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VI-1 (6P)

DISCRIMINATION OF A POTENTIAL EARTHQUAKE SOURCE IN THE POLLINO AREA (SOUTHERN ITALY) BASED ON GEOLOGIC AND GEOMORPHIC OBSERVATIONS

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The Pollino area (southern Italy) is located along the main italian seismogenic zone but here no large or moderate magnitude earthquakes are recorded since 1000 A.D., suggesting that it corresponds to a seismic gap. The presence of two active faults was recently pointed out in the area: the Castrovillari Fault (CF) and the Pollino Fault (PF). Since an important concern for the seismic hazard evaluation of the region is the identification and characterization of the potential earthquake source, the understanding of the relation between the CF and PF is relevant, also in consideration of the fact that for their geometry and kinematics the two structures cannot be seismically active at the same time. The study of the landscape, in particular of young features (i.e. fault scarps, stream beds, alluvial fan and terraces) and their interaction with the pre-existing morphology can be used to solve this question. For this reason, we recently started aerial photos and geological surveys, and microtopographic mapping along the CF, in addition to trenching investigation.

Our preliminar results show that:

1) recent movements along the PF are mainly localized west of the junction with the CF;
2) the major topographic features of the area are mainly related to the long-term activity along the PF;
3) the CF do not show significant topographic contrast, suggesting that the beginning of its activity is very recent;
4) trenching and detailed geomorphic study at regional scale indicate evidence of repeated surface faulting events along the CF.

VI-1 (7P)

ACTIVE THRUST-RELATED FOLD AND STRUCTURAL MODELLING : THE EL ASNAM EXAMPLE

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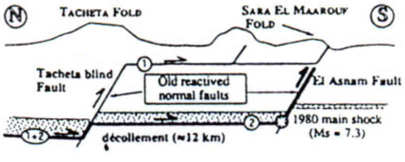
Conventional models of thrust-related folds applied to the Sara El Maarouf (SEM) active fold near El Asnam, suggest a shallow decollement at about 4 km. This contrasts with the 12 km rupture depth inferred from the seismic sequence of the 1980 earthquake (Ms=7.3). Detailed geological and geomorphological investigations combined with data analysis of the aftershock distribution at depth provide a basis for understanding such structures. The high-angle active fault appears to be an old major normal fault that controls the Miocene and Pliocene deposits of the Chéliff basin. The seismogenic El Asnam reverse fault is then an inverted frontal structure associated with a regional piggy-back sequence. On the other hand, the SEM fold itself can be considered as built up above a shallow décollement which is likely a branch of the Tacheta blind thrust (see figure below). Thus, early stages (lower Quaternary) of the SEM fold development are related to a ramp propagation from the shallow décollement. Although the fold is clearly localized by the old major normal fault, its early stages (early Pleistocene) did not result from reverse movements along this fault. During the late stages, the 12 km depth décollement propagates to the old normal fault which act as a breakthrough reaching the surface during past large earthquakes. The folding process and its geomorphic signature are documented and we discuss the proposed kinematic model with similar examples of seismogenic faults and related folds.



VI-1 (8P)

INFLUENCE OF FIEALE VOLCANO ON THE DEFORMATION OF THE ASAL RIFT (DJIBOUTI)

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Considering the low rate of erosion and sedimentation in Afar, the high resolution digital elevation model of Asal rift furnish an opportunity to understand the mechanics of rifting. Geology and morphology of the Asal rift reveals that the topography has resulted from the dismemberment over the last 100,000 yr of the Fieale volcanic edifice.

Three dimensional deformation of this volcano has been quantified from the restoration of the former geometry. Faulting and dykes injection has accomodated 2550m of extension and 350 m of subsidence. Moreover, it indicates heterogeneous deformation, with localisation of the extension at rift axis. This heterogeneity is also visible on the fracturation field:

(1) the faults are curved toward rift axis around Fieale crater.
(2) en echelon normal faults indicate either left lateral and right lateral shear zones oblique to the rift axis around Fieale crater.

These shear zones as well as tendency of faults to concentrate at rift axis near the Fieale crater suggest that the heterogeneous distribution of strain is due to the presence of the volcano.

Numerical mechanical simulations allow to explore the possibility that this heterogeneity is due to the topographic loading of the volcano or to the presence of a magmatic chamber.

