



## Three Millennia of Seemingly Time-Predictable Earthquakes, Tell Ateret

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Among various idealized recurrence models of large earthquakes, the “time-predictable” model has a straightforward mechanical interpretation, consistent with simple friction laws. On a time-predictable fault, the time interval between an earthquake and its predecessor is proportional to the slip during the predecessor. The alternative “slip-predictable” model states that the slip during earthquake rupture is proportional to the preceding time interval. Verifying these models requires extended records of high precision data for both timing and amount of slip. The precision of paleoearthquake data can rarely confirm or rule out predictability, and recent papers argue for either time- or slip-predictable behavior.

The Ateret site, on the trace of the Dead Sea fault at the Jordan Gorge segment, offers unique precision for determining space-time patterns. Five consecutive slip events, each associated with deformed and offset sets of walls, are correlated with historical earthquakes. Two correlations are based on detailed archaeological, historical, and numismatic evidence. The other three are tentative. The offsets of three of the events are determined with high precision; the other two are not as certain. Accepting all five correlations, the fault exhibits a striking time-predictable behavior, with a long term slip rate of 3 mm/yr. However, the 30 October 1759  $\sim 0.5$  m rupture predicts a subsequent rupture along the Jordan Gorge toward the end of the last century. We speculate that earthquakes on secondary faults (the 25 November 1759 on the Rachaya branch and the 1 January 1837 on the Roum branch, both  $M \geq 7$ ) have disrupted the 3 kyr time-predictable pattern.