Coral geochemical proxies reveal climate drivers of river discharge in the southern Great Barrier Reef

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Progressive degradation of inshore water quality along the eastern coast of Queensland driven by the increased terrestrial discharge is a matter of great concern for coral reef communities of iconic Great Barrier Reef (GBR). Proxy-based reconstruction is critical for understanding long-term impacts of anthropogenic pollution and for identifying drivers of extreme climatic events, such as floods, droughts and cyclones. This study investigated coastal water quality using 79 year (from 1934 to 2012) records of monthly resolution Ba/Ca and Y/Ca in *Porites* sp. coral samples collected from Great Keppel and Square Rock in the southern Great Barrier Reef (GBR), Australia. Geochemical proxy records were influenced by environmental and climatic changes on a seasonal to decadal scale. Although seasonal oscillation of Ba/Ca and Y/Ca was related to rainfall and discharge from the Fitzroy River catchment, some uncorrelated anomalous peaks were evident throughout the time series. Regardless, the behaviour of these proxies was significantly consistent over the longer time scale. A long term drought-breaking flood resulted in significant rise in the elemental ratios and sediment influx to the near shore marine environment owing to greater topsoil erosion from a catchment with reduced groundcover, whereas sediment flux was reduced after repeated intense flushing events in the preceding wet periods. More importantly, this study identifies for the first time that although El Niño Southern Oscillation (ENSO) influenced Ba/Ca records, Pacific Decadal Oscillation (PDO) significantly explained the variability of Ba/Ca as a primary climatic driver. Positive anomalies of Ba/Ca were associated with the negative phases of PDO and vice versa. Therefore, this study strongly supports the dominant control of PDO on the intensity of river discharge and rainfall in the Fitzroy River catchment and on associated sediment delivery to nearshore marine environments in the southern GBR.