Unusual Mw 7.0 Extensional Aegean Earthquake Related to African Slab Rollback and Formation of Extensional Plate Boundary in Anatolia

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A devastating M 7.0 earthquake on October 30, 2020, offshore Samos Island, Greece, was a consequence of the Aegean and Anatolian upper crust being pulled apart by north-south extensional stresses resulting from slab rollback, where the African plate is subducting northwards beneath Eurasia, while the slab is sinking by gravitational forces, causing it to retreat southwards. Since the retreating African slab is coupled with the overriding plate, it tears the upper plate apart as it retreats, breaking it into numerous small plates with frequent earthquakes along their boundaries. The earthquake happened offshore of the extensional Büyük Menderes Graben, where a 150 km long, 10 km wide, incipient upper plate rift system formed in the Anatolian plate, showing that the entire Aegean-Western Anatolian region is being pulled apart by extensional stresses related to the slab rollback. Earthquake solutions and fault plane studies around western Anatolia support this spectacular extension, and show that the modern extension was preceded on many faults by oblique extension and strike-slip motions, perhaps reflecting a change in tectonic setting from sideways escape from the Africa-Arabia collision with Eurasia, to the pure extension related to slab rollback of the African plate, and the retreat of the Hellenic trench. Historical earthquake swarms and deformation of the upper plate in the Aegean have been associated with massive volcanism and cataclysmic devastation, such as the M 7.7 Amorgos earthquake in July 1956 between the islands of Naxos and Santorini (Thera). Even more notable was the eruption of Santorini 3650 years ago, which contributed to the fall of the Minoan civilization. The Samos earthquake highlights the long historical lack of appreciation of links between deep tectonic processes and upper crustal deformation and geological hazards, and is a harbinger of future earthquakes and volcanic eruptions, establishing a basis for studies to institute better protection of infrastructure and upper plate cultures in the region. Further detailed studies are needed in this area to better understand and predict earthquake frequency, possible locations, and to establish better building codes to protect people's lives and property.