The topographic loading increase the maximum shear stress above the volcano and suggest activation of faults at rift axis. Vertical strain (ε_{zz}) derived from the modeling is more intense above the volcano and is consistent with the vertical displacement on faults recorded by the topography. However the direction of middle principal stress (σ_2) which could be considered as the fault strike on extensional stress field is not modified by the topography.

The effect of magmatic chamber, simplified as a hole in a elastic medium, combined with the regional extensional stress field reveals that the direction of middle principal stress σ_2 is consistent with the observed curvature of faults.

VI-1 (9P)

GEOMORPHOLOGICAL CHANGES AT THE AREA OF PYRGOS (WEST PELOPONNESE, GREECE) DURING THE EARTHQUAKE OF THE 26TH MARCH 1993

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The western part of Peloponnese and especially the area around the city of Pyrgos is characterised by the presence of an active stress field due to the convergence between the European and African plates. The earthquake of the 26th March 1993 (Ms=5.2 R) and the following seismic activity affected the thick Quaternary deposits which fill the tectonic graben of Pyrgos. They caused extensive geomorphological changes, which are listed below:

- Landslides - Rock Falls. There were observed 10 big falls of sandstone blocks (100 - 100,000 m^3). The falls were situated along Vounargos - Katakolo "geomorphological discontinuity". The geomorphological discontinuity coincide with a fault zone which gave small earthquakes. Note that along other geomorphological discontinuities, which do not coincide with major fault zones there were no falls observed.
- Seismic Fractures. They were observed in the Pyrgos built up area and can be connected with known active faults. Their length is a few metres and their width is up to a few centimetres.
- Subsidence. It was observed along the Katakolo - Zacharo coastal zone, near the delta of Pinios River, and extented over an area of 2 km^2. Maximum subsidence was at the order of a few tens of centimetres. The main reason of the subsidence is thought to be the loose, unconsolidated soil formations.
- Liquefaction phenomena. It was observed along the Katakolo - Zacharo coastal zone, 3 km away from Alfios River. The liquefied formations underlie the superficial deposits and disturbed them extensively. The liquefied formations were ejected upwards and, in a few sites, formed small mounts.

All the geomorphological changes described here, have affected the topography and are going to play a key role in the long term urban planning of the region.

VI-1 (10P)

IMPACT OF THRUST TYPE TECTONIC ACTIVITY ON THE EVOLUTION OF THE GEOMORPHOLOGY OF INAHOS VALLEY (W. GREECE)

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The Inahos valley is situated between the calcareous Valtos (Gavrovo) mountain to the east and the flyschic Makrynoros mountain to the west, in Akarnania district (W. Greece). The valley trends in its greater part, parallel to the thrust front, formed by the Valtos mountain overthrusted on the Makrynoros flysch sequences. In fact, the valley was opened, initially, along the axis of Epirus-Akarnania syncline which is formed in the eastern part of the Ionian zone in Greece.

In order to examine the relations between the actual geomorphological situation and the tectonic activity of the region we studied the evolution in time and space of the fluvial terraces developed in both sides of the valley. For a better understanding and mapping of the particular features of the terraces we used aerial photo stereo pairs, topographic maps 1:50.000 and GIS facilities. From the aerial photos we mapped the tectonic features of the studied area while from the topographic maps we created the digital elevation model (DEM) and the slope steepness map. By combining these data through a GIS we observed that the fluvial terraces are drifting from the east towards the west, forming cliffs to the western banks, developed on the flysch formations. The active tectonics of the region is prooved closely related to the thrust of Valtos mountains. The whole mechanism of the geomorphological evolution is thus controled by the advancing thrusting and the consequent migration of Inahos valley to the west. In the same time the relations between the valley axis and the syncline of Akarnania becomes more obscure.

VI-1 (11P)

EARTHQUAKES AND COASTAL MORPHOGENESIS IN CENTRAL EUBOEA

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A flight of benches, more than one hundred and fifty meter high, is observed along East Coast of Central Euboea Island, central Aegean Sea.

These benches have no marine sedimental cover but are mostly cut unconformably into limestones and correlate with relicts of uplifted marine Pliocene and Quaternary sediments: they can therefore be safely considered as remains of marine terraces.

