Tectonic Crossroads: Evolving Orogens of Eurasia-Africa-Arabia

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AN INTEGRATED HISTORY OF PALEOEARTHQUAKES ALONG THE NORTH ANATOLIAN FAULT (TURKEY)

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The North Anatolian Fault is a 1400 km long right-lateral strike-slip fault that accommodates the extrusion of the Anatolian microplate away from the Arabian-Eurasian collision zone. During the 20th century the fault has ruptured over 900 km in a westward propagating sequence of eight earthquakes of magnitude greater than 7. This migrating sequence suggests a simple seismic cycle characterized by nearly equal stress loading and strain release. This view is confirmed by the concordance between the fault slip rate deduced from dated offset geomorphological markers and the crustal loading inferred from geodetic data. However until now paleoseismological data available along the fault were too sparse to confirm if the North Anatolian Fault typically fails in bust of seismicity like the 20th century sequence.

Here we reanalyze selected paleoseismic trenching investigations using Bayesian statistical modelling to determine an accurate record of the temporal probability distribution of earthquakes. The data is then combined with paleoseismic sedimentary records obtained from lakes along or near the fault to check the completeness of the earthquake catalogue. Indeed lacustrine sediments contain a continuous record of all environmental stress including earthquake whereas erosion and/or non-deposition can occur in terrestrial sedimentary trap trenched in classical paleoseimic investigations. The analyze shows that west of the Marmara Sea, the 600 km long fault segment extending between the Erzincan Basin in the east and the Bolu/Gerede towns in the west has ruptured in sequence during the 17th century (1668 earthquake sequence), 13th century, 11th century and 5th century. The seismic behavior around the Marmara Sea is still unclear due to the lack of long-term paleoseimic records available.

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