

# **THE POTENTIAL OF TSUNAMI GENERATION ALONG THE MAKRAN SUBDUCTION ZONE IN THE NORTHERN ARABIAN SEA - CASE STUDY: THE EARTHQUAKE AND TSUNAMI OF NOVEMBER 28, 1945**

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## **ABSTRACT**

Although large earthquakes along the Makran Subduction Zone are infrequent, the potential for the generation of destructive tsunamis in the Northern Arabian Sea cannot be overlooked. It is quite possible that historical tsunamis in this region have not been properly reported or documented. Such past tsunamis must have affected Southern Pakistan, India, Iran, Oman, the Maldives and other countries bordering the Indian Ocean.

The best known of the historical tsunamis in the region is the one generated by the great earthquake of November 28, 1945 off Pakistan's Makran Coast (Balochistan) in the Northern Arabian Sea. The destructive tsunami killed more than 4,000 people in Southern Pakistan but also caused great loss of life and devastation along the coasts of Western India, Iran, Oman and possibly elsewhere.

The seismotectonics of the Makran subduction zone, historical earthquakes in the region, the recent earthquake of October 8, 2005 in Northern Pakistan, and the great tsunamigenic earthquakes of December 26, 2004 and March 28, 2005, are indicative of the active tectonic collision process that is taking place along the entire southern and southeastern boundary of the Eurasian plate as it collides with the Indian plate and adjacent microplates. Tectonic stress transference to other, stress loaded tectonic regions could trigger tsunamigenic earthquakes in the Northern Arabian Sea in the future.

The northward movement and subduction of the Oman oceanic lithosphere beneath the Iranian micro-plate at a very shallow angle and at the high rate is responsible for active orogenesis and uplift that has created a belt of highly folded and densely faulted coastal mountain ridges along the coastal region of Makran, in both the Balochistan and Sindh provinces. The same tectonic collision process has created offshore thrust faults. As in the past, large destructive tsunamigenic earthquakes can occur along major faults in the east Makran region, near Karachi, as well as along the western end of the subduction zone. In fact, recent seismic activity indicates that a large earthquake is possible in the region west of the 1945 event. Such an earthquake can be expected to generate a destructive tsunami.

Additionally, the on-going subduction of the two micro-plates has dragged tertiary marine sediments into an accretionary prism - thus forming the Makran coastal region, Thick sediments, that have accumulated along the deltaic coastlines from the erosion of the Himalayas, particularly along the eastern Sindh region near the Indus River delta, have the potential to fail and cause large underwater tsunamigenic slides. Even smaller magnitude earthquakes could trigger such underwater landslides. Finally, an earthquake similar to that of 1945 in the Makran zone of subduction, has the potential of generating a bookshelf type of failure within the compacted sediments - as that associated with the "silent" and slow 1992 Nicaragua earthquake - thus contributing to a more destructive tsunami. In conclusion, the Makran subduction zone has a relatively high potential for large tsunamigenic earthquakes.