



The application of striation analysis and focal mechanism stress inversion in deducing the kinematic history of faults: Examples from the Bristol Channel UK and the Ionian Zone Greece

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The present work compliments the application of a methodology, in reviewing and investigating further the kinematic history of faults, based on striation analysis and stress inversion of earthquake focal mechanisms and combines them to refine tectonic modelling and hence improve further hazard assessment. Two areas are chosen for this application: the Bristol Channel, UK and the Ionian Zone, Greece.

Striation analysis is carried out in two complementary fault terranes. The first along the northern margin of the Inner Bristol Channel, UK, offers a natural laboratory to study in detail the reactivation history of the inverted Bristol Channel basin; and, the second along the north western coastline of the Ionian Zone, Greece, presents an opportunity to illustrate the relationship between movement of a framework of faults within the external orogenic zone of the Hellenides and the stress deduced from focal mechanisms of earthquakes in the region.

The UK example reveals phases of Mesozoic negative inversion of Late Palaeozoic basement frontal and oblique ramp thrust faults, followed by Cenozoic positive inversions of Mesozoic normal and strike slip faults. The Greek example shows an equally composite history of faulting; Tethyan basement strata contain normal faults that pass up sequence and across unconformities into Mesozoic and Cenozoic strata, with thrusts and positively inverted faults recording typical dextral transpression. The fault framework in older strata and the veneers of Recent strata above them display Neotectonic fault histories of sinistral transtension, in addition to the transpression. Since the Ionian Zone lies suitably in the external zone, deformation favours the reactivation of fault lineaments, rather than the genesis of pristine faults. Both examples are used to demonstrate this structural principle.

Focal mechanisms of Greek earthquake data are used in stress inversion and the results are applied upon the inherited fault framework and are postulated to reactivate it. For example, structures are selected in the field from the tectonised strata of northern Corfu and from recent geological maps of north western Greece. These data are used in conjunction with the results of stress inversion of focal mechanisms, in order to anticipate and then test the gross senses of fault reactivation.

Tests are investigated using structural field techniques and available international striation analysis software modules. The defined framework analysis is applied to both the data from ancient faults, in UK and the focal mechanisms of earthquakes, in Greece. Stress tensors are calculated and fault kinematic histories are evaluated. Hence, this application permits the effects of a modern stress regime to be deduced for a known fault framework, in order to complete and understand fully the kinematic history to the present day.

As a corollary, the significant field techniques of tracing major fault lines across regional unconformities and measuring the sense of displacements across these stratigraphic boundaries permit kinematic histories to be defined more precisely in both terranes, than by using only structural techniques.