# Strontium isotopes in detrital sediments constrain the glacial position of the Agulhas Retroflection

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The Agulhas Leakage represents a significant portion of the warm, surface return flow of the global overturning circulation, and thus may be a positive feedback in the ocean-climate system. Models indicate that reduced Leakage could be caused by a stronger Agulhas Current and/or a more upstream Agulhas Retroflection [1, 2]. However, data for the last glacial maximum (LGM) have been taken to support a weaker Agulhas Current and less Agulhas Leakage, thus implying a possible displacement of the Retroflection [3].

The modern pathway of the Agulhas Current, Retroflection and Leakage can be traced by terrigenous sediment provenance [3]. Sediments underlying the Agulhas Current and the Agulhas Return Current have higher $^{87}Sr/^{86}Sr$ than the surrounding sediments. We therefore hypothesize that the region of high $^{87}Sr/^{86}Sr$ can be used to trace the mean path of the Agulhas Current, Retroflection and Return Current in the past. Until now, there has been no data between the latitudes of 36°S and 41°S to constrain the mean position of the Agulhas Retroflection during the LGM.

We present new $^{87}Sr/^{86}Sr$ results for modern and LGM sediments within this region. The $^{87}Sr/^{86}Sr$ values are generally lower in the LGM, but the pattern of variability is very similar to today's, indicating that the glacial Agulhas Current and Retroflection approximately followed its modern trajectory. Based on these results and those of our previous study [3], we infer that reduced glacial Leakage must be caused by the weakened Agulhas Current. Accordingly the provenance data appear to rule out a stronger Agulhas Current or a more upstream Agulhas Retroflection [1, 2]. More work on this oceanographic region is needed to fully integrate the observations and their implications with numerical modeling constraints.

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# Masking of inter-annual climate proxy signals by residual tropical cyclone water from Hurricane Mitch: Observations and challenges for low-latitude speleothem paleoclimatology

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It has been recently established that information about tropical cyclone activity can be extracted from stalagmites at sub-seasonal resolution [1, 4]. This proxy exploits the characteristically low stable isotope ratios of tropical cyclone rain water compared to typical summertime precipitation in the low to mid-latitudes [3]. The karstic plumbing system feeding each speleothem controls the extent to which the isotopically distinct stormwater reaches the growing crystal surface either as a coherent slug, or after attenuation by mixing with other vadose groundwater with more typical oxygen isotope ratios ($\delta^{18}O$ values).

Evidence from a modern Belize stalagmite shows that "residual tropical cyclone water" from a single hurricane rainfall event can depress the $\delta^{18}O$ value of stalagmite calcite for months to years. After Hurricane Mitch struck the region in 1998, the expected high $\delta^{18}O$ values from the 1997-'98 El Niño event did not occur. In contrast, expected high $\delta^{13}C$ values were observed [2].

We suggest that the expected high $\delta^{18}O$ value ENSO signature was masked by low $\delta^{18}O$ values of residual rain water from Hurricane Mitch. Consequently, for speleothems from tropical cyclone basins, interannual to decadal variations in 18O values may not be simply interpretable as a function of precipitation amount. Rather, variable rainfall contributions from tropical cyclones may modulate the accuracy of tropical speleothem oxygen isotope-based paleoclimate reconstructions. Carbon isotope ratios were relatively insensitive to the effects of transient events such as tropical cyclones compared to persistent inter-annual climatic anomalies (e.g. El Niño events).

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