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Lithospheric behaviour and extensional regime in the Northern Apennines: indications from rheological profile

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The aim of this work is to asses the conditions leading to extension during the tectonic evolution of the Northern Apennines starting form the reconstruction of the rheological behaviour of the lithosphere.

Despite the numerous hypothesis proposed to explain the geodynamical scenario of the NA, the marked geological and geophysical differences, collected for over a century, along the chain, underline the peculiar tectonic setting of the NA: coexistence and continuous eastward migration of both extensional and compressional structures since Lower Miocene. This coexistence occurs at any time and at any position.

As consequence of this tectonic regime, an overall thinning of the lithosphere characterized the westernmost sector of the chain (with the lithosphere-asthenosphere boundary at depth of about 30 km) and it is reflected in the high surface heat flow (> 150 mW/m^2) and provides an explanation of the positive Bouguer anomalies found in this domain (Marson et al., 1998). The easternmost sector is instead characterized by a lithospheric thickness of about 70-90 km and the Moho is located at a depth of about 35-40 km (De Franco et al., 1998). The Bouguer anomalies are negative and there are relatively low values of the heat flow (between 70 and 40 mW/m^2).

The transition between the two sectors occurs in a belt passing through the Perugia-Lago Trasimeno area and could be located west of the Val Tiberina basin where the zero of gravity anomaly occurs. In this region geophysical soundings have shown a clear image of a regional east-dipping, low-angle, normal fault (Alto Tiberina fault) that crops out west of the Tiber Valley and dips towards NE, beneath the Apennine

Chain, to a depth of about 12 km. This fault represents the youger and easternmost expression of crustal extension of the Northern Apennines (Barchi et al., 1999; Boncio et al., 2000 ; Pauselli et al., 2002).

Starting form this geological framework, rheological profiles of the lithosphere are obtained to asses the conditions leading to extension during the tectonic evolution of the Northern Apennines.

In order to do that the temperature field and the strength of the lithosphere during the evolution of the belt and in different sector of the NA, are calculated. The calculations assume that the heat is transported by conduction. Advection is also taken into account introducing a thermal perturbation migrating from west to east during the evolution of the belt. In addition, the thermal regime has been calculated considering crustal thickning in the easternmost sector of the chain contemporaneous to the advection in the western sector. The temperature field has been obtained verifying the choice of the physical parameters assigned to the terranes through the constraints offered by the Curie's isotherm and the lithosphere-asthenosphere transition.

The temperature distributions are used to determine rheological profiles for different sector of the chain in different time. In this way the strengths of the lithosphere are obtained and then comparated with the stress induced by compensated topography (Mareschal, 1994). A collection of relocated hypocenters available in this zone has been used in order to check the obtained brittle/ductile transition depth.

The calculations show that, for homogeneous crustal thickening, the advection term moving form west to east would increase the tensile stress in the area where the transition between the advection processes and the thickening processes is located. In this area the strength is reduced in such a way to trigger extension.

It is interesting to note that this procedure allows to asses the conditions leading to extension during the tectonic evolution of a belt not taking into account the formation mechanisms of the complex structure of the Apennines but taking into account the registred geophysical characteristic of the lithosphere. In this way has been possible to determine quantitatively the rheological conditions and where and when the extension could follow a compressional event. In addition, the obtained trend of the brittle/ductile transition depth points out the presence of a peculiar zone in correspondence with the seismic image of the Alto Tiberina fault. Here, the peculiarity of the brittle/ductile transition (going abruptly from a depth of about 10-12 km, that characterizes the western sector, to a depth of about 30 km of the eastern sector) suggests that this sector of the Northern Apennines represents a transitional area between the western extensional sector and the eastern compressional sector of the orogen. This could explain the not yet completed crustal thinning even in presence of an exten-

sional active tectonics.

References

Barchi M., Paolacci S., Pauselli C., Pialli G., and Merlini S.,1999. Geometria delle deformazioni estensionali recenti nel bacino dell'Alta Val Tiberina fra S.Giustino Umbro e Perugia: evidenze geofisiche e considerazioni geologiche. *Boll.Soc.Geol.It.*, **118**, 617-625.

Boncio P., Brozzetti F. and Lavecchia G., 2000. Architecture and seismotectonics of a regional Low-Angle Normal Fault Zone in Central Italy. *Tectonics*, **19**,1038-1055.

De Franco R., Ponziani F., Biella G., Boniolo G., Caielli G., Corsi A., Maistrello M. & Morrone A. (1998) - DSS-WAR experiment in support of the Crop03 project. *Mem. Soc. Geol. It.*, **52**, 67-90.

Marson I., Cernobori L., Nicolich R., Stoka M., Liotta D., Palmieri F. & Velicogna I., 1998. CROP03 profile: a geophysical analysis of data and results. *Mem. Soc. Geol. It.*, **52**, 123-137.

Mareschal J.C., 1994. Thermal regime and post-orogenic extension in collision belts. *Tectonophysics*, **238**, 471-484.

Pauselli C., Marchesi, R., Barchi, M, 2002. Seismic image of the compressional and extensional structures in the Gubbio area (Umbrian-Pre Apennines). Atti del Convegno "Evoluzione geologica e Geodinamica dell'Appenino" - *Boll.Soc.Geol.It.*, Vol.Spec. 1 (**1**), 263-272.