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Seabed samples rewrite earthquake history near Istanbul

SAN FRANCISCO – Located in the Marmara Sea, major earthquakes along the North Anatolian Fault (NAF) system have repeatedly struck what is current-day Istanbul and the surrounding region, but determining the recurrence rate has proven difficult since the faults are offshore. Cores of marine sediment reveal an earthquake history of the Çınarcık Segment, a main segment of NAF, and suggest a seismic gap where the next earthquake is likely to rupture, as detailed in a new study published in the *Bulletin of the Seismological Society of America* (*BSSA*).

The area has experienced several large earthquakes (>M6), and the scientific community has debated the exact location of the ruptures along the North Anatolian Fault, which extends nearly 750 miles across Northern Turkey and in the Aegean Sea. Most of the deformation on the fault is localized on the northern branch of the NAF, which crosses the Marmara Sea.

"The important part of this study is that it assigns past earthquakes to specific segments of the fault," said lead author Laureen Drab, a seismologist at the Ecole Normale Superieure in Paris, France. "Knowing which segment ruptured when has a big impact on the recurrence rate of earthquakes on the main fault segment that affects Istanbul."

Drab and her colleagues examined two cores of sediment deposits removed from the seabed to identify and date widespread quake-induced disturbances. Large earthquakes on submarine faults can cause underwater landslides, shaking up sediments that result in rapidly deposited layers, or turbidites, of silt and sand of jumbled grain sizes, minerals and specific geochemical properties. Radiocarbon dating and other tests of two core samples identified the age and timing of deposits.

Combining the historical catalogue and the new data from the core samples, Drab reconstructed the timing of earthquakes along NAF's main segment. The turbidites reveal six large earthquake-related events, from 136 to 1896 AD, along the Çınarcık Fault and reassigned the 1766 AD rupture previously thought to have occurred on the Çınarcık Fault to another segment.

"The combined records show three entire rupture sequences on the NAF, with the current

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sequence incomplete along the Çınarcık Fault," said Drab. "Based on this new data, we see that there is a seismic gap on the Çınarcık Segment, which, from my point of view, is where the next earthquake is likely to occur."

Drab's co-authors on the study include Aurelia Hubert-Ferrari, Sabine Schmidt, Philippe Martinez, Julie Carut and Meriam El Ouahabi. The paper will be published online March 31st.

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