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Active tectonics of Iran and the South Caspian: from earthquakes to mountain-building

Richard Walker (1), Yevgeniy Bezmenov (2), Andrew Carr (3), Nicholas Dodds (1), Christoph Gruetzner (4), James Hollingsworth (5), James Jackson (6), Robert Mirzin (2), Zahra Mousavi (7), Ed Rhodes (8), Morteza Talebian (9), and Andrea Walpersdorf (5)

(1) University of Oxford, Department of Earth Sciences, Oxford, United Kingdom (rtwalker.oxford@gmail.com), (2) National Academy of Sciences, Institute of Seismology and Physics of the Atmosphere, Ashgabat, Turkmenistan, (3) University of Leicester, School of Geography, Geology, and the Environment, Leicester, UK, (4) Friedrich Schiller Universitat, Jena, Germany, (5) Universite Grenoble Alpes, ISTerre, Grenoble, France, (6) University of Cambridge, Bullard Laboratories, Madingley Road, Cambridge, CB3 0EZ, (7) IASBS, Zanjan, Iran, (8) University of Sheffield, Department of Geography, Sheffield, UK, (9) Research Institute for Earth Sciences, Geological Survey of Iran, Tehran, Iran

Iran is a region of widespread active deformation, faulting, and earthquakes set within the Arabia-Eurasia collision zone. We focus on the presently active tectonics of Iran, in which we are aided by the pristine landscape across the arid interior of Iran, which allows the mapping of active faults and earthquake ruptures, and by the long historical record that gives us insight into the distribution and style of earthquakes over appropriately long timescales. There is a societal motivation in the study of earthquakes and active faults in Iran, as many of the towns and cities are sited close to active faults, leading to high levels of hazard for much of the population.

Our knowledge of the rates and distribution of active faulting across Iran have arisen through complementary geodetic and geologic studies over the last fifteen years, and we are now at a point where most of the deforming regions are covered by relatively dense GPS networks, and where the long-term slip-rates and earthquake histories of many of the major strike-slip and reverse faults have been determined through field-based geomorphological and palaoseismological studies. Comparisons of these datasets indicate that the present-day strain accumulation across the major fault zones is consistent with the long-term Holocene (10 ka) and late Pleistocene (10-100 ka) average slip-rates, at least within the uncertainties of our measurements.

In the later part of our talk we focus on the active faults that define the margins of the South Caspian Basin, which is itself an enigmatic deep-water basin that appears to move relative to adjacent parts of Iran and Eurasia. We report on recent field-based estimates of the major strike-slip faults in both NE Iran and Turkmenistan, which allow us to determine the rates and directions of motion relative to both Iran and Eurasia. We also uncover evidence for large earthquakes that have occurred within the last 1000 years. Comparison of the present-day fault slip-rates with cumulative bedrock displacements across the faults, and also with independent geological estimates of mountain building where available, allow us to comment on the onset of the presently active deformation in the basin interior and within the mountain ranges that surround it.