Coral skeletal geochemistry to disentangle natural variability from anthropogenic impacts on the Great Barrier Reef, Australia

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There is increasing concern about the progressive degradation of inshore coral reefs in the iconic Great Barrier Reef (GBR), which is considered to be driven by poor water quality related to increased terrestrial sediment runoff due to inland human activities[1]. Proxy based reconstruction of long term water quality changes is critical to adequately and objectively infer future impacts of anthropogenic disturbances and extreme weather events, such as tropical cyclone and floods. This study utilizes geochemical proxies in coral skeletons from Keppel Islands, GBR to isolate and identify which aspects of changing coastal water quality are natural versus anthropogenic. Trace element analysis in coral subsamples revealed annual cyclicity of Sr/Ca ratios, which were calibrated against the instrumental temperature to infer the chronology of geochemical data. A close association between Fitzroy River discharge and coral Mn/Ca ratios were observed especially during the high discharge and flood events when massive top soil erosion occurred and flood plumes reached the vicinity of the islands. Mn/Ca peaks were related to the Green/Blue spectral luminescence[2], which is considered as an independent marker of terrestrial discharge in coastal marine environment. High discharge periods during summers were also linked to conventionally used Ba/Ca river discharge proxy. Shale normalized rare earth elements (REEs) showed seawater like patterns, attesting the usefulness of REEs for unlocking water quality changes. The correlation between the variability of Nd/Yb (light/heavy REE) and Mn/Ca ratio was attributed to the enrichment of light REEs in flood water, as the light REEs mobilize faster than the heavy REEs. An increasing trend in total REEs was observed over time in Keppel coral, possibly due to greater erosion of Fitzroy river catchment because of expansion of agricultural activities.

[1] Brodie et al. (2012) *Marine Pollu. Bull.* **65**, 81-100. [2] Rodriguez-Ramirez et al. (2014) *Plos One* **9**: e84305.