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MESOZOIC TECTONO-SEDIMENTARY EVOLUTION OF THE ROCCA BUSAMBRA (WESTERN SICILY)

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Key terms: Mesozoic pelagic platform carbonates; synsedimentary tectonic; buttress unconformities

In western Sicily, the Rocca Busambra ridge is a meso-cenozoic carbonate structural unit of the Sicilian Chain recording a variety of tectono-sedimentary features such as Mesozoic paleofaults, paleoscarp morphologies, anomalous stratigraphic relationships, neptunian dykes with several infilling generations, accompanied by several large hiatuses, different facies and lateral facies change, unconformity surfaces (buttress unconformity, onlap, downlap), resedimented materials, erosional submarine and subaerial surfaces.
Different orientations of the fault planes are pointed out by physical-stratigraphy analyses, combined with facies and structural analyses, allow to distinguish different depositional sectors evidencing lateral change from an open marine carbonate platform stepped faulted margin, located in the westernmost sector to an eastward deeper basinal depositional setting, throughout upper slope scalloped margin and base-of-slope systems with talus breccias.
Extensional to transtensional tectonic pulses punctuated the sedimentary evolution during middle Liassic, early Late Jurassic, Late Cretaceous and early Miocene times. The reconstructed meso-cenozoic tectonic evolution is closely related to the tectono-sedimentary evolution of the African continental margin.

SESSIONE D03

Geologia Strutturale

D03-1 Key Lecture Finetti, Icilio

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CONTRIBUTION OF THE CROP-18 TRANSCRUSTAL SEISMIC DATA TO THE UNDERSTANDING OF THE LARDERELLO - M. AMIATA□ TECTONO - PLUTONIC SETTING

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Key terms: CROP-18; Transcrustal; Setting

Since nearly a century ago initiated a first world exploitation of geothermal energy in the Larderello area, Tuscany (Italy). But only recently the advanced transcrustal CROP Seismic Project (CROP-18) supplied the geoscience with deep geophysical information determinant for understanding the existing complex tectono-plutonic setting and reconstruction of reliable, controlled subsurface imagings. Two sections of the CROP-18 (CROP-18a and CROP-18b), generously offered by ENEL Group, explore the Larderello and M.Amiata areas. In this presentation the author exhibits the results of a new carefully conducted interpretation of the CROP 18 sections and of other integrating seismic lines, stressing the importance of the CROP project for geo-academic lithospheric studies and for uptodate geothermal exploration-exploitation. Scope of the work is the reconstruction of the crustal tectono-stratigraphic setting of the area extending from the Tyrrhenian coast to the M. Cetona thrust. The results obtained are very important and decisely innovative as regard to the definition of predicted geothermal magmatic bodies. In fact, for the first time two big plutons intruded in the deep upper crust are seismically imaged in a clear manner. Both the plutons are characterized by marked negative Bouguer gravity anomalies and are associated with anti-Apennine transcurrent (transfer) faults through which the magma ,coming from crust and upper mantle flowed during the pluton emplacement.
Beneath the plutons the lower crust and basal upper crust form a marked synclinal fold, accentuated by the relatively lower velocity of the overlain pluton body with respect surrounding rocks. Immediately over the pluton a highly reflective K-interval is evident, very likely represented by thin laminated layers saturated by fluids. The above-pluton upper crust forms an anticlinal fold on both the intrusive bodies.
This new reconstruction of plutons setting exhibits, very clearly, that the high-angle normal faults are not generated by crustal distension, but are pluton-intrusion-related collapse faults, absent outside the plutons area. Lack of Tuscan units over the Triassic evaporite (or even of both evaporite and cover) are not due to distension but to tectonic detachment and outward transportation. According to this new careful seismic control now carried out, no basic crustal distension phase is seismically acceptable from the Tyrrhenian coast to the M.Cetona thrust. Overpressures met by geothermal wells are nor compatibles with extensional processes.
Pluton accretion dynamics is active since Pliocene and is continuing at present as indicate pluton cover uplifting and frequent seismicity. It preserves high temperatures and long-term geothermal resources, keeping tectonically open the ways of hot fluids ascent. As occurred in the hydrocarbon history, also in the geothermal exploration-exploitation a new stage of systematic massive employment of advanced seismic techniques is now essential for discovery of new resources with drastic reduction of dry boreholes and cost of production of converted and/or direct geothermal energy.
A great amount of boreholes, geological, geophysical and engineering data disclosed by ENEL, together with the CROP-18 sections contribute in a determinant way to understand the complex innermost Northern Apennines.

