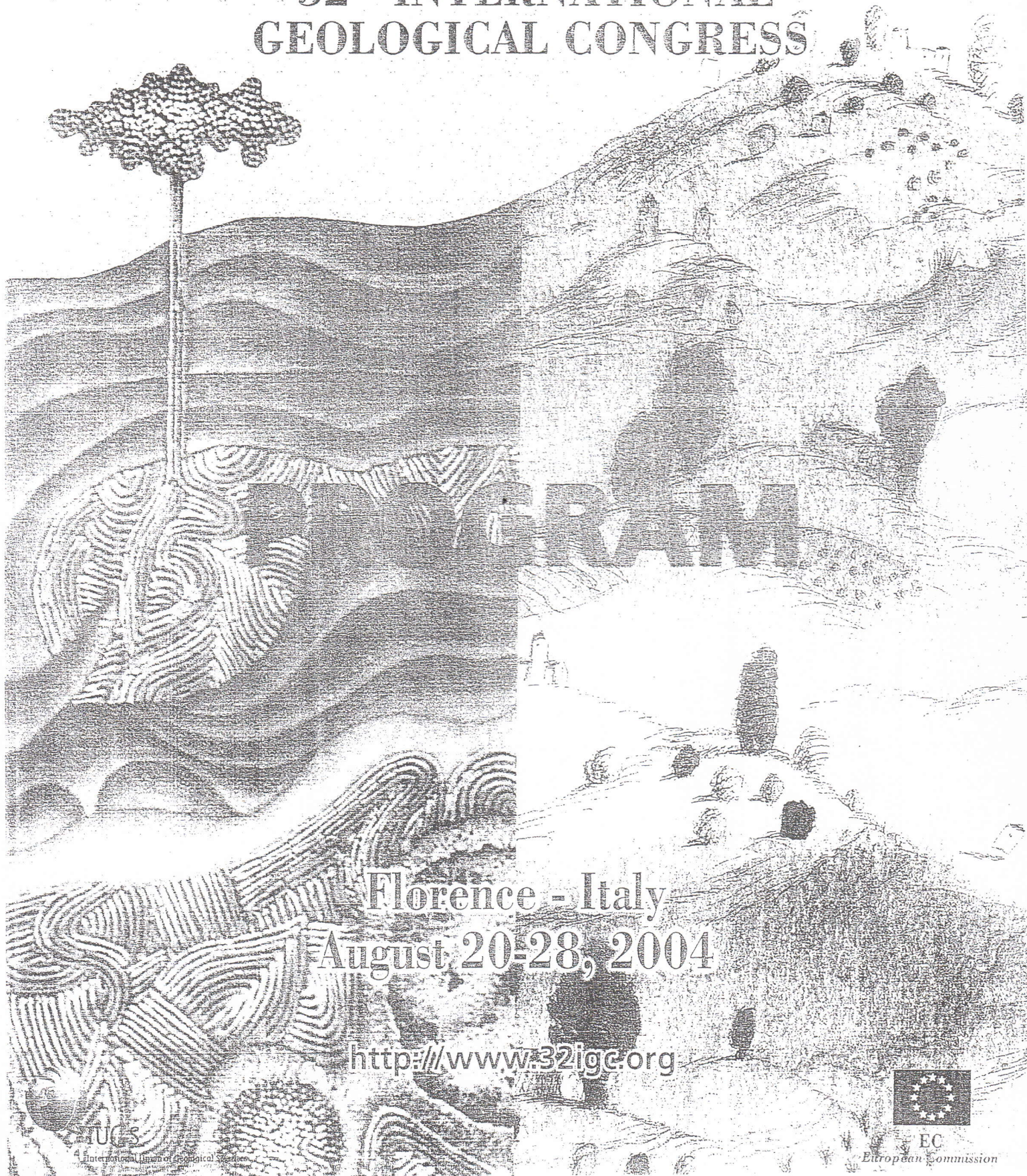


32nd INTERNATIONAL GEOLOGICAL CONGRESS



Florence - Italy
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SESSION 147

Session starting on TUESDAY at 9:00

WITH GRANULAR MATERIALS

147-25 Booth 248

Alves Dasilva Fernando Cesar *, Galvão Carlos César, Carvalho Júlio Alexandre Almeida De, Carvalho Marcelo José De, Lins Fernando Antônio Pessoa Lira: BRITTLE DEFORMATION IN THE SILICICLASTIC BODY OF SANTANA DO ACARAÚ (CEARÁ STATE, NE BRAZIL): A MULTIDISCIPLINARY AND MULTISCALE APPROACH

