Contemporary Kinematics of the South Aegean Area (Greece) Detected with Continuous GNSS Measurements

Vassilis Sakkas, Chrysa Doxa, Andreas Tzanis, and Haralambos Kranis
National & Kapodistrian University of Athens, Department of Geology and the Geoenvironment, Athens, Greece (vsakkas@geol.uoa.gr)

We examine the kinematic characteristics of the crustal deformation in the broader southern Aegean region using 47 permanent GNSS stations distributed across the eastern Peloponnesus, Attica, Cyclades, Dodecanese, Crete and the coast of western Anatolia. Our analysis is based on the study of velocity vectors relative to local reference points at the western and eastern halves of the study area, as well as on the strain field calculated from absolute velocity vectors across the study area. We demonstrate that the South Aegean region undergoes complex distributed block deformation.

At the eastern end of the study area this varies from N210°-N220° extension and with crustal thinning across NE Peloponnesus – Attica, to N210°-N220° compression between the central-eastern Peloponnesus and western Crete, both consistent with the geodynamic setting of the Hellenic Subduction System.

A principal feature of the S. Aegean crust appears to be a broad shear zone extending between the islands of Samos/Ikaria and Kalymnos, Paros/Naxos and Amorgos and Milos – Santorini; It exhibits left-lateral kinematics and its southern boundary appears to coincide with the Amorgos – Santorini ridge and comprise the Anhydros basin and associated volcanic field (including Columbo and Santorini). Significant WNW-ESE crustal thinning is observed within the zone.

The area of the Dodecanese, to the south of Kalymnos and east of Astypalaea and north of Rhodes appears to undergo severe crustal thinning in the NW-SE direction while the SE rim of the Aegean Plate appears to undergo thinning in the NE-SW direction. Finally, the abrupt increase in velocity between eastern Crete and Karpathos island indicates the presence of a very significant N-S tectonic boundary of unknown as yet nature, extending between 35°N and 36°N at least.

In order to assign some values to the above qualitative description, we note that with respect to a reference point at Anavyssos, Attica, the distribution of velocities allows identification of four and possibly five major tectonic blocks with different kinematics, whose location, direction of motion and average velocities respectively are:

- Samos – Ikaria and Naxos-Paros-Amorgos group of islands, N220° and 1.5mm/yr respectively.
- The south-western Cyclades (Anafi, Ios, Antiparos, Milos, Folegandros, Sikinos and Santorini
group of islands, N210° and 3.3 mm/yr.
- The northern Dodecanese (Kalymnos, Kos, Astypalaea group), N150° and 3.0 mm/yr.
- The southern Dodecanese (Nisyros, Telos, Rhodes, Karpathos group), N120° and 7.4 mm/yr respectively.
- The Cretan Sea and Crete, N160° and 2.0 mm/yr respectively.

An interpretation of the nature and kinematics of the boundaries between these blocks will be presented and discussed. Overall, the south Aegean appears to undergo distributed block deformation associated with a rather complex kinematic pattern, the nature of which remains to be confirmed, validated and explained with future research.

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