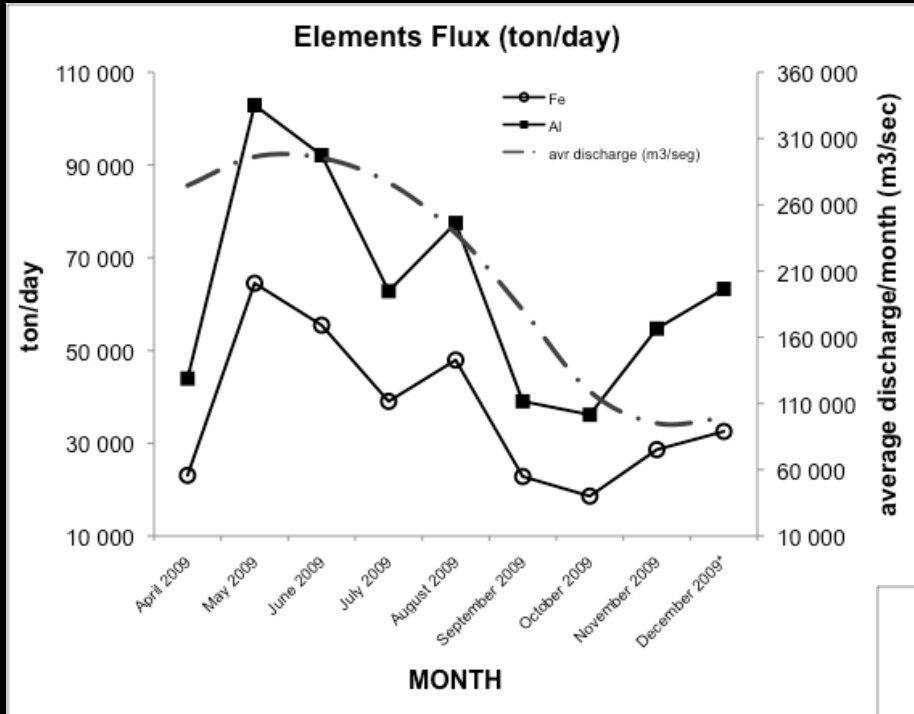


Mn – behavior
in suspended matter



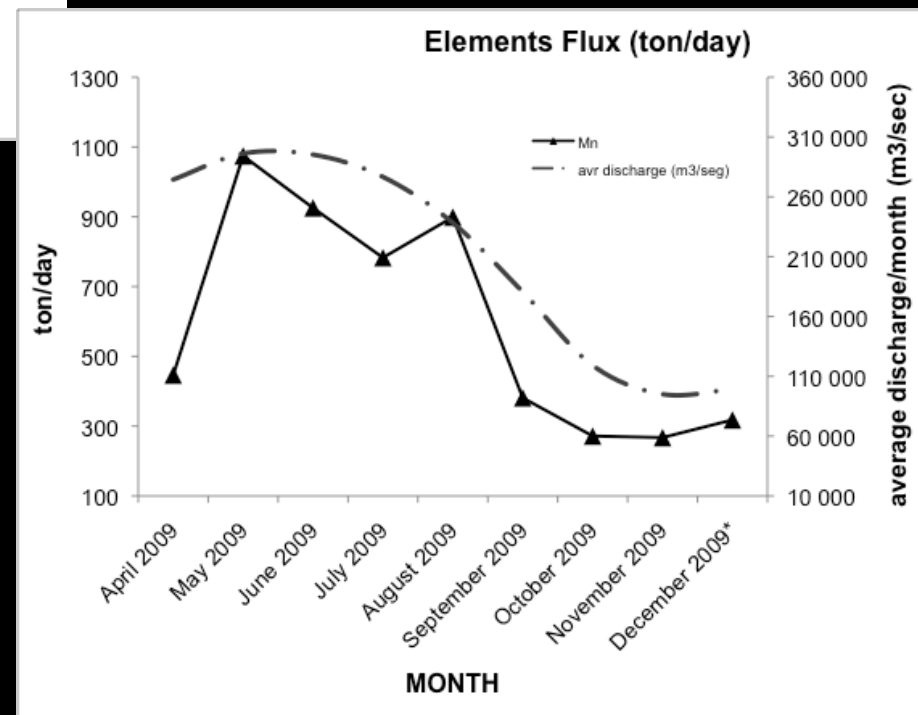
Temporal Series Óbidos – Suspended Matter Iron Concentration (MC-ICPMS)