Among them, the ten to fifteen metre high terraces are well defined, they consist of smaller benches and correlate with slightly consolidated beach deposits on vertical cliffs and remains of yet undated fauna of the infralittoral zone.

The preservation of this fossil fauna is likely to indicate an episodic, conspicuously seismic subsequent drop of the relative sea level that is responsible for the stepped profile of these terraces. This process probably continued until the present since a notch reflecting a two-phase, more than one metre high, seismic uplift in the last 2000 years is observed.

Coastal morphogenesis in this part of the Aegean seems therefore to be controlled by seismic movements.

VI-1 (12P)

ACTIVE TECTONICS IN THE LOW SEGURA BASIN

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The Low Segura Basin is located in the province of Alicante (SE Spain), in the northeastern end of the Lorca-Alhama Corridor, constituting one of the numerous intramontane neogene-quaternary basins of the Betic Chain. Its elongated configuration, mainly controlled by NE-SW fault lineaments, represent an inheritance from the last important compressive phase occurred during or just at the end of the Pliocene. These phase is the responsible for most of the deformational features observed in the neogene materials, as folds and reverse faults which partially control the present topography. After this compressive phase a new episode, moderate in activity, takes place so that the quaternary sediments filling the basin and of the continental shelf may show some deformational features. Studies carried out on some aspects of active tectonics, as deformations in Tyrrhenian shore deposits, geomorfologic indices of mountanous fronts, presence of seismites in the most recent fill of the basin and the fact of tectonic subsidence during the Holocene, brought to light by means of absolute geochronology methods, confirm this index of moderate tectonic activity.

As far as seismicity is concerned, numerous earthquakes have been recorded during the instrumental period, although all of them showing a magnitude less than 4. Nonetheless the historical record reveals that a catastrofic event of intensity X (6.3-6.9 estimated magnitude) caused great damage in the area in 1829. This seismic activity is related mainly to the fore mentioned NE-SW fault system, which in this end spans up to a ENE-WSW trend: the Crevillent Fault System, in the northwestern edge of the basin, and the Low Segura System in its southern border. There exist another transversal NW-SE system, called San Miguel de Salinas Fault System, genetically associated to the precedent, which is also considered to be responsible for the seismicity of the area.

Although data on focal mechanisms and depth distribution of hypocenters as well as recent deformational records observed at surface are rather scarse, the analysis of all this information is consistent with a compressive situation in the Low Segura Basin with a NNW-SSE to N-S main shortening and an associated E-W extension. In this geodynamic setting, the deep NE-SW to ENE-WSW Fault Systems work as normal or reverse faults with sinistral strike slip, while the NW-SE Fault System behave as dextral slip.

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VI-1 (13P)

THE RECENT VERTICAL MOVEMENTS AND CERTAIN CHARACTERISTIC FEATURES OF THE EARTH CRUST FOR THE AREA OF WEST-HUNGARY-REGRESSION ANALYSIS

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In the area of Hungary using the data of repeated precise geodetic measurements we have some reliable information about the tendencies of recent vertical movements. As a result of the correlation analysis made few years ago we have found the area of West-Hungary the best appropriate region for the application of multiple linear modelling technique in the investigation of recent vertical movements. This area is the end of the Eastern Alps which is bordered by the Rába tectonical line. On the basis of the results of this investigation and geological data (basement depth, gravity anomaly, terrestrial heat flow, seismicity) a presumed connection has been investigated by using regression analysis. A linear function with four variables will be presented in our paper as a model of the investigated phenomena, including the model fitting analysis.

VI-1 (14P)

SPACE-TIME MIGRATION OF STRESSED-DEFORMING PROCESSES IN THE EARTH'S CRUST (WITHIN CAUCASUS)

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The analysis of geodesic measures data, seismologic information and complexities under drilling and exploitation of oil-gas wells on Tersko-Sunjenskaja oil-gas zone allowed to reveal some features of modern stressed-deformed state of the Earth's crust. Particularly, the migration of P- and S-waves of seismotectonic activity has been established as a result of study of time distribution course of earthquakes separately on zones in meridional and latitudinal directions. P-wave moves from the south to the North, its velocity for various structure zones ranges 2-7 km/year; S-wave moves from the