

# Long-term anthropogenic change in South Australian gulfs recorded by the faviid coral *Plesiastrea versipora*

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Corals are sensitive to changes in climate and recently, high-latitude coral communities have received increased attention for their ability to act as refugia during global climate change. In this study, we report on high resolution elemental ratio and stable isotope time-series generated from *Plesiastrea versipora* to assess the fidelity of using geochemical variations to reconstruct environmental conditions in South Australian gulfs. This coral species has an expansive distribution throughout the Australasian marginal seas, providing a potential climate archive in a diverse range of oceanic conditions.

High resolution laser-ablation ICP-MS analyses of established paleo-temperature proxies including B/Ca, Sr/Ca and U/Ca, a suite of minor trace elements (P, Mn, Zn, Sn, Y, Mo, Cd, Ba, Pb) and milled  $\delta^{18}\text{O}$  and  $\delta^{13}\text{C}$  analyses were obtained from seven cores of *P. versipora* from Gulf St Vincent and Spencer Gulf (34.5°S), South Australia. The annual nature of density bands were verified using U/Th ages derived from multi-collector ICP-MS analyses and colony ages ranged from 100-400 years. Annual extension rates of *P. versipora* varied from 1.2 mm yr<sup>-1</sup> to 7 mm yr<sup>-1</sup> for different colonies located within the same reef.

Sr/Ca and U/Ca from all colonies were strongly correlated ( $r^2 = 0.8-0.96$ ) in contrast to previous studies using *Porites* ( $r^2 = 0.4-0.8$ ). Ba/Ca generally displays a strong inverse correlation with SST.  $\delta^{13}\text{C}$  analyses from a slow growing colony revealed a significant correlation with surface oceanic <sup>13</sup>C depletion from fossil fuel CO<sub>2</sub> (0.8‰) from the early 1930's to 2005 (the Suess effect). High levels of Zn and Sn in a coral recorded point source pollution from a steel smelter. Strong annual cycles of Zn were observed in two corals from different locations, however the cause of this signal is uncertain.

These data suggest that *P. versipora* can provide valuable paleoclimate information in high-latitude environments, recording seasonal and long-term variation in productivity regimes with high fidelity. *P. versipora* has the potential to act as a sentinel organism recording the industrial depletion in <sup>13</sup>C of DIC. This archive may be employed to reconstruct anthropogenic activity since European settlement and land-use changes in temperate Australia.