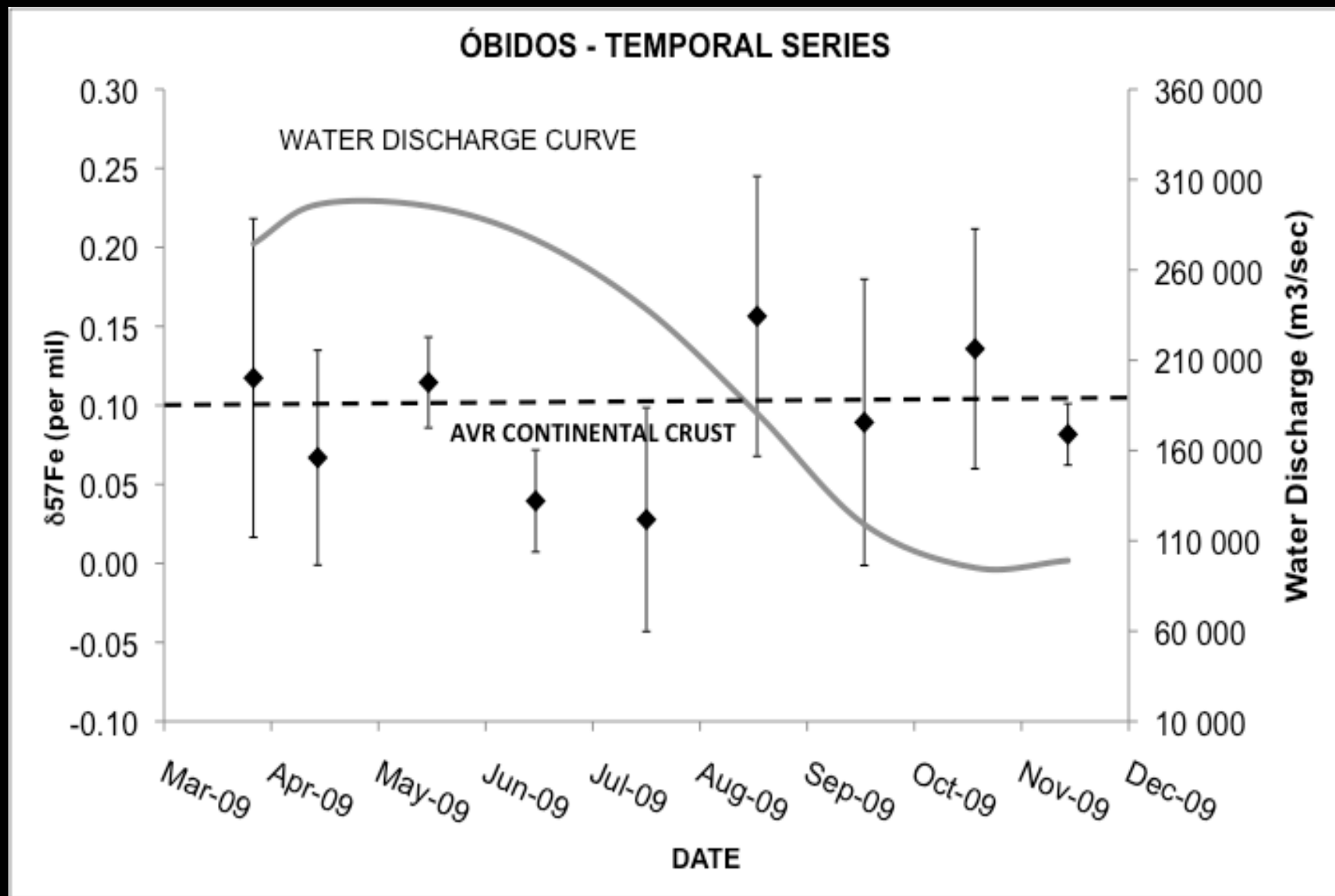


Flux of elements - Fe, Mg, Al
Tons per day

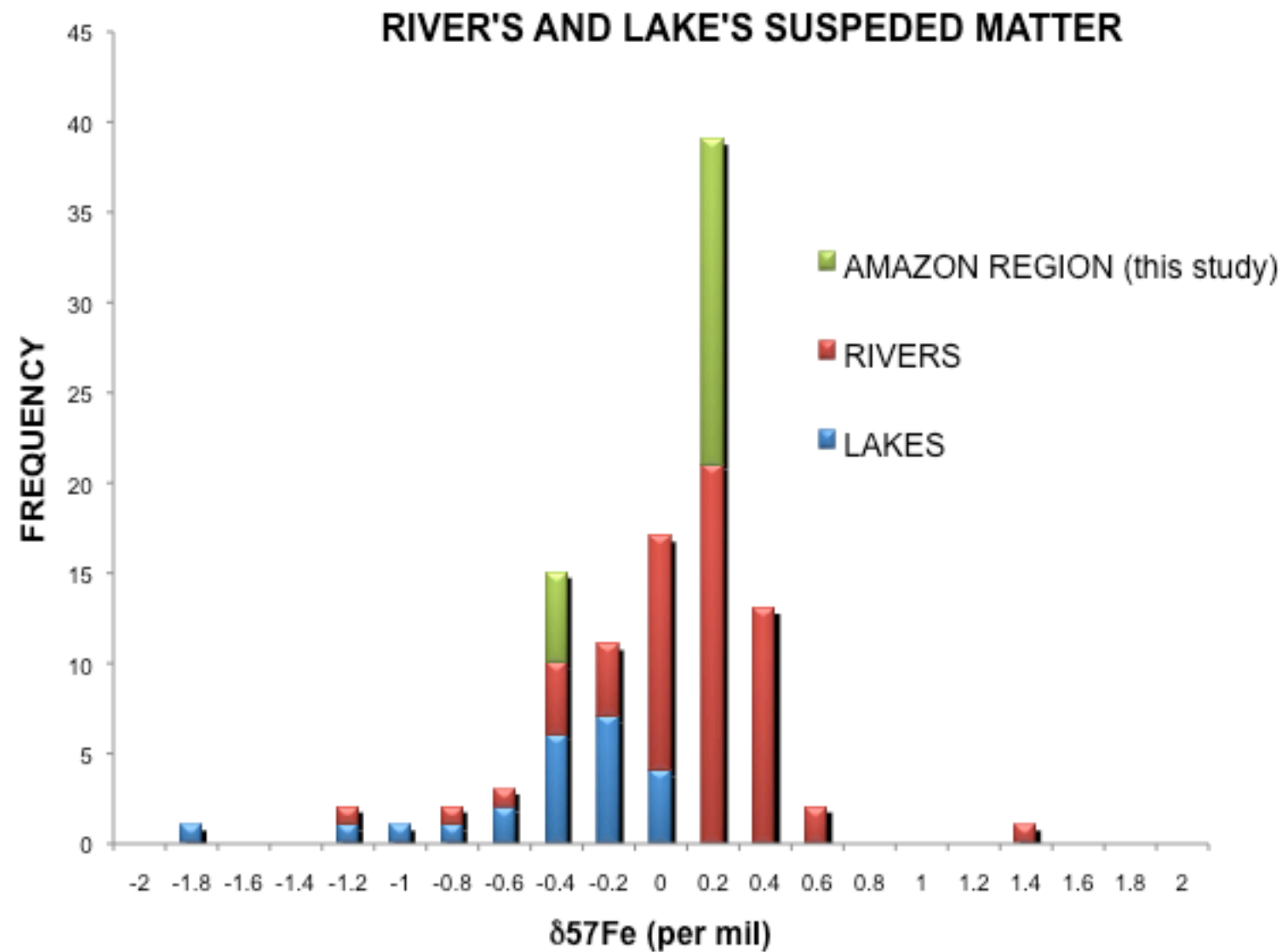
