Monsoon-driven switch of heavy to light copper isotopes in suspended particulate matter in the Changjiang (Yangtze River)

Ana Cristina Vasquez, Shouye Yang, Zhiwei He, Junjie Guo

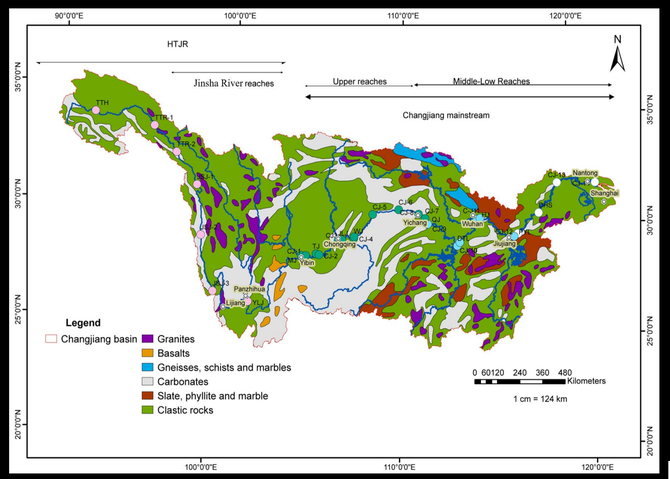
State Key Laboratory of Marine Geology, Tongji University

INTRODUCTION

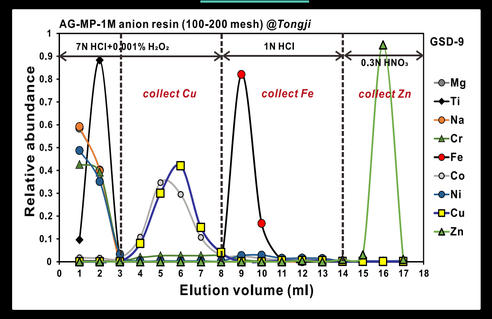
Copper (Cu) is an essential transition metal, distributed in various minerals, rocks, fluids, and organisms, and it is widely involved in diagenesis, mineralization and biogeochemical processes. Identifying sources of Cu enrichment in rivers is necessary to measure natural and anthropogenic contributions. Particulate matter (SPM) generally display a light pool (-1.02 to +0.09 ‰; Wang et al., 2017). Here we introduce the Cu concentration and isotopic composition in particulate loads obtained in the Datong Hydrological Station (Anhui province) for the period of one-year.

BACKGROUND

The Changjiang Basin extends for ~6397 km, comprises a catchment area of 1.8 million sq km, and is driven by the Indian monsoon in its headwaters (Tibetan Plateau) and the East Asian monsoon (upper to lower reaches).