147-26 Booth 249

Carraça Barbara *, Manfred Strecker, Sobel Ed: SEDIMENTARY, TECTONIC AND THERMOCHRONOLOGIC EVOLUTION OF THE SOUTHERNMOST END OF THE PUÑA PLATEAU (NW ARGENTINA): THE INTRAMONTANE BOLSON DE FIAMBALÁ

147-27 Booth 250

Chernicoff Carlos Jorge, Zappettini Eduardo Osvaldo *: FORELAND BASIN FORMATION ASSOCIATED TO THE CUYANIA TERRANE ACCRETION IN SW GONDWANA, ARGENTINA: A REDEFINITION OF THE CARAPACHA FORMATION

147-28 Booth 251

Holz Michael *, Küchle Juliano, Philipp Ruy Paulo, Arima Naoki: TECTONIC CONTROL ON THE STRATIGRAPHY OF THE EARLY PERMIAN SUCCESSION OF THE PARANA BASIN IN SOUTHERNMOST BRAZIL

147-29 Booth 252

Hulka Carola *, Uba Cornelius, Heubeck Christoph: CONTROLLING FACTORS ON THE EVOLUTION OF THE CHACO FORELAND BASIN, BOLIVIA

147-30 Booth 253

Martinelli Cesar *: STRUCTURAL GEOLOGY OF ARAËS GOLD MINERALIZATION, NOVA XAVANTINA, MT, BRAZIL

147-31 Booth 254

Rossello Eduardo Antonio *, Nevistic Antonio, Araque Libardo, Bordarampé Cristóbal, Córscio Sebastian, Colo Carlos, Covellone Graciela, Haring Claudio, Pina Luis: THE ANDEAN SANTANDER-CORDILLERA ORIENTAL TECTONIC SYNTHESIS (COLOMBIA) FROM ANALOGUE MODELS

147-32 Booth 255

Nevistic Antonio, Rossello Eduardo Antonio *, Bettini Fernando, Bordarampé Cristóbal, Castro Egon, Colo Carlos, Córscio Sebastian, Covellone Graciela, Pina Luis: ANDEAN TRANSPRESSIONAL DEFORMATION ALONG THE EASTERN FOOTHILLS OF THE CORDILLERA ORIENTAL (COLOMBIA): INFLUENCES ON TRAPS HYPOTHESIS

147-33 Booth 256

Rossello Eduardo Antonio *, Mozetic Marcos, Lopez De Lucchi Monica: THE CRETACEOUS TRANS-ARGENTINE RIFT CORRIDOR: AN ABORTED SOUTH-AMERICAN PLATE RUPTURE DUE TO GONDWANA BREAK-UP

147-34 Booth 257

Haring Claudio, Rossello Eduardo Antonio *, Nevistic Antonio, Vergani Gustavo: ANDEAN TECTONIC STYLES AND ARCHITECTURE OF THE AUSTRAL BASIN IN THE FOOTHILLS OF CORDILLERA FUEGUIANA, ARGENTINA

147-35 Booth 258

Rossello Eduardo Antonio *, Haring Claudio, Nevistic Antonio, Cobbald Peter: WRENCHING ALONG THE FAGNANO-MAGALLANES FAULT ZONE, NORTHERN FOOTHILLS OF THE FUEGUIAN CORDILLERA (ARGENTINA-CHILE): PRELIMINARY EVALUATION OF DISPLACEMENTS

147-36 Booth 259

Rossetti Dice *: TECTONIC CONTROL ON INCISED VALLEYS: EXAMPLES FROM LATE CRETACEOUS AND MIOCENE SUCCESSIONS IN NORTHERN BRAZIL

147-37 Booth 260

Tschielci Flavio Eduardo *, Franca Rosilene L., Bruno Vera L. V. S. R.: SEISMIC IMAGES OF TURBIDITE CHANNELS IN THE FAZENDA CEDRO PALEOCANYON, ESPÍRITO SANTO BASIN, BRAZIL

