When is a Tsunami not a Tsunami? When is it a Storm?

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ABSTRACT

A key issue for reconstructing lengthy chronologies of coastal hazards is the ability to identify paleostorm and paleotsunami deposits. In essence, it is rather useful to be able to tell the difference between them. The deposits however often look similar and both are generally what might be termed "deposits out of place" such as sand units in peat or estuarine mud.

Intuitively it seems logical that there should be some fundamental differences between storm and tsunami deposits since they are laid down by two fundamentally different processes. A tsunami consists of seismically-induced waves. Individual waves that leave a deposit inundate the land for a matter of minutes and are associated with high energy levels in both runup and backwash. Tsunamis usually consist of a few high velocity, long-period waves that entrain sediment from below storm wave base, the shoreface, beach, and landward by-pass zone. Sediment is transported primarily in suspension, and material is distributed over a broad region where sediment falls out of suspension when flow decelerates. Flow depths can exceed 10 meters. Storms, on the other hand, consist of meteorologically induced waves that can inundate the land, almost continuously, for many hours with highly variable energy levels. Storm inundation is usually gradual and prolonged, consisting of many waves that erode beaches and dunes with no significant overland return flow until after the main flooding. Sediment is transported primarily as bed/traction load that is deposited within a zone relatively close to the beach. Storm flow depths are commonly less than three meters.

Two main approaches have been adopted for studying the differences between storm and tsunami deposits. First, researchers have studied areas where there has been a fortuitous preservation of both types of deposit at the same location. This reduces the variability of physical characteristics found when comparing storm and tsunami deposits from different sites. This approach has been explored for historical and prehistoric deposits. Second, comparing and contrasting the characteristics of storm and tsunami deposits from different sites. Physical characteristics will vary between sites, but a study of a more diverse range of depositional conditions might provide a better opportunity to identify differences between the two processes. This approach has been based upon a detailed study of recent documented events.

In general terms the results are the same, although there are numerous provisos, not the least of which is that the identification of distinguishing characteristics depends upon their preservation potential. Recent recognition of the "taphonomy" of tsunami deposits acknowledges that over time several distinguishing characteristics may become less distinct. There are marked differences however in sediment composition, texture, grading, stratification, thickness, geomorphology, and topographic interactions. Tsunami deposits are generally thinner than those of storms, they can extend hundreds of meters

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inland, fill microtopography, create a new macrotopography, and usually comprise a single bed that is normally graded overall, or that consists of only a few thin layers. Ripup clasts, internal mud laminations, and flow indicators showing runup and backwash can also be present.