METHOD

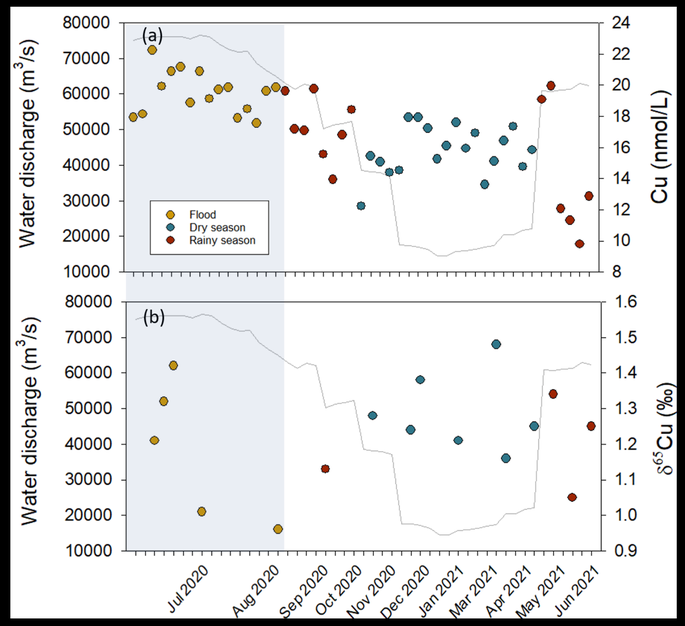


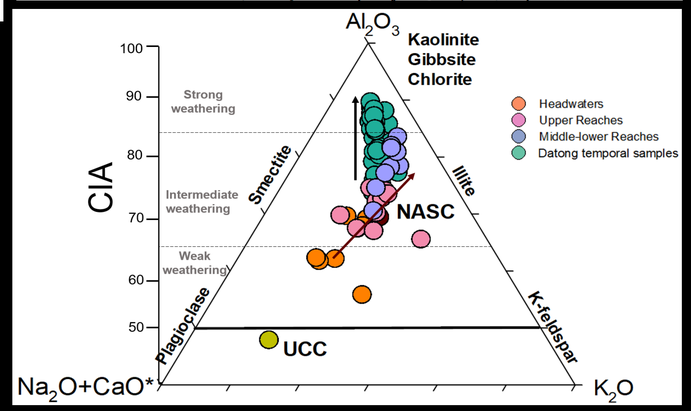
RESULTS / FINDINGS

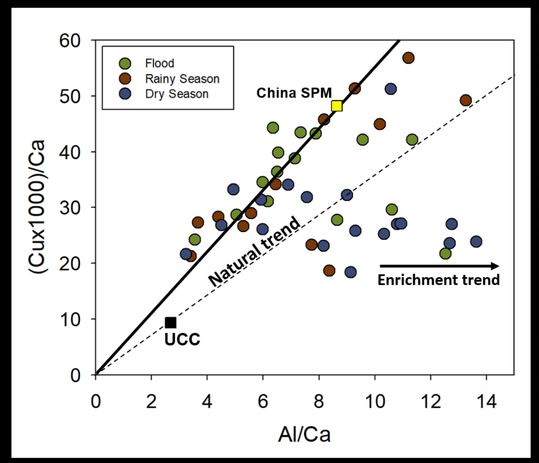
- Annual Cu in particulate load (44-50 µg/g, n= 49) shows minimal changes, despite short-term (12-24 h) variations and isotopic fluctuation
- High intensity precipitation events show an increase up to ~60 µg/g
- SPM evidences intense weathering (CIA) with high concentration of Al hydroxides.
- Enrichment factor (avg= 1.8) suggest limited anthropogenic contributions

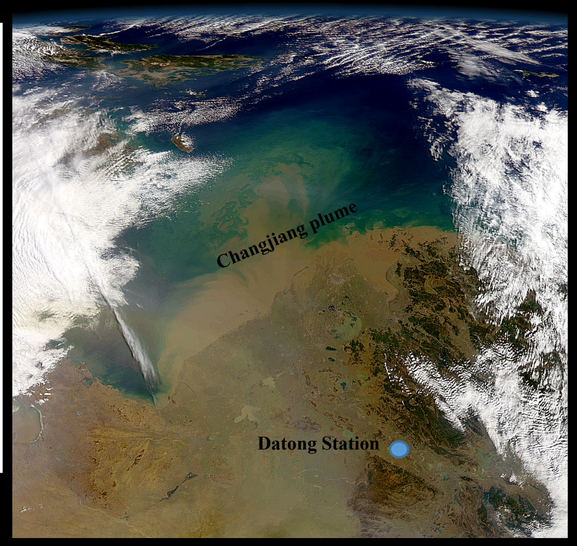
No correlation with organic matter evidence inorganic origin.

No correlation with nitrites nor phosphates discard agricultural-related sources



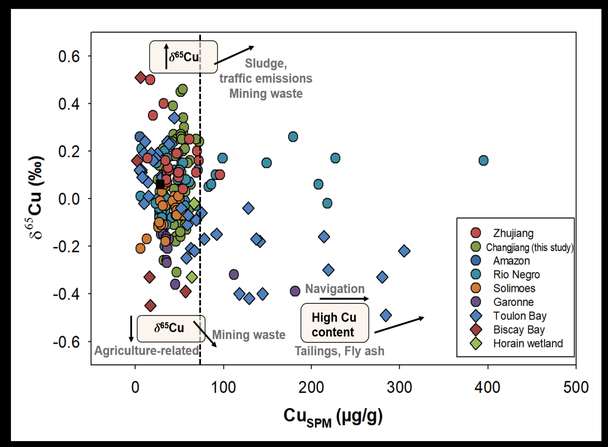


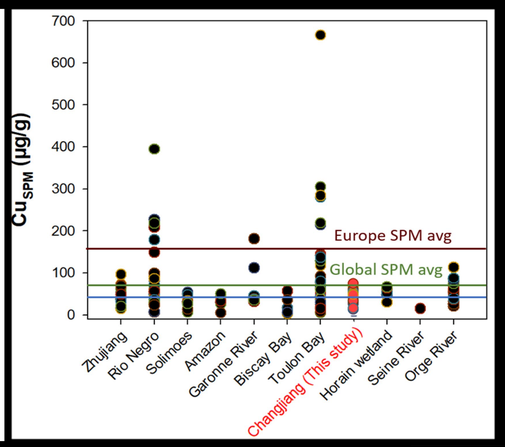




SOURCES OF CU IN THE BASIN

- SPM shows a trend of low content/ heavy signature (49 ug/g, -0.01 ‰) relative to global averages (75.9 µg/g, -0.31 ‰)
- Comparative studies in riverine suspended loads of Cu suggest the global average might be overestimated.
- **Cu isotopic signatures are result of a mixing of sources and processes.**
- Heavy Cu signatures are result from human-related activities intensifying natural processes (i.e., mining, erosion, karstification), and evidence the complexity of Cu isotopic dynamics in riverine settings cannot be used as accurate environmental tracer.
- Cu content geogenic sources display a constant influx in the SPM along the year, where mineral variations in rainy/dry season yield important fluctuations in Cu isotopic signatures





REFERENCES

Wang, Z., Chen, J., Zhang, T. (2017). Cu Isotopic Composition in Surface Environments and in Biological Systems: A Critical Review. International Journal of Environmental Research and Public Health. 14. 538. 10.3390/ijerph14050538

Viers, J., Dupré, B., Gaillardet, J., 2009. Chemical composition of suspended sediments in World Rivers: new insights from a new database. Sci. Total Environ. 407, 853–868