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Factors influencing mangrove carbon storage and its response to environmental stress

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Mangrove forests serve as significant carbon sinks and play a crucial role in mitigating
climate change. Currently, the response of mangroves to intensified climate change
and human activities, and the factors that influence the magnitude of carbon storage
in their sediments remain uncertain. To address these questions, two sediment cores
were collected from the mangrove reserve in Pearl Bay, Guangxi, China. The activity
of ^{210}Pb in the sediment, grain size, bulk elemental composition, stable carbon
isotopes, lignin, and different sediment organic matter (OM) fractions were
investigated to determine the local mangrove's response to climate change and
human activities, as well as the factors influencing its carbon storage. The results
showed mangrove forests with lower tidal ranges, slower sedimentation rates, and
where OM predominantly originated locally tend to have larger carbon stocks. The
mangrove OM (MOM) decreased progressively from the bottom to the top of the
cores, indicating that the mangroves in Pearl Bay have possibly undergone
degradation, which was further substantiated by the decrease in lignin content.
Based on these results, the entire cores were divided into two stages: stable stage 1
(1963–2001) and degradation stage 2 (2001–2020). The cause of the mangrove
degradation is likely due to the impact of human activities; however, these impacts
are anticipated to gradually lessen in the future due to mangrove protection policies.
Our results indicate that lignin can track and predict mangrove growth trends and
provide guidance for the sustainable management of mangrove ecosystems.