Flux of elements - Mn
Tons per day



Temporal Series Óbidos – Iron Isotopes – Suspended Matter



DISCUSSION

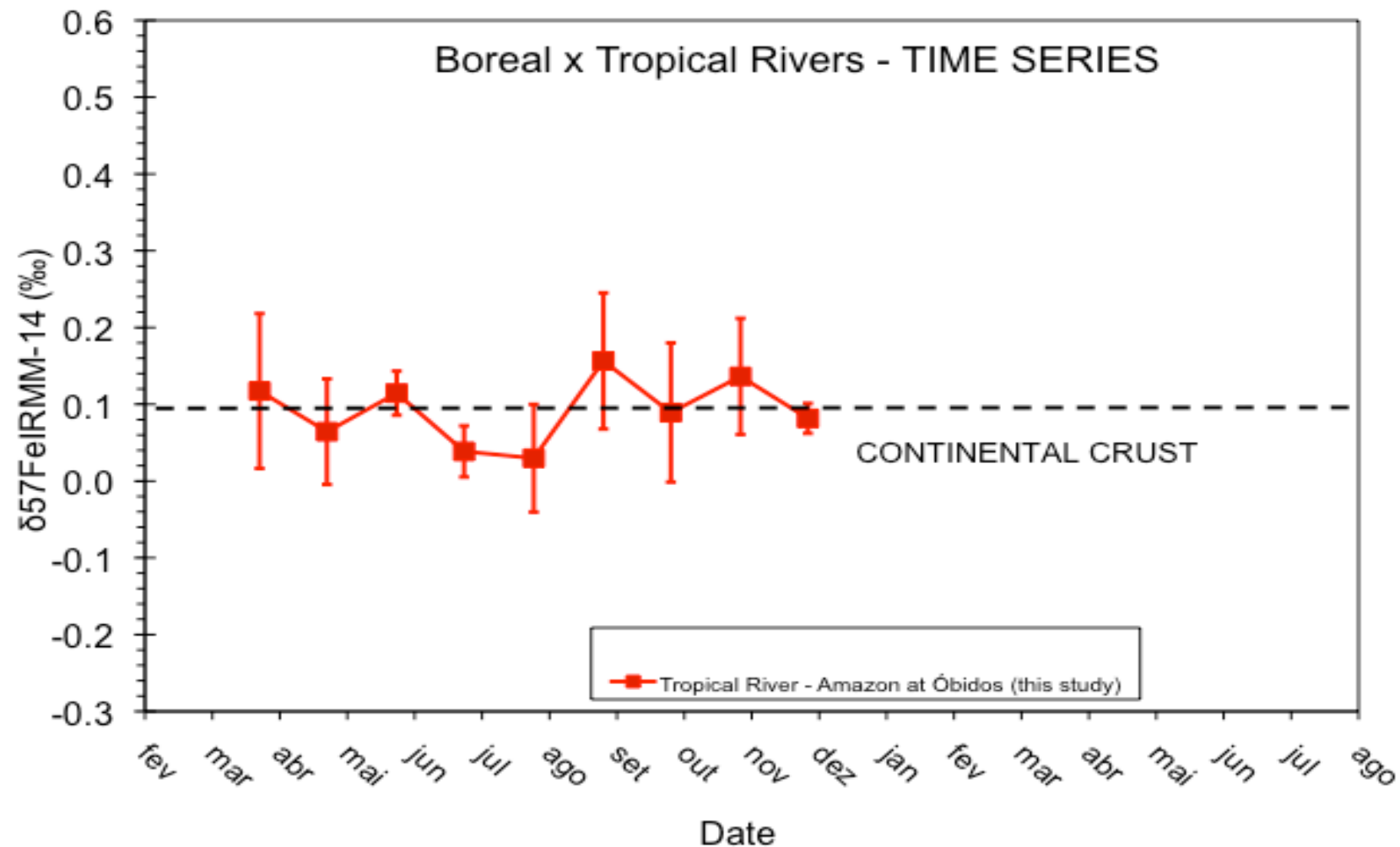


Data from: Bergquist & Boyle, 2006; Ingri *et al.*, 2006; Escoube *et al.*, 2009; Song *et al.*, 2011

