REPEATED REACTIVATION OF FAULTS AND SHEAR ZONES IN THE APENNINE-MAGHREBIDE SYSTEM, ITALY: IMPLICATIONS FOR THE KINEMATIC EVOLUTION OF OROGENIC BELTS

Faults and shear zones are the most abundant structures within the Earth’s crust, and there is increasing evidence that their reactivation plays a dominant role in continental deformation (Holdsworth et al., 1997). The results of recent research show that fault reactivation is a common feature in cratons, orogenic belts and extensional basins, an argument supporting the long-held view that faults are inherently weak structures. However, examples of faults that experienced repeated episodes of reactivation through time are relatively rare: yet documentation of long-lived faults is important because it can provide valuable information on the causes leading to fault-zone weakening processes.

Italy owes its complex geological structure to a switch in tectonic regime, that involved the opening of the Tethys Ocean during Early Mesozoic time (D’Argenio and Alvarez, 1980), and its closure leading to development of the Apennine-Maghrebide fold-and-thrust belt during the Eocene-to-Recent interval (Boccaletti et al., 1980; Calamita and Deiana, 1988). Contractional deformation largely occurred under non-metamorphic conditions, migrated progressively from the present peri-Tyrrhenian areas eastwards and southwards, and is probably still active in the vicinities of the Apulian and Hyblean foreland sectors (Mantovani et al., 1997; Gueguen and Tomasi, 1999). The structures inherited from early extensional episodes often influenced the geometry and location of regionally important thrusts (Tavarnelli, 1996). The best documented example is the so-called Ancona-Anzio Line, a major arcuate fault-zone in the central Apennines, that separates the basin-derived Umbria-Marche tectonic units, to the west, from the platform-derived Latium-Abruzzi units, to the east. This fault-zone experienced extensional, strike-slip, and contractional deformations during the Jurassic, Miocene and Pliocene times, respectively (Castellarin et al., 1982).

A history of tectonic inversion is also preserved within two major fault zones, the Valnerina Line (Decandia, 1982), in the central Apennines, and the Gratteri-Mt. Mufara Line (Renda et al., 1999), in central-northern Sicily, that were repeatedly reactivated with different kinematic characters. The results of structural analyses yield relevant implications for the tectonic evolution of the Apennine-Maghrebide fold-and-thrust belt. The deformation style of this orogenic system has long been proposed to be thin-skinned, i.e. dominated by thrusts and related folds that only affect the sedimentary cover units (i.e. see Bally et al., 1986). However, recent seismic profiles across the belt have questioned the validity of this assumption, by showing that conspicuous basement slices are also locally involved within the structures that affect
the overlying sedimentary cover (Barchi et al., 1998). Our data indicate that Mesozoic fault zones emanating from the pre-triassic basement were repeatedly reactivated during the Tertiary evolution of the fold-and-thrust belt, thus supporting the view that deep basement faults locally controlled the distribution and geometry of contractional structures within the overlying sedimentary cover.

The documented history of repeated reactivation along pre-existing faults of the Apennine-Maghrebid system yields a more general implication. Our data suggest that structures produced during the early stages of continental rifting, passive margin development and ocean opening, can locally influence the final shape of younger folds and thrusts by fault-reactivation processes. These results may provide relevant constraints for regional cross-section restoration, thus leading to an enhanced understanding of the kinematic evolution of orogenic belts through geological times.

REFERENCES


