minerals authorized by IMA) and to a chemical composition (presence / absence of elements and their different combinations). In result the user receives as a combination of the various information on the chosen mineral from different databases, and links to primary databases for receiving of more detailed information.2. Search for the chosen name of a mineral in most of search engines of the Internet with the maximal relevance is possible. The portal can be easily integrated into museum and regional mineralogical cadastres and databases, that those could (without creating own databases on minerals) to provide automatic receiving of the information on the minerals included in them. Connection to a portal of databases on a geographic distribution of minerals in Russia and the world is in the long term supposed. It can be also easily used in the educational purposes at different levels of education and for use by amateurs. The portal includes links to more than 4000 minerals (without synonyms and out-of-date names), is realized in English and Russian languages and can be found at the address http://mineral.iem.ac.ru.

## SESSION 330

**G16.04 - Geomorphic signature of large active faults**
**SATURDAY, August 28, 2004 - 9:00**
**Room: 20**

### Conveners:

Stewart Iain, Valensise Gianluca

### 330-1 Oral Di Bucci, Daniela

RELAY RAMPS IN NORMAL FAULT ZONES: A KEY FOR THE ACTIVE TECTONICS IN THE EPICENTRAL AREA OF THE 1688 SANNIO EARTHQUAKE (BENEVENTO, ITALY)

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Keywords: seismotectonics; transfer zone; Southern Apennines

In 1688, a strong earthquake (Io = XI, macroseismic magnitude = 7.1) occurred in southern Italy. The epicentral area was located along the Calore River valley, WNW of the town of Benevento, in the axial zone of the Southern Apennines. This part of the Apennine chain, which is characterised by present-day SW-NE oriented extension, hosted many other strong earthquakes in the past (e.g., from NW to SE: 1805 Molise, 1456 Molise, 1980 Irpinia, 1857 Basilicata). The seismogenic structure responsible for the 1688 event is still unknown, and also the definition of the active tectonic setting in the epicentral area is extremely poor. This research aims at filling this lack of information by the acquisition of new surface geological data and the interpretation of subsurface geological and geophysical information.We integrated the results of a geological field survey, particularly focused on the Quaternary continental deposits, with original geomorphic and mesostructural analyses and new radiometric dating (39Ar/40Ar) of pyroclastic layers interbedded within the Calore River deposits and/or involved in faulting. Moreover, based on the interpretation of reflection seismic lines and well logs integrated by surface data, a preliminary reconstruction of the deep geological setting of the epicentral area was obtained.The identified faulting pattern is interpreted as an evidence for the occurrence of a relay ramp between two active normal faults. A discussion on the existing models for the 1688 seismogenic structure in the light of the results of this study is presented.

### 330-2 Oral Ridente, Domenico

NEO-TECTONIC STRUCTURES AND STYLES OF DEFORMATION IN LATE PLEISTOCENE-HOLOCENE SHELF DEPOSITS, ADRIATIC FORELAND

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Keywords: adriatic; foreland; quaternary; neotectonic

The late Pleistocene-Holocene stratigraphy of the Adriatic shelf consists of a succession of depositional sequences recording ca. 100 kyr glacio-eustatic cycles. During the last ca. 20 kyr, sea level rose about 125 m from the lowstand position of the Last Glacial Maximum to the modern highstand. The upper-most stratigraphic units of the Adriatic shelf can be grouped in lowstand, transgressive and highstand systems tracts. Below these units, four depositional sequences record older cycles between ca. 450 and 20 kyr BP. Each of these older sequences is up to few tens of metres thick, and is essentially composed of forced-regression units recording prolonged phases of sea level fall. The first-order control of eustasy is evidenced by the overall stacking pattern of self-similar regressive-transgressive units having comparable thickness, internal reflector architecture and regional bounding surfaces. This stack of eustasy-driven sequences, however, also documents the impact of tectonic deformation during each sea level cycle.A dense grid of very high-resolution seismic profiles reveals small-scale deformations affecting shelf units that appear undeformed on conventional multichannel seismic lines. Moreover, subtle topographic gradients, generated by tectonic deformation, affect internal stratigraphy and thickness of forced-regression units on the shelf. In the Adriatic, topographic gradients of only few metres per tens of kilometres resulted from the local growth of gentle anticlines and synclines, indicating ongoing tectonic activity during the last ca. 450 kyr. Beside gentle folding, displacement of reflectors in the order of few metres evidences deformation along subvertical faults; these faults may extend over hundreds of metres to tens of kilometres.Based on the inferred age of the deformed sequences, three deformational stages are distinguished and areas of neo-tectonic activity can be identified: 1) folds and faults affecting deposits older than 400 kyr; 2) folds and faults affecting deposits younger than 400 kyr but older than 18-20 kyr; 3) faults affecting deposits younger than 18-20 kyr. The distribution of the fold and fault systems deforming recent deposits reflects the location of older tectonic structures within the Adriatic foreland. We interpret the small-scale folding and faulting of late Pleistocene-Holocene deposits as the most recent manifestation of ongoing foreland deformation along pre-existing regional folds and blind-faults.

