PROGETTO CROP - Crosta Profonda

Sottoprogetto CROP 04 - Appennino Meridionale

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bodies, sandwiched between the F.Tusciano-M.Costa Calda thrust sheet below and the Lagonegro II and Monti Picentini thrust sheets above. The Lagonegro II Unit is more continuously outcropping across the study area even if it is missing in some sectors where the Monti Picentini Unit is in tectonic contact directly on the F.Tusciano-M.Costa Calda Unit.

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STRATIGRAPHY OF SELECTED WELLS ALONG THE CROP-04 TRANSECT

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Several wells drilled in the Campania-Lucania Apennines and in the Apulia foreland have been used to interpret and calibrate the CROP - 04 seismic profile. Among these wells, San Fele 1 (TD 3515 m), Monte Foi 1 (TD 5755 m), San Gregorio Magno 1 + 1bis (TD 3976 m), Contursi 1 (TD 3479.70 m), and Acerno 1 (TD 4625 m) have provided very important constraints and suggestions that have strongly influenced the interpretation of the line. In this paper we present a revision of the well stratigraphy based on the analysis of the cutting samples (thin-section analysis, microfossil and nannofossil analysis) and on the interpretation of the gamma ray/SP and resistivity logs.

San Fele 1 and Monte Foi 1 have explored important duplex structures in the Apenninic nappes, basically represented by Pliocene antiformal stacks of Lagonegro II imbricates that exceed 5500 metres in thickness. San Gregorio Magno 1 testifies to a first-order positive structure in the Apulia carbonates (axial culmination of the buried duplex system) beneath the Alburno - Cervati carbonates of Monte Marzano. Acerno 1 reveals the existence of an important stack of Lagonegro imbricates on top of the Apulia carbonates in correspondence to the southern slope of the Picentini Mountains. This occurrence supports the attribution to the Lagonegro units of a thick package of continuous reflectors that underlies the Alburno-Cervati carbonates west of the Tanagro Valley as far as the Tyrrhenian coast.

CONSTRAINTS ON THE INTERPRETATION OF THE CROP-04 SEISMIC LINE DERIVED FROM LATE PLIOCENE TO PLEISTOCENE THRUST-SHEET-TOP AND FOREDEEP DEPOSITS

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The Pliocene and Pleistocene deposits unconformably covering the allochthonous sheets in the Southern Apennine mountain chain and disconformably overlying the autochthonous Apulia carbonates in the Bradano Trough display remarkable stratigraphic signatures closely controlled by the trajectories of the active thrusts. Thrust propagation during the Pliocene and Pleistocene followed in the study area a quite simple leitmotif that recalls the advancing mode of a caterpillar, every stage of forward nappe displacement having been preceded and followed by a telescopic shortening of the structural edifice behind the inactive front of the tectonic wedge. This behaviour allows the recognition of well-defined tectonic cycles, each cycle starting with the activation of a long thrust flat and ending with a forward propagation of the active thrusts and the incorporation of new horses into the duplex system. Tectonic cycles have been recorded in the foredeep basin and on top of the allochthonous sheets by thrust-related depositional sequences, every sequence being divided into four systems tracts

representative of the principal steps that describe the caterpillar-like motion of the tectonic wedge:

1) forward transport of the Apenninic nappes on top of a long thrust flat;
2) development of a steep ramp at the front of the tectonic wedge;
3) deactivation of the leading edge of the duplex system and out-of-sequence migration of the active thrusts towards the axis of the mountain chain;
4) forward migration of the active thrusts beneath and beyond the previously abandoned leading edge.

We carefully analysed the different systems tracts of the Ofanto and Bradano depositional sequences along the CROP-04 transect in order to provide additional information about the relationships between thrust propagation and sedimentation in late Pliocene and early Pleistocene times. In this paper, new constraints about the kinematic evolution of the thrust belt-foredeep system in the 3.70 - 0.60 Ma interval will be presented. The new data have allowed us a quite accurate age determination of the growth of the principal tectonic structures both in the buried Apulia carbonates (e.g. San Gregorio Magno antiform) and in the roof units of the Apennine duplex system (e.g. San Fele antiformal stack and Ofanto synform).

GEOLOGICAL INTERPRETATION OF THE CROP - 04 SEISMIC LINE

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The interpreted CROP - 04 line is a stack section derived from a recent reprocessing down to 10 seconds TWT of the original seismic data. The new stack shows a remarkable improvement with respect to the previous one that had been obtained by a standard processing sequence. The principal steps of the reprocessing sequence are described in Mazzotti *et al.* (this volume). In this paper we shall describe the principal elements that have contributed to the interpretation of the seismic line and the main steps we have taken in order to reach the final geological profile.

Surface-geology information. Significant improvements of the available geological information mostly concern the age and facies of the Mesozoic-Tertiary Monte Marzano carbonates, of the Pliocene deposits filling the Ofanto, Ruoti-Baragiano and Potenza synforms and of the Pleistocene deposits disconformably overlying the Apenninic nappes in the Vulture region. Improvements also concern the geometry and kinematics of the Daunia, Tufillo-Serra Palazzo and Sannio imbricates that form the outer margin of the thrust belt. The revised surface geology of the study region is shown in the enclosed structural map at the scale 1:250.000.

Subsurface-geology information. Several boreholes located along the CROP - 04 line, together with several commercial lines calibrated on wells and tied to the CROP - 04 seismic profile, have provided important constraints for the identification and characterization of the tectonic structures in the buried Apulia carbonates and in the Apennine allochthonous sheets (see Patacca *et al.*, this volume). In addition, the integration between surface and surface data on the Pliocene and Pleistocene deposits crossed by the CROP - 04 line allowed us the establishment of important constraints on the kinematics of the thrust belt-foredeep system between 3.70 and 0.60 Ma (see Patacca and Scandone, 2001 and this volume).

Interpretation of the seismic line. The available surface and subsurface information has been plotted on the seismic line in order to define the shallow geological structures in terms of composition and tectonic-unit attribution. In a second step, a line drawing of the seismic profile from the Tyrrhenian coast to the outer margin of the Apennines has been done. Finally, major geological bodies corresponding to the different tectonic units of the thrust belt have been delimited, together with the principal faults, consistently with the well data, with the line drawing and with the information on the overall structural architecture derived from all the available seismic lines in the area. In such a way, a preliminary interpretation of the entire seismic line has been obtained.

Time-Depth conversion. The interpreted time section has been digitised and subsequently depth-converted by means of the software GeoSec 4.2 using the following velocity values for the different rock units:

- 2200-2300 m/s to the Pliocene-Pleistocene deposits disconformably overlying the Apulia carbonates and unconformably covering the Apenninic nappes;
- 3000-3500 m/sec to the North-Calabrian, Sicilide, Sannio, Serra Palazzo and Daunia units, as well as to the Albidona Formation;
- 5000-5500 metres to the Alburno-Cervati and Monti della Maddalena carbonates;
- 4000-4500 m/sec to the Lagonegro nappes;
- 5500-6000 m/sec to the Apulia carbonates, including the Triassic evaporites;
- 4500-5000 m/sec to the Verrucano-like siliciclastic deposits underlying the Apulia