Contractional reactivation of a transpressive fault zone: Torino Hill and Monferrato domains (NW Italy)

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In the Torino Hill and Monferrato domains, a regional transpressive and polyphasic, NW-SE striking, fault zone (Rio Freddo Deformation Zone - "RFDZ", *sensu* Piana & Polino, 1995) is understood as surficial expression of a deep-seated thrust along which the metamorphic basement of the Torino Hill has overridden the Ligurian non-metamorphic nappes since the Paleogene up to Burdigalian.

This work outlines that the tectonic discontinuities associated to this deep-seated thrust have controlled, since Oligocene, the structural setting and kinematic evolution of the Torino Hill and Monferrato sedimentary successions. The Oligocene structures have been in fact reactivated in the frame of a polyphasic contractional faulting stages, lasted since Early Miocene up to Pliocene, due to the NW-ward migration of the Apennines thrust fronts into the proper Alpine belt (Pieri & Groppi, 1981).

The RFDZ consists of two predominant fault systems, striking respectively NW-SE and NE-SW and showing different age and complex crosscutting relations.

Detailed structural analyses and mapping pointed out that the RFDZ evolution is due to four main faulting stages that occurred in the frame of a continuous contractional regional deformation, and that will be described as follows:

- Oligocene *p.p.*: during this stage the NW-SE striking fault systems developed as left-lateral transtensive faults, while the NE-SW ones probably acted as extensive faults. In this way, the RFDZ defined pull-apart duplexes, as also suggested by sedimentary data;
- Late Oligocene-Aquitanian: the transtensional regime is inverted to a transpressional one, inducing left-lateral and reverse movements on the NW-SE faults, maybe related to roughly E-W regional shortening. The RFDZ pull-apart is splitted into contractional strike slip-duplexes (*sensu* Woodkock & Fisher, 1986), while in vertical section, the RFDZ defines a flower structure (*sensu* Sylvester & Smith, 1976). Faults displacement decrease gradually NW-ward and toward the surface. Consequently, the RFDZ flower structure gradually changes, from SE to NE, into an open, NW plunging, fold;
- Late Serravallian: a regional NW-SE shortening occurred in this stage. The NE-SW faults were reactivated as reverse dextral faults, while the NW-SE faults have been reactivated, with right-lateral movements, as compartmental faults that transferred the prevalent SE-directed reverse movements;
- Messinian-Pliocene: regional N-S shortening are prevalent during this stage and are consistent with the N-ward movement of the south-Padane Thrust Belt. This caused only minor displacement of Torino Hill and Monferrato domains that essentially suffered S-ward tilting. Consequently, the preexisting fault systems show only minor displacement. Nevertheless they are characterized by high intensity of deformation, interpreted as due to overpressured fluids circulation on fault surfaces. These fluids maybe squeezed from the basal surface of the south-Padane Thrust.

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