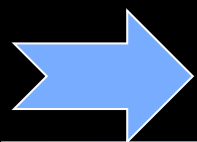
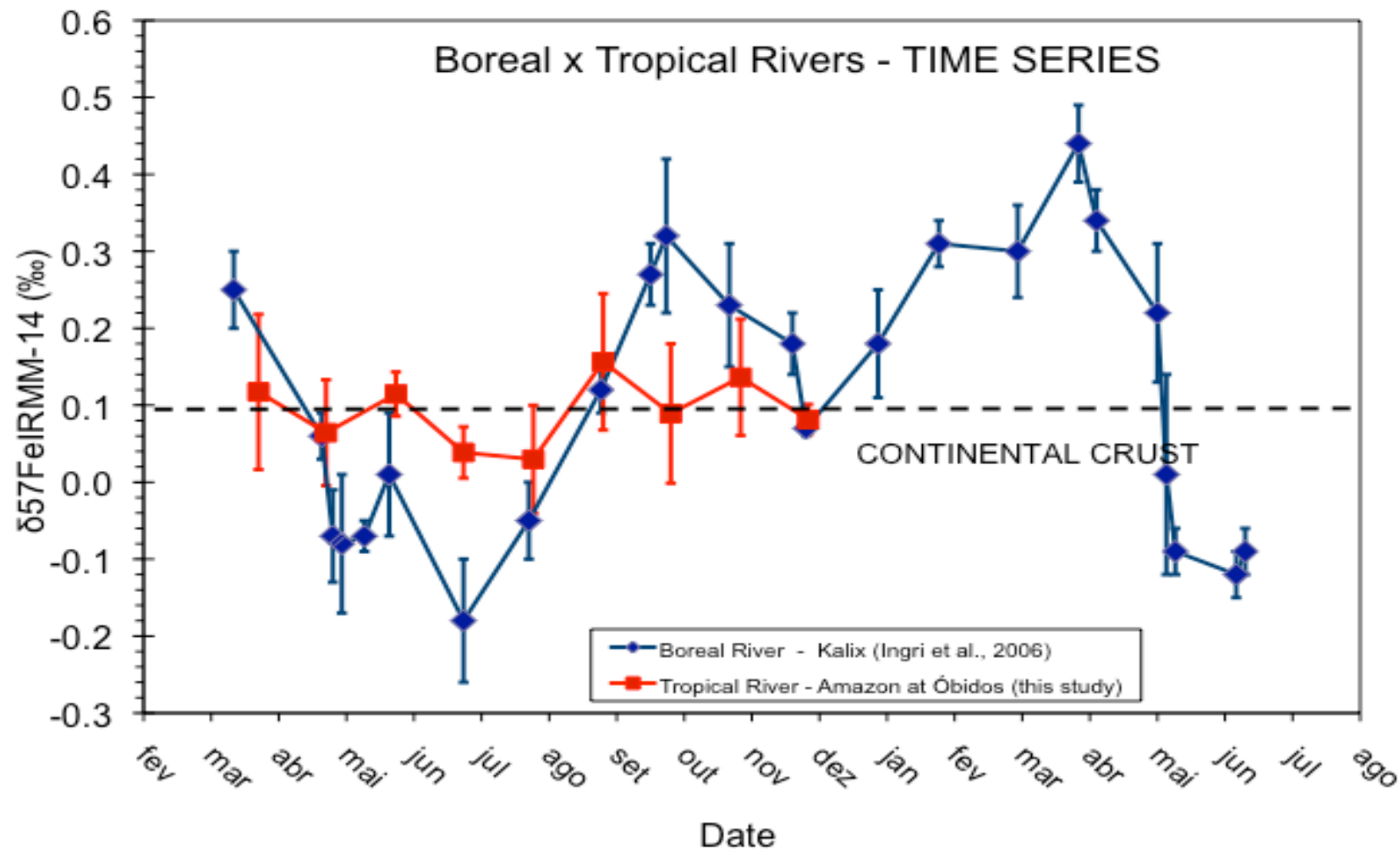


BOREAL X INTERTROPICAL RIVERS

Iron Isotopes – Amazon River at Óbidos



Iron Isotopes – Kalix River (Sweden) & Amazon River



Contrasting behaviour between equatorial and boreal

CONCLUDING REMARKS

- ✓ Surface samples seem representative of the whole river section
- ✓ Results obtained for depth profiles (Madeira & Amazonas) and for the temporal series (Amazonas) are similar the continental crust's $\delta^{57}\text{Fe}$ ($\sim 0.1\text{‰}$, **Poitrasson, 2006**)
- ✓ Negro River – only station with distinct $\delta^{57}\text{Fe}$ values (but \neq **Bergquist & Boyle (2006)** : 1‰ discrepancy!
- ✓ Contrasting with boreal rivers, where $\delta^{57}\text{Fe}$ values in suspended load varies by up to $\sim 0.6\text{‰}$ along the year (**Ingri *et al.*, 2006**)
- ✓ Very little Fe isotope fractionation during Fe transfer from soils to rivers in intertropical zones (see also: **Poitrasson *et al.*, 2008**)

ACKNOWLEDGMENTS



A serene sunset scene over a calm body of water. The sun is a bright orange orb on the horizon, casting a long, shimmering reflection down the center of the water. The sky is a deep blue with wispy white clouds. In the lower-left foreground, a small, dark boat is visible, leaving a gentle wake behind it. The overall mood is peaceful and contemplative.

GRACIAS!

Thank you!

Obrigada!

Merci!

GIANA@UNB.BR