Contemporary and concurrent extension and compression in Italy

Paola Montone1, M. Teresa Mariucci1 and Simona Pierdominici2

1-Istituto Nazionale di Geofisica e Vulcanologia, Rome , Italy

2 – GFZ GeoForschungsZentrum, Potsdam, Germany

We present the latest updating and the complete collection of data on the contemporary stress orientations in Italy. Data are relative to different stress indicators: borehole breakouts from deep drillings, crustal earthquake focal mechanisms and fault data. With respect to the previous compilation, performed in 2004, 206 new entries complete the definition of the horizontal stress orientation and tectonic regime in the most part of the territory, and bring new information mainly in Sicily and along the Apenninic belt. With an increase of 37% with respect to the previous compilation, now the global Italian dataset consists of 499 records with a reliable quality for stress maps. The total dataset includes the following active stress indicators: 56% borehole breakouts, 39% single earthquake focal mechanisms, and 5% represented by formal inversions of focal mechanisms, faults and overcoring data. A quality ranking between A and E is assigned to each stress data, with A being the highest quality and E the lowest. Only A-, B- and C-quality stress indicators are considered consistent for analyzing stress patterns. Depth interval of the entire dataset is between 0 to 40 km. The results in map are reported in terms of minimum horizontal stress (Shmin) because most of earthquakes present an extensional regime. Concerning breakouts, their orientations correspond to Shmin; since all the considered faults are normal faults, we assume the Shmin direction as perpendicular to the fault strike when no information on slip direction is available. The achieved results can be summarized in 3 main points: i) in some areas of Italy (Sicily, Friuli and Po Plain in the northern Italy), the alignment of horizontal stresses closely matches the ~N-S direction of ongoing crustal motions with respect to stable European plate. This result can be associated to the first-order stress field that drives the plate movement; ii) along the entire Apenninic belt – from north to south- a diffuse extensional stress regime is clearly showed by a large dataset indicating a NE-SW direction of extension, probably related to a second-order stress field; iii) the stress rotations observed in some areas (i.e., Po Plain minor arcs and Gela thrust front) reflect a complex interaction between first order stress field and local effects, revealing the importance of the inherited tectonic structure orientations. In particular in this work the simultaneous occurrence of different stress regimes is discussed. Finally, we underline that this kind of map is very useful to those many users that work on this topic and/or related ones such as, for instance, geophysical modeling, seismic hazard assessment, rock mechanics laboratory experiments, deep drillings but also on oil and gas well production and construction of nuclear waste deposits.

INDEX TERMS: [8164] TECTONOPHYSICS / Stresses: crust and lithosphere, [8168] TECTONOPHYSICS / Stresses: general. [7230] SEISMOLOGY / Seismicity and tectonics.
codice AGU 10253353