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The preservation potential of siliciclastic onshore tsunami deposits – A 2012 re-survey of the deposits of the February 27, 2010 Chile tsunami

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In the last decades numerous post-tsunami surveys resulted in the recognition of a set of sedimentary and erosional structures typical of but not unique to onshore tsunami deposits. This absence of unique tsunami depositional structures hampers the unequivocal recognition of paleotsunami deposits in the geological record. The style and potential of preservation of such deposits depends on climate, post-seismic geomorphic changes and burial history. The interaction of these processes, and potential others, is poorly understood.
Earlier we reported detailed accounts of the tsunami sediments deposited by the February 27, 2010, Chile tsunami at several sites of the coast of Central Chile including Isla Mocha. In April 2012 we conducted a re-survey of some of those sites studied by us two years earlier in order to explore the preservation potential of tsunami deposits.
A striking feature at many sites including Tirúa and Isla Mocha is the development of a vegetation ground cover now almost completely canopying the sandy and gravelly tsunami sediments. At Isla Mocha, inflow and backflow sediments had been deposited. Inflow sediments comprised mainly of fields of blocks and boulders with weights of up to 12 t. Boulders consist of clayey fine-grained sandstones derived from the island's bedrock which in many cases are now disintegrating along networks of joints similar in appearance to desiccation cracks. Boulder dimensions thus decreased from the m scale to the few dm and even cm scale. Incrustations of dried marine algae were already chipped off from the majority of the boulder surfaces, deleting the direct evidence for their intertidal marine provenance. Weathering causes exfoliation of the rock surfaces resulting in sediment consisting of individual grains and small flakey rock fragments accumulating around the boulder bases.
Back flow sediments and particularly sandy back flow fans developed on the lower coastal plain became almost invisible due to the new vegetation cover. Their previously prominent morphological expression due to their original thickness of 20 cm has largely disappeared. The depositional fronts of the fans may still express themselves by slight changes in vegetation density. The back flow sediments themselves have been slightly compacted. Backflow soil rip-up clasts of up to 25 cm diameter were lost.
At La Trinchera post-seismic subsidence of over 5 cm led to inundation of large parts of the coastal plain which was partially covered by tsunami sand sheets in 2010. At elevated localities the tsunami sands show a decrease from the original thickness of 15-20 cm by a few cms, and a c. 20% loss of heavy minerals.
Our results contradict the general view that cold, humid climates, such as Central Chile, possess a moderate to high preservation potential of tsunami sediments. Here we document that significant changes to the composition, thickness and geometry of onshore tsunami sediments are occurring within less than two years of an event. Prominent features like boulders are equally rapidly broken down to a number of significantly smaller fragments, depending on lithology. Extrapolating speculatively from our observations after two years the boulders at Isla Mocha may largely be disintegrated to clay to gravel sized accumulations within c. 10 years.