the plate kinematics. In the NBNE segment, hardening in the CMB led to localization of deformation into the NSZS during the Carboniferous.

Coupling between surface processes and various modes of continental compressional deformation

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Models of tectonic deformation commonly neglect the surface processes and subsurface heterogeneities such as lateral variations in the crustal composition, minor or healed faults, assuming that they are negligible with respect to the effects of the topography and tectonic forces. Recent problems with estimation of lithospheric strength in cratons and common problems with simultaneous reproduction of realistic vertical tectonic velocities and surface geometries in the mechanical tectonic models suggest that the above factors may play a leading role in many cases. Using a forward numerical approach allows to account for brittle-elasto-ductile rheologies, erosion and non-predefined faults, we demonstrate the crucial importance of the account for the surface processes and distributed faulting in modelling of compressional deformation and orogeny. Erosion allows to obtain 10times higher vertical tectonic rates than for the conventional models, and significantly influence the evolution and distribution (spacing) of faults, finite amplitudes of tectonic movements and even the subsurface structure of the lithosphere. In contrast to the traditional opinion, our model show that volumetric shortening, folding instabilities associated with long-distance transmission of far-field tectonic stress and faulting can actually co-exist for a very long time, partly thanking to the stabilizing feedback with the surface processes. The importance of coupling between the surface and deep processes was also demonstrated in our HT-HP rock exhumation models in which we test three basic mechanisms presumably responsible for ultra-rapid exhumation, compressional instability, RT-type instability in the subducted crust, and crustal squeezing.

Mechanisms involved in the formation of the Tertiary Piemonte Basin in a collisional setting and relations between source area and basin infill from $^{40}Ar/^{39}Ar$ dating

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The Tertiary Piemonte Basin (TPB) is a syn-orogenic basin located in an area of convergence straddling the junction of the Alpine and Apennine chains. The TPB contains >4000 m of clastic transitional/marine deposits with subsidence and deposition starting in the Oligocene and continuing until the Late Miocene. During this time span important events were taking place in the surrounding areas like the continental collision between the Adrian and European plates and the opening of the Liguro-Provencal basin. Despite this, the TPB has not suffered major deformation and it is not separated by major faults from the surrounding orogen. Subsidence analyses have been carried out in order to establish the tectonic evolution of the basin and to investigate the mechanisms involved. Two main periods of subsidence are detected: the first in early Oligocene time and the second, stronger event, in middle Miocene time. The beginning of the subsidence coincides in time with the backthrust of the Brianconaise zone on the Gran Paradiso nappe, which occurred in the Western Alps 30-35 Ma ago.

To derive further information on the exhumation/erosion history of the orogen surrounding the basin and on the basin depositional pattern, $^{40}Ar/^{39}Ar$ dating has been applied to white micas from clastic sediments. The entire basin stratigraphy (early Oligocene-upper Miocene) was sampled and up to 10 grains from each sample dated. A first order age distribution shows that the conglomerates at the base of the succession were fed from a southern source area (Voltri Group and Ligurian Alps). From the beginning of the Rupelian a new source area was activated probably in the Western Alps which gradually replaced the southern one. From the Serravallian, the source area drastically changes from southern Ligurian Alps to the Western Alps.

The role of pre-existing structures in Quaternary extensional tectonics of the Southern Apennines, Italy: the Boiano Basin case history

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This talk illustrates the results of a multidisciplinary study of the Boiano Quaternary Basin (Central-Southern Apennines, Italy) in order to define its geometry and kinematics within the Apennines orogen evolution. In detail, we investigated the relationships between newly formed NW-SE extensional faults active between Middle Pleistocene and Olocene, and pre-existing geological features (essentially E-W high angle faults and the compressive thrust stack geometry) and discuss their implications in terms of active tectonics. In the end, a comparison between this case history and similar cases in the Southern Apennines is proposed. To achieve this goal we integrated new geological (from detailed field surveys, structural analysis at the mesoscale) and geomorphological data (field surveys, interpretation of aerial photographs) with subsurface data (deep well logs, seismic reflection lines, seismicity).

This study allowed the basin geometry to be rather accurately defined, the Quaternary and active extensional fault system to be reconstructed, the relationships with pre-existing features to be traced. We identified an extensional pattern including a system of synthetic and antithetic faults with the master fault dipping to the NE at an angle of about 50°–60° and developing at least for 9–10 km of depth. In detail, at surface the synthetic faults are represented by a pattern of neoformed NW–SE-trending, NE-dipping normal faults. The deformation among them is transferred by pre-existing (Late Tortonian and Late-Pliocene p.p.–Early Pleistocene) E–W-striking faults, reactivated through both dextral-transtensional and pure dip-slip movement. The hanging-wall of the master fault hosts the Boiano Basin, partially filled by an asymmetric wedge of associated Quaternary continental deposits. The thickness of these sediments increases towards the fault reaching a few hundred metres, suggesting that the system was active during their deposition.

Furthermore, available historical data suggest that the large 26 July 1805 earthquake may well have been generated by this extensional system. At a regional scale, the Boiano Basin lays along the boundary between the carbonate platform domains and the marly–clayey–arenaceous pelagic basin domains, which compose the Central–Southern Apennines chain. This first order boundary can be followed all along the southern part of the chain, and separates the orogen into two portions characterised by different topographic elevation and landforms. This boundary also appears to coincide with the concentration of the largest earthquakes of this portion of the Italian peninsula. In this context, we discuss the hypothesis that some of the features characterising the recent tectonic evolution of the study area can be recognised in other parts of the Southern Apennines, possibly contributing to the identification of yet unknown belts of recent extensional deformation eventually associated to earthquake sources.