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Towards a standardised procedure in Earthquake Archaeology

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Archaeoseismology is currently at the centre of some controversy, with criticisms over the extent to which this research field can contribute to seismic-hazard analysis. Addressing these concerns – in other words, refining the utility of archaeologically-derived earthquake information to permit its inclusion in earthquake-hazard assessments – requires first a systematic, quantitative and interdisciplinary approach to the seismo-cultural record.

Here, we modify a semi-quantitative logic-tree formalism developed for palaeoseismology (Atakan et al. 2000) to explore a methodological scheme that can track uncertainties in successive stages of archaeoseismological investigation. In this scheme, the six interpretative stages (tectonic setting; site environment; site potential; identification of earthquake damage; dating of earthquake damage; regional correlation) conform to nodes on a logic tree at which different alternatives can be described, along with their associated uncertainties.

The most simple logic-tree approach is adopted, whereby each node has only two alternatives, one representing the preferred solution and the other the sum of all remaining alternatives. The end-result of our logic-tree formalism is a value that expresses the level of certainty to which an archaeological site has recorded a palaeoearthquake and thus reflects its relative significance with respect to a seismic-hazard analysis; we call this measure the *Archaeoseismic Quality Factor* (AQF).

We illustrate how the methodological scheme might work by applying it to Sagalassos in southwest Turkey, an archaeological site for which earthquake effects are extensively reported (Sintubin & Stewart 2008). Although we derive an AQF from our critical review of the Sagalassos dataset, this value is currently meaningless without comparative assessments from other sites. Once equivalent reappraisals of earthquake evidence at other archaeological sites are available, the relative significance of the Sagalassos AQF can be appreciated.

Nevertheless, our logic-tree analysis of Sagalassos does reveal some immediate benefits. In particular, the varying levels of uncertainty that we assign for different stages in the logic tree allow us to identify key weaknesses in the earthquake hypothesis at Sagalassos, deficiencies that might be redressed through future investigations on site.

The logic-tree scheme promotes active collaboration between specialists in different research fields, and may serve as a way of integrating the remarkably disparate elements of archaeoseismological research (geology, geomorphology, archaeology, history, anthropology, engineering, seismology, geophysics, etc) in a rigorous, workable methodological framework. Moreover, the logic-tree formalism offers the potential of a standardised procedure to compile, categorise and evaluate archaeoseismological information in a semi-quantitative form that might, with refinement from wider earthquake archaeology studies, be appropriate for seismic-hazard analysis.

Literature

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