DETRITAL ZIRCON PROVENANCE FIDELITY IN THE MODERN AMAZON DRAINAGE SYSTEM

Drew S. Coleman[1]; Russell W. Mapes[2]; Afonso C.R. Nogueira[3]

[1] UNIVERSITY OF NORTH CAROLINA; [2] EXXON MOBIL; [3] UNIVERSIDADE FEDERAL DO PARÁ

RESUMO: The Amazon River drainage basin provides an excellent opportunity to evaluate zircon transport in a continent-scale fluvial system, and to evaluate provenance fidelity in river sediments. The regular change in basin bedrock geology from young rocks (Phanerozoic) in the Andean headwaters to old (Paleoproterozoic) downstream permits monitoring of long range transport of zircon from headwaters to river mouth in a tropical environment. We dated detrital zircon from sediment collected from the active channel of the Amazon River and tributaries from the headwaters to the upper limit of tidal influence near Santarém, Brazil. Additionally, we dated zircon from Cretaceous and Miocene river sediments that are being actively eroded by the modern river system to evaluate the impact of storage and "cannibalism" on the age spectra of modern sediments.

Age spectra for Amazon River sand record the range of sources that exist within the drainage basin in a qualitative sense and demonstrate that long-distance fluvial transport of detrital zircon populations is possible. Zircons with uniquely Andean ages make up ~30% of the total age spectrum in sand collected at the onset of the Amazon estuary, 3000+ km displaced from their igneous/high-grade metamorphic sources after transport in what is close to the worst-case scenario in terms of harshness of chemical weathering, sediment trapping on highly-vegetated banks, and aggradation in an active foreland basin. The actual proportion of Andean derived grains is likely larger, possibly as high as 90%, if Precambrian grains recycled from Andean sedimentary and metasedimentary rocks are considered and it does not appear that destruction, aggradation, dilution, or recycling have a significant effect on altering the primary, Andean age signature. Analysis of weakly consolidated Miocene and Cretaceous river sediments actively being eroded into the modern system demonstrate that, although storage is significant, the contribution of stored zircon appears to be negligible on the modern sediment. Comparison of age spectra from ancient river sediments to upstream and down stream modern sands shows 1) ancient sands likely had a source in an eastern highland, and 2) there is no overlap of peak ages between ancient and modern sands.

Results of this and previous studies indicate that the major control on zircon age spectra is relative stream gradient: areas with higher relief contribute the most zircon. Significant differences between age spectra, even for samples collected in close proximity, indicate that sediment mixing in the fluvial environment is not thorough enough to yield a characteristic and uniform age distribution and therefore, age population proportions should not be used to quantitatively assess catchment geology or geography.