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Which mechanical model for the Sea of Marmara releasing bend?

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The Sea of Marmara lies on a major releasing bend along the North Anatolian Fault (NAF). Its present kinematics is currently debated. Three different classes of models have been proposed. The recent structures in the Sea of Marmara result mainly from (1) distributed Aegean extension, (2) pure strike-slip along a single throughgoing fault, or (3) oblique pull-apart extension across a stepover of the NAF. Disagreement is about the geometry and kinematics of faults observed at the surface. Differing conceptions of the rheology of the continental lithosphere stand behind this disagreement. Correspondingly, in those views the lithosphere (1) is viscous and drives from below the motion of upper crustal blocks, (2) is rigid and all the deformation occurs at the boundaries of rigid-blocks, or (3) is elastic-plastic involving plastic slip on faults and elastic deformation between faults. To determine the long-term kinematics of the Marmara Sea region geological and morphological features are critical. The present-day kinematics can be derived from the GPS data. Both the long- and short-term kinematics of the Sea of Marmara region prove consistent with the pull-apart model. Thus the same kinematics seems to have persisted throughout the formation of the pull-apart and requires asymmetric slip partitioning within the Sea of Marmara region. We also find that the deformation of the Sea of Marmara region is driven by the broader motion of Anatolia extrusion as derived from space geodesy. Distributed Aegean extension is not required to reconstruct the geology, nor to model the GPS. A throughgoing strike-slip fault may locally explain the GPS data but is inconsistent with the extensional Marmara stepover. The large scale partitioning and the oblique motion in the bend appear imposed by the plate boundary conditions and the large scale processes involved in the formation of the Sea of Marmara pull-apart require elastic interactions at the scale of the lithosphere.