147-38 Booth 261

Uto Tatsuo *: AN ACCRETIONAL ZONE WITH AN OLISTOSTROME UNIT OF LOWER-MIDDLE MIOCENE SEQUENCE IN PACIFIC SIDE, CENTRAL JAPAN

147-39 Booth 262

Mukherjee Soumyajit *: MICROFLANKING STRUCTURES

147-40 Booth 263

Naik Anurag *: BASEMENT TECTONICS AND THE EVOLUTION OF CHANDIPOSH BELT IN THE NORTHWESTERN PART OF ORISSA, EASTERN INDIAN SHIELD

147-41 Booth 264

Ryu Ji-Chang *, Park Se-Jin: STRATIGRAPHIC RESPONSE TO TECTONIC EVOLUTION OF THE SOUTH YELLOW SEA (KUNSAN) BASIN, WESTERN OFFSHORE KOREA

147-42 Booth 265

Wan Tianfeng *: INTRODUCTION TO THE TECTONICS OF CHINA CONTINENT

147-43 Booth 266

Kawamura Kiichiro *, Kawakami Shunsuke, Ogawa Yujiro: ANATOMY OF ACCRETIONARY PRISM TOE: OFF-SCRAPING ACCRETION PROCESSES AND MECHANISMS AT THE EASTERN NANKAI TROUGH

147-44 Booth 267

Zur Yoav, Eyal Yehuda *, Shamir Gadi: RATE OF FOLDING ASSOCIATED WITH THE HATIRA MONOCLINE, THE "SYRIAN ARC" FOLD BELT, ISRAEL

147-45 Booth 268

Gerasimchuk Alexander *, Korobkov I.G., Veretennikov V.A.: INTERCONNECTION OF PALEOGEOMORPHOLOGICAL ELEMENTS OF BEDROCK AND ANCIENT DIAMOND PLACERS IN THE EAST OF TUNGUSKAYA SYNECLISE

147-46 Booth 269

Gorev Nikolay *, Korobkov I.G., Veretennikov V.A.: STRUCTURAL FEATURES OF YAKUTIAN DIAMONDFEROUS PROVINCE KIMBERLITE FIELDS

147-47 Booth 270

Moridi Ali Asghar *: NOSRATABAD-KAHURAK SHEAR ZONE: STRUCTURAL EVOLUTION OF THE WESTERN PART OF THE FLYSCH ZONE, SE IRAN

147-48 Booth 271

Kang Ji-Hoon *: THE TECTONIC EVOLUTION OF THE CENTRAL OKCHEON BELT IN THE CHUNGJU-BUSAN-MUNGYEONG-OKCHEON AREAS, KOREA

147-49 Booth 272

Kim Seung Bum *, Chough Sung-Kwon, Chur Seung Soo: FINING-UPWARD BASIN-FILLS WITH GRAVELLY DELTAIC DEPOSITS IN A STRIKE-SLIP SETTING: KYOKPORI FORMATION (CRETACEOUS), SOUTHWEST KOREA

147-50 Booth 273

Zhang Yuming *: CHARACTERISTICS AND PETROLEUM SIGNIFICATION OF THE REVERSE STRUCTURES IN SHIWU RIFT-DEPRESSION IN THE SOUTHERN PART

OF SONGLIAO BASIN, NORTHEASTERN CHINA

147-51 Booth 274

Tori Msaayuki *, Oga Motovoshi, Shibuya Hidetoshi: THE TIMING OF COUNTERCLOCKWISE ROTATION OF SOUTHEASTERN KYUSHU, JAPAN

147-52 Booth 275

Cheong Daekyo *, Egawa Kosuke: THE BASIN FORMING TECTONICS AND CONGLOMERATE FACIES OF THE LOWERMOST NAKDONG FORMATION IN THE CRETACEOUS GYEONGSANG BASIN, KOREA

147-53 Booth 276

Zaky Khairy *: STRUCTURAL ANALYSIS OF EL FARAFRA OASIS, CENTRAL WESTERN DESERT, EGYPT

147-54 Booth 277

Ayadi Soumaya *, Boukadi Neureddine, Zargouni Fouad: THE LABEID-KOUDIAT EL BEIDA-BLED EL GONNA LINEAMENT: AN IMPORTANT PALEO GEOGRAPHIC TREND IN CENTRAL TUNISIA

147-55 Booth 278

Haddon Ian Gerald *: INTERPRETING THE EVOLUTION OF THE CENOZOIC KALAHARI BASIN FROM NEOTECTONIC AND GEOMORPHOLOGICAL EVIDENCE

