



Kinematics of structures and active tectonics of an active orogenic belt, Alborz Mountains, northern Iran: New insights from scaled analogue modelling

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Analogue and numerical modelling have been used to simulate spatial-temporal evolution of structures formed during evolution of the orogenic belts. However, few modeling studies have focused on the deformational styles of oblique shortening or indentation. This paper investigates the influence of South Caspian Basin (SCB) motion since the past 12 Ma on the kinematic of the structures and active tectonics of the Alborz Mountains by conducting scaled analogue models.

The modeling approach illustrates the sequential development of an arcuate-shape foreland-propagating imbricate stack in front of a rigid indenter during the orthogonal and subsequent shortening. The orthogonal shortening characterize by a prevailing dextral and sinistral oblique-slip motion in the east- and west-side of the models. According to our analyses, the oblique shortening is substantially accommodated by the sinistral transpression in the sand wedge borders and internal uplift. The oblique shortening is associated with the consistent sinistral motion on the WNW-striking oblique-slip thrusts, whereas the east-west thrusts and ENE-striking dextral oblique thrusts reactivate as the sinistral oblique thrusts.

Quantification of the model surface deformation approves shortening partition by the foreland-vergent sinistral thrusting in the south and hinterland-vergent back thrusting in the north. The similarity of our model with nature is examined with the geologic, geodetic and seismicity of the Alborz and suggest concentration of moderate- to large-magnitude earthquakes (M_w up to 7.4-7.7) with a recurrence interval of ~ 700 -1300 years predominantly along the frontal sinistral-slip thrusts in the southern margin of Alborz and much less on the hinterland-vergent back thrusts in the south of Caspian Sea. Model results also suggest that short-lived back-thrusts of the south central Alborz could reactivate and sustain destructive earthquakes in the capital city of Tehran.

Key words: Oblique shortening, scaled analogue modelling, active tectonics, Alborz Mountains, northern Iran.