Paleo-Hazard Recognition in Coastal Settings—Microfossil Determinations of the History and Precursors of Major Catastrophic Events

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ABSTRACT

Many catastrophic events (e.g., earthquakes, large storms) occur on or close to ocean coastlines and because over 50% of the world's population lives within 100 km of a coastline, advance notification of more than a few hours of hurricanes/typhoons, tsunami, or earthquakes is important. In this respect, the history of occurrence of these is essential in understanding and planning for such events. Cores taken in coastal areas, particularly wetlands, can provide indications of periodicity or repetitions of hurricanes/typhoons, earthquakes, and tsunami. Around the Pacific Rim, particularly on the west coast of North America, a "precursor" event a few years before an actual megathrust earthquake in coastal sediments has been detected, suggesting a possible advance warning mechanism.

Microfossils provide accurate paleo-indications from small diameter cores that are not readily obtainable by any other means. In particular, marsh foraminifera provide an accurate paleo-measurement of former sea levels and are a key to detecting small sea-level and crustal movements prior to megathrust earthquakes. These fossils are also useful for determining the presence of tsunami layers that are re-deposited from deeper water depths and the periodicity of such events at any one site. The same is true along coasts prone to hurricane/typhoon strikes. Foraminifera from a marsh indicate the origin of sand layers—if the layer has an abundance of calcareous offshore foraminifera, it very likely resulted from a violent storm, because normal storms usually do not rework offshore material over a beach ridge and into wetland areas. These layers are rapidly buried and leave an excellent record of hurricanes in the coastal setting. With sufficient records, probabilities of hurricane strikes, tsunami occurrences, earthquakes, and precursors to megathrust earthquakes can be determined for specific areas that could save many lives with the development of early warning systems.

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