### 330-3 Oral Palyvos, Nikolaos

GEOMORPHIC SIGNATURE AND HOLOCENE EVOLUTION OF A COASTAL FAULT SYSTEM, WESTERN CORINTH GULF (GREECE)

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Keywords: Tectonic Geomorphology; Coastal fault; Paleoseismology; Corinth Gulf

The WNW-ESE Corinth Gulf Rift consists of a system of normal fault zones that accommodate N-S extension of up to 10-15 mm/yr at its western part. Long-term basinward migration of activity finds the presently active faults on the southern gulf coast and offshore. Geomorphic observations on DTMs derived from very detailed (1:5,000) topographic maps, revealed two ~15m-high scarps (1.5-2 km long) on two Holocene fan deltas NW of Aigion town. These scarps are off-shooting from a 300m-high main coastal escarpment (MCE) backing the fan-deltas, typically depicted without a fault zone at its base. In a broader context, viewed together with the substantially larger Aigion fault escarpment (3.3 km, 150m high) located ESE of the MCE, these scarps suggest the presence of a NW-SE coastal fault system (min. 10 km long - unknown submarine part), consisting of E-W to WNW-ESE right-stepping overlapping faults, with intervening NW-SE faults (also indicated by geomorphic signatures). This system parallels a major fault zone 2-3 km offshore and also the general trend of the MCE. The latter could be the product of an older instance of the system, lacking straight and steep morphology due to the specific fault pattern, soft lithologies and an overprint of a staircase of Pleistocene marine terraces. A first verification of the tectonic origin of the geomorphic features discussed was provided by a trench across one of the NW-SE scarps, exposing syn-sedimentary faulting on subaerial fan-delta deposits and a brackish unit blanketing them (fauna assemblages indicate a lagoonal environment). During the last earthquake, faulting was underwater. A preliminary interpretation yields at least 3 earthquakes during the past 3,860 yrs, and a min. vertical displacement rate of 1 mm/yr at the specific fault, implying substantially higher slip rates for the system as a whole. Oscillating coastal vertical movements are suggested by the fact that the brackish deposits are uplifted on both the footwall and hangingwall of the trenched fault (uplift by offshore faults), and by a rather abrupt transition from a subaerial to a brackish environment (subsidence by landward faults). These movements could be reflecting an ongoing process of strain migration from the MCE-bounding faults to the coastal and offshore fault system, in similarity to the situation recognized at a larger temporal and spatial scale between the Eliki and Aigion faults farther SE (based on M.-L. Pleistocene marine terraces).

### 330-4 Oral Vanneste, Kris

LATE QUATERNARY INTERACTION OF THE OMOUROVO RIVER AND CHIRPAN FAULT, SOUTHERN BULGARIA, FROM GEOMORPHOLOGIC AND GEOPHYSICAL DATA

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Keywords: active fault; paleosol; resistivity imaging; terrace; Upper Thracian Depression

In April 1928, three strong earthquakes struck the Upper Thracian Depression in Southern Bulgaria. The first of these earthquakes caused vertical displacements of 0.3-0.4 m over a length of at least 15 km on Chirpan fault, a normal fault defining the northern limit of a 10-20 km wide graben. Several small rivers and creeks, the largest of them the Omourovo river, drain perpendicular to the fault scarp towards the larger Maritsa river inside the graben. We conducted an integrated geomorphologic and geophysical survey of the intersection of the Omourovo valley and Chirpan fault, using aerial photographs, microtopography, vertical electric soundings, 2-D resistiviy imaging and hand borings. Outside the Omourovo valley, the fault scarp is well expressed in the morphology, and geophysical profiles show that the fault juxtaposes alluvial sands of the Plio-Pleistocene Ahmatovo Fm. in the footwall against late Quaternary silty flood deposits in the hanging wall. Inside the valley, the morphology is more complex, and there is no obvious fault trace. In the footwall, two or three terraces are preserved, but the morphology is overprinted by modern erosion, most likely of anthropic origin, as a result of which the Omourovo is presently incised 7 m below the youngest surface. In a quarry in the hanging wall, we discovered a sequence of 5 paleosols below this same surface. In three of these paleosols ceramics were found. Radiocarbon datings are not yet available, but these observations are consistent with the results of earlier trenching 2 km west of the site, where evidence was found for at least 4 paleoearthquakes, including the 1928 event, since the Late Glacial to Holocene transition (Radulov et al., this volume). Geophysical profiles show that in the subsurface, the situation is likewise complicated. The top and base of the Ahmatovo Fm. appear to be affected by several subparallel faults, with offsets varying along strike. Correlation based on fault geometry suggests a right-stepping fault pattern, coinciding with a similar step in the morphology. Some of the faults affecting the Ahmatovo Fm. do not seem to be active anymore. A lineament on aerial photographs, interpreted as the 1928 rupture trace, shows a right step as well, and seems to correspond with one of the identified faults, but not with the main fault. Its geomorphic expression is subdued, suggesting that this may have been the first surface-rupturing earthquake since the anthropogenic erosion took place.

### 330-5 Oral Pucci, Stefano

LANDSCAPE EVOLUTION AND ACTIVE TECTONICS ALONG THE DUZCE SEGMENT (NORTH ANATOLIAN FAULT ZONE, TURKEY)

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Keywords: active tectonics; geomorphology; coseismic rupture; structural geology

SAT