Determining the magnitude, frequency and source of prehistoric events - Is there a Holy Grail?

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Over the last five years there has been a growing body of literature on efforts to try and identify evidence for prehistoric precursors of the 2004 Indian Ocean Tsunami. Similar work is also being carried out in many parts of the World and evidence for palaeotsunamis is slowly emerging – this is commendable. In some cases extensive databases for individual events have been, and continue to be, assembled. The Storegga Slide off Norway is probably the most comprehensive dataset collated for a single event and provides an excellent example of how the source and magnitude of a prehistoric tsunami can be assessed. As an increasing amount of information is gathered a growing number of palaeotsunamis are being recognised as "hybrids" - events that are historic in one country and prehistoric in another. The 1700AD Cascadia event is probably the most well-known of these, although the 1575AD Chilean tsunami is another one of increasing importance. Hybrid tsunamis help us to better understand the nature and extent of palaeotsunamis in regions with short historical records – Pacific Island nations are an excellent example.

Globally, we are recognising that the study of contemporary tsunamis is a multi-disciplinary field. Not surprisingly, the same applies to palaeotsunamis. The collation and interpretation of data for these prehistoric events however, is fraught with difficulties and currently nearly every palaeotsunami database that has been developed consists almost entirely of geological data. In an increasingly multidisciplinary field this is severely limiting.

We provide three examples from the New Zealand palaeotsunami database – one includes a range of multi-disciplinary data for a local event, another is a distantly sourced hybrid, and the final one looks at regional source identification using multiple contemporaneous deposits. This is quite a remarkable dataset, but it throws up some interesting issues. To be able to effectively identify regional and distant palaeotsunami sources, we need to be able to compare and contrast between national databases. This can only happen if databases exist and are compatible – for example, are the criteria used for palaeotsunami interpretations consistent? Similarly, to be able to start commenting on the magnitude and frequency of palaeotsunamis from local, regional and distant sources there need to be regional and national databases to refer to. Surprisingly, this is rarely the case. We highlight this issue with reference to palaeotsunami data from the Pacific Ocean.

Palaeotsunami magnitude, frequency and source (PMFS) modelling can be and has been achieved albeit with some caution. While it is acknowledged that any single palaeotsunami database will never be entirely complete and we may therefore never be fully able to determine the PMFS for any one region, this does not mean that is has no value. Far from it, after all every single historical database is also incomplete and they are regularly used for probabilistic tsunami hazard modelling. Is there a Holy Grail? In many ways it largely depends upon whether you think the cup is half full or half empty.