

Orogenic processes and the Alps/Apennines geodynamic evolution: insights from the Taiwan orogen

Molli G.¹ and Malavieille J.²

¹Dipartimento di Scienze della Terra, Università di Pisa, Via S.Maria, 56126 Pisa (Italia)

²Géosciences Montpellier, UMR 5243, Université Montpellier 2, 34095 Montpellier (France)
& Laboratoire International Associé “ADEPT” France-Taiwan

The Alps/Apennines system, as well as many collisional orogens through the world, shows a finite deformation produced during a long geological history which involves numerous superimposed tectonic events. As a result, complex and often contrasted reconstructions for the setting and tectonics of the different stages of the growing and interfering Alps/Apennine orogenic system have been proposed (Elter & Pertusati, 1973; Principi ad Treves, 1985; Doglioni, 1991; Vignaroli et al., 2008).

To enlight some of the geometric and kinematic signatures related to past geodynamics in the composite Alps/Apennine system we analyse the major deformation processes, their superimposition and resulting finite structural geometries in the currently growing Taiwan orogenic system.

This young orogen represents a typical example of continental subduction involving an arc/continent collision which develops in a well constrained geodynamic setting and kinematics (e.g. Suppe, 1981). The island itself represents the emerged part of a southward-propagating orogenic wedge located between the Eurasian and Philippine Sea plates. In this area the upper crust of the Chinese continental margin was accreted few Ma ago in the northwestern part of the island and it is still accreting today to the southwest, deforming against a backstop formed by the Philippine Sea Plate lithosphere and remnants of the volcanic arc.

A first order analysis of the geodynamic boundary conditions and orogenic processes of the currently ongoing Taiwan orogen can provide useful insights for a better understanding of the past kinematic relationships of the Alps/Apennines system. Among them, the following are here pointed out:

1) both orogenic systems are the result of an oblique convergence giving rise to transpressive mountain building with a large scale strain partitioning; 2) in Taiwan, obliquity of the ocean-continent transition of the Chinese continental margin relative to the orientation of subduction developed an along strike deformation propagation with transition between oceanic and continental subduction and major architectural variations through the orogenic building; 3) two opposite verging convergent plate boundaries intersect at right angle and with slabs obliquely subducting; 4) flip in subduction polarity with or without intervening slab-breakoff has been recognized as an important tectonic setting in Taiwan (Chai, 1972; Suppe, 1984, Tasi, 1986; Teng et al., 2000; Lallemand et al., 2001; Malavieille et al., 2002) as well as in the Alps/Apennine orogens (Boccaletti et al., 1971 ; Doglioni 1991; Carminati et al., 2004; Molli, 2008) and finally (5) slab rollback controlled opening of a back-arc basin and its propagation in the last My north of Taiwan into the former collisional orogen as probably occurred for the Alps/Apennine junction during Late Oligocene.

Using such actualistic superimposed geodynamic scenarios and the related first order kinematic constraints we will attempt a reconstruction of the tectonic evolution for the Alps/Apennine orogenic system foregrounding the key role of continental subduction and subduction reversal during this evolution.