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Paleotsunami records from arid environments: an example from Sur Lagoon, Oman

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The seismically active Makran Subduction Zone (MSZ), located in the northern Arabian Sea, has previously generated tsunamigenic-earthquakes that have impacted the coastlines of Iran, Pakistan, India, and Oman. The historical record of tsunamis impacting this region is limited to only a few accounts spanning the last 2000 years; resulting in uncertainty over the recurrence interval and possible magnitudes of earthquakes originating from the MSZ. Coastlines of the Arabian Sea may contain sedimentary evidence of past tsunamis that have occurred over the last several millennia, however, these coastlines are predominantly arid and few tsunami indicators are developed for these settings. In arid environments, where physical weathering due to wind exposure is common, settings conducive to the preservation of tsunami deposits are generally limited to low-energy marginal marine environments such as lagoons. These environments can be problematic for identifying tsunami deposition due to the lack of contrast between the marine-influenced tsunami deposit and the surrounding marginal marine sediment.

In this study, we develop a suite of paleontological proxies that are used to document an anomalous shell bed in Sur Lagoon, Oman, inferred to be from the most recent Makran tsunami in 1945. The 1945 tsunami deposit consists of a coarse shell-rich layer with distinctive taphonomic and stratigraphic characteristics that extends laterally throughout the 12-km2 lagoon. Our findings indicate that the combination of foraminifera and mollusk taphonomic analysis can be used to delineate the 1945 tsunami deposit from normal background sedimentation in an arid intertidal environment. Within the 1945 tsunami deposit, high abundances of angular shell fragments, articulated bivalves (out of life position), and calcified fossil foraminifera support an offshore provenance. Below the 1945 deposit, seven anomalous sand layers (10-35 cm thick) were found separated by sandy-mud. We have attributed the seven layers to overwash deposition because they have features consistent with the 1945 tsunami deposit such as fining upward sequences, a sharp basal contact, and marine foraminifera (e.g., Amphistegina sp., Ammonia inflata, planktics). Ongoing analyses will constrain the timing of each of the seven overwash layers and will assess relative magnitudes of the events that deposited them.