147-56 Booth 279

Mouna Frigui *, Mohamed Ben Youssef, Mohamed Ghanmi: AN UPDATED GENETIC STRATIGRAPHY OF THE NEOGENE DEPOSITS IN THE TUNISIAN SAHEL AND THE PELAGIAN SEA: EUSTASY AND TECTONIC DUALITY

147-57 Booth 280

Galetskiy Leonid *, Shevchenko Tamara: STRUCTURE OF THE UKRAINIAN SHIELD

147-58 Booth 281

Gogus Oguz *, Cermen Ibrahim, Catiol Elizabeth, Ozderdem Cenk: STRUCTURAL ANALYSIS ALONG THE BUYUK MENDERES SHEAR ZONE, BASCAYIR REGION, WESTERN TURKEY

147-59 Booth 282

Gabalón López Vicente, Quesada Ochoa Cecilio *, Gómez Fernández Juan José: SEDIMENTATION WITHIN SYN-OROGENIC BASINS IN A TRANSPRESSIONAL OROGEN (SW IBERIA VARISCAN BELT)

147-60 Booth 283

Starostsev Valeri Stananovich *: SPATIAL AND TEMPORAL MUTUAL RELATIONS OF DISLOCATIONS OF CRATONS AND MOBILE BELTS

147-61 Booth 284

Lerov Marie *, Dauteriu Olivier, Guiraud Michel: POST BREAK-UP COMPRESSION OF ATLANTIC PASSIVE MARGINS AND ITS IMPACT ON BASIN SEDIMENTATION

147-62 Booth 285

Malyshov Nikolay *, Pimenov Boris, Tarasov Pavel: TECTONICS AND GEODYNAMICS OF THE NEOPROTEROZOIC COMPLEX OF THE MEZEN BASIN IN THE NORTH-EAST OF THE EAST-EUROPEAN CRATON

147-63 Booth 286

Akdag Kemal *, Kirmaci M. Ziya, Turan Mehmet: RELATIONSHIP BETWEEN SEDIMENTATION AND TECTONICS IN GÜMÜRHANE LATE CRETACEOUS BASIN (NE, TURKEY)

147-64 Booth 287

Benvenuti Marco *: CHAIN-PARALLEL AND CHAIN-TRANVERSAL STRUCTURE INTERACTION IN THE DEPOSITIONAL DEVELOPMENT OF NEOGENE POST-COLLISIONAL BASINS OF CENTRAL TUSCANY (ITALY): EXAMPLES FROM THE VALDELSA AND CASINO BASINS

147-65 Booth 288

Bolano Umberto *: INTEGRATED SEDIMENTOLOGIC, STRATIGRAPHIC AND TECTONIC DATA OF CASTELVETTERE AND CAIAZZO TURBIDITE FORMATIONS (UPPER MIOCENE OF SOUTHERN APENNINES): IMPLICATIONS FOR FORELAND BASIN SEDIMENTARY EVOLUTION AND MODELLING

147-66 Booth 289

Cavinato Gian Paolo *, Parotto Maurizio, Sirna Maurizio, Di Luzio Emiliano, Saroli Michele, Cosentino Giuseppe, Iocchi Emanuele: ROLE OF MESO-CENOZOIC PALEO GEOGRAPHY ON MESSINIAN AND EARLY PLIOCENE TECTONIC-CONTROLLED SEQUENCES WITHIN CENTRAL APENNINES (ITALY)

147-67 Booth 290

Dominici Rocco, Doglioni Nicolò *, Muto Francesco, Barone Mirko, Cavozi Cristian, Lugli Stefano, Costa Elisabetta: THE NEOGENE STRATIGRAPHIC AND TECTONIC EVOLUTION OF THE NORTHERN CROTONE BASIN (CALABRIA, ITALY): NEW DATA ON THE MESSINIAN SALINITY CRISIS

147-68 Booth 291

Biagi Sabina, Costa Pisani Patrizia *, Milli Salvatore, Moscattelli Massimiliano: ACTIVE THRUST FRONT/FOREDEEP DEPOCENTER MIGRATION VS FLEXURE MIGRATION: THE EVOLUTION OF CENTRAL APENNINES

147-69 Booth 292

Dorrea Dorin *, Sprinceