



## Analysis of the seawater CO<sub>2</sub> system in the barrier reef-lagoon system of Palau using total alkalinity-dissolved inorganic carbon diagrams

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**ABSTRACT:** We studied the seawater carbon dioxide (CO<sub>2</sub>) system in the Palau coral reef by measuring total alkalinity (TA) and total dissolved inorganic carbon (DIC). Variation in the CO<sub>2</sub> system on the reef flat and in the lagoon was analyzed by TA-DIC diagrams, taking into accounts the differing residence times of seawater. CO<sub>2</sub> in the offshore water was relatively stable in space and time, but on the reef flat it was subject to rapid (about 3 h) and substantial changes due to photosynthesis and calcification during the day and due to respiration and calcification at night. Water flowed into the lagoon where decomposition of organic matter and continuing calcification occurred over relatively long residence times (~30 d). Despite the spatial and temporal variations, the center of the lagoon had relatively constant TA and DIC values similar to the mean values for the entire lagoon. A long-term 30-40% decrease in reef productivity and calcification has occurred over the last decade, primarily a result of degradation of the reef environment following a major coral reef bleaching event in 1998. This is reflected in decreases in the differences in TA and DIC between offshore lagoon waters and those in center of the lagoon.

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