D03-2 Orale Galadini, Fabrizio

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ACTIVE TECTONICS IN ITALY: HISTORY OF THE RESEARCH AND PRESENT GEOLOGICAL KNOWLEDGE

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Key terms: active tectonics; active faults; seismogenic source

The modern researches on active tectonics in Italy begun during the 70s of the past century. Geomorphology was used in order to define recent activity, sometimes only represented by the morphological evidence of displacement of recent landforms. The few works available defined fault scarps supposed to be direct evidence of the recent fault activation. Geologically based investigations on faulting began in the half of the 80s, during and immediately after the experience of the CNR-PFG project which promoted a deeper use of the Quaternary geology in the tectonic investigations. Evidence of Late Pleistocene-Holocene activity was, in some cases, directly supported by the dating of the displaced landforms and deposits. The second half of the 80s also represented the period during which the first attempts of paleoseismological investigations started, with ad hoc excavations across faults or detailed geomorphological investigations aimed at distinguishing single displacement events in the central Apennines. The paleoseismological investigations have increased since the 90s, particularly in the Abruzzi Apennines and to a lesser extent in the southern Apennines and Calabria. During this phase, the awareness of the researchers about the seismogenic perspective increased, especially through specific GNDT projects and initiatives of INGV. The assessment of seismic hazard has been one of the main GNDT goals during the 90s. Within this framework, the use of the geological information on the active tectonics has been fundamental for the "seismogenic zonations" produced until the beginning of this century. The GNDT "tradition" on the zonations has been transferred in the product (ZS9) which has been recently used for the map of seismic hazard delivered to the Civil Protection in 2004.
The necessity to produce tectonic data in a form suitable by different users led to projects and initiatives by various institutions. For example, GNDT promoted an inventory of active faults at the end of the 90s and APAT created ITHACA. In both products the geological surficial information is predominant and faults supposed to be active are reported. In the GNDT inventory, primary faults (direct surficial expessions of seismogenic sources potentially responsible for earthquake with M 6.2) were defined as active in case of post-LGM activation. In contrast, ITHACA reports "capable faults", i.e. active faults not depending from hierarchical orders. In this case, the amount of reported faults is significantly larger than that of the GNDT inventory. This suggests that the two products are based on different methods and are probably characterised by a different reliability.
A completely different cultural option is represented by DISS, the database of seismogenic sources, produced by the INGV researchers since the 90s. DISS tries to define the causative sources for earthquakes with M 5.5, i.e. it defines also sources whose geological "visibility" is scarce. DISS is, presently, the most used database of seismogenic fault-sources and is continuously implemented with new information through dedicated projects.
As for the current methods in the investigation of active faulting in Italy, a decreasing use of paleoseismological techniques and an increase of the quantitative geomorphology has to be mentioned.
As for the state of the art, some points can be summarized in the lines below:
- knowledge on active fault/seismogenic sources can be considered as satisfactory in the central Apennines, eastern Southern Alps and Calabria;
- knowledge needs to be strongly implemented in some sectors of the southern and northern Apennines and in the central Southern Alps;
- current studies with promising perspectives are being performed in eastern Sicily and in the Adriatic sector of peninsular Italy.

D03-3 Orale Argnani, Andrea

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ASSESSMENT OF ACTIVE TECTONICS IN THE MESSINA STRAIT AND SURROUNDINGS: PRELIMINARY HIGHLIGHTS FROM THE TAORMINA-2006 CRUISE

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Key terms: Messina Strait; active tectonics; multichannel seismic

The TAORMINA-2006 seismic cruise aimed at investigating the seismotectonics of the Messina Straits and surrounding regions within the frame of a DPC-INGV project addressing the active faults assessment in Italy. Special attention has been payed to verify the existence of the Taormina Fault, which has not been directly documented. This fault, if present, might represent a large seismic gap and a substantial hazard to people and infrastructures in the region (Neri et al., 2006).
The Messina Strait has been the site of the large 1908 Messina earthquake, the most destructive earthquake in Italy, and GPS horizontal velocity measurements and uplifted late Quaternary marine terraces indicate that this area is tectonically active. However, in spite of such hazard potential, geophysical surveys purposedly devised to investigate the neotectonic features are lacking. In order to bridge this gap we carried out a multichannel seismic survey aimed at defining the structural pattern of the Messina Straits and surroundings.
A seismic survey, totalling about 700 km of profiles, has been carried out with two different acquisition systems, a 48-channel 600 m long streamer and a 24-channel 120 m long streamer, according to the operation conditions. Multibeam and Chirp Sonar data have also been acquired during the seismic survey, and independently in selected areas.
Some preliminary results have relevance on the seismotectonics of the study area:
1) the Taormina Fault is thought to run NNE-SSW along the coast of Sicily between Taormina and Messina. However, besides uplifted marine terraces and rised marine notches (Catalano and De Guidi, 2003; Antonioli et al., 2006) its occurrence remains hypothetical. Our seismic profiles fail to image a fault running parallel to the coast and show that the slope between Taormina and Briga is characterised by a package of sediments originally deposited sub-horizontally and now tilted east-ward. Altogether, it appears that the whole sector straddling the coastline has been tilted to the east.