

GPS Evidence for Northward Motion of the Sinai Block: Implications for E. Mediterranean Tectonics

Salah Mahmoud » Geological & Planetary Science-Geodynamics Group, Massachusetts Institute of Technology

Robert Reilinger » Geological & Planetary Science-Geodynamics Group, Massachusetts Institute of Technology

Simon McClusky » Geological & Planetary Science-Geodynamics Group, Massachusetts Institute of Technology

Philippe Vernant » Geological & Planetary Science-Geodynamics Group, Massachusetts Institute of Technology

Ali Tealeb » Geological & Planetary Science-Geodynamics Group, Massachusetts Institute of Technology

GPS survey sites in the Sinai Peninsula show northerly motion relative to Africa (Nubia) at 1.4 ± 0.8 mm/yr north and 0.4 ± 0.8 mm/yr west (Figure 1). Continuous International GPS Service (IGS) sites in Israel, west of the Dead Sea fault show a similar northerly sense of motion relative to Nubia (2.4 ± 0.6 mm/yr north and 0.04 ± 0.7 mm/yr east), suggesting that the entire Sinai Block south of Lebanon is characterized by northward translation relative to the Nubian plate. We develop an elastic block model constrained by the GPS results that is consistent with the regional tectonics and allows us

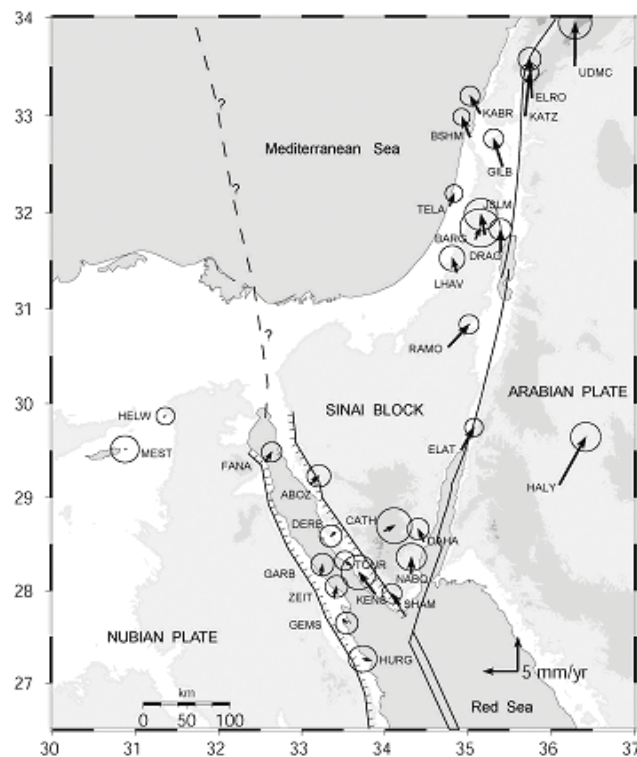


Figure 1. Simplified tectonic map of the Sinai and surrounding regions showing GPS velocities and 95% confidence ellipses relative to Nubia. Lines with tick-marks are normal faults, ticks on downthrown block, double line is Red Sea rift, plain lines are strike-slip faults. GPS velocities are given in Table 1.

References

Mahmoud, S., R. Reilinger, S. McClusky, P. Vernant, and A. Tealeb, GPS evidence for northward motion of the Sinai block: Implications for E. Mediterranean tectonics, *Earth and Planetary Sci. Lett.*, 238, 217-227, 2005.

to estimate slip rates for Sinai bounding faults, including the Gulf of Aqaba – southern Dead Sea fault system ($\sim 4.4 \pm 0.3$ mm/yr, left lateral), the Gulf of Suez (1.9 ± 0.3 mm/yr left lateral, and 1.5 ± 0.4 mm/yr extension), and the Cyprus Arc (predominantly convergence at 8.9 ± 0.4 mm/yr along the western segment, and $\sim 6.0 \pm 0.4$ mm/yr left-lateral, strike-slip along the eastern segment) (Figure 2). These observations imply that the Sinai Peninsula and Levant region comprise a separate sub-plate sandwiched between the Arabian and Nubian plates.

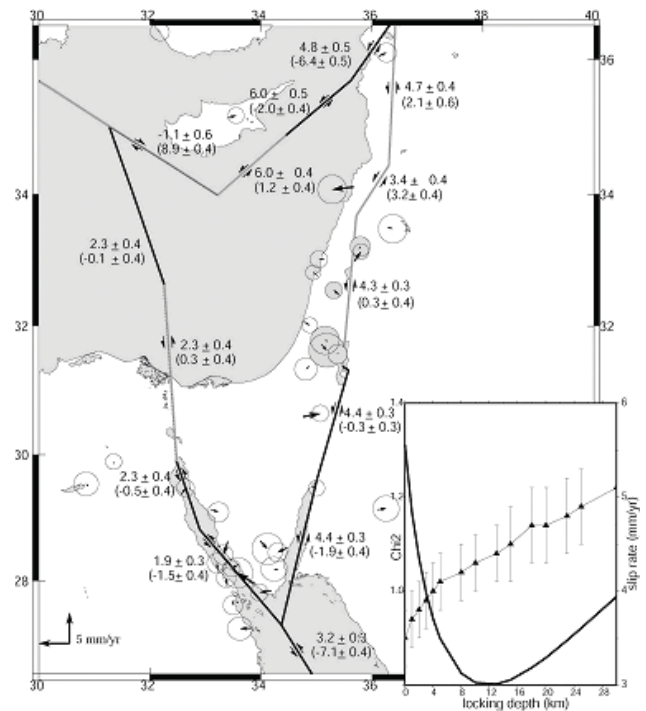


Figure 2. Elastic block model for the Sinai area showing GPS residual velocities. Faults are vertical and assigned locking depths of 15 km except for the Gulf of Aqaba/Dead Sea fault system that has a locking depth of 13 km, and the western Cyprus Arc that has a 30° dip down to the NE. Numbers show fault strike slip and fault normal slip rates and 1-sigma uncertainties (fault normal component in brackets; negative for left-lateral and extension). Slip rates are averages along each segment. Light modeled faults indicate segments with fault-normal shortening, and dark extension. Inset shows a plot of the local χ^2 computed from sites close to the fault (shaded error ellipses indicate sites used to estimate fault locking depth) and estimated fault strike slip rate as a function of the locking depth for the Dead Sea Fault. The best fit is for a 13 km locking depth and a strike slip rate of 4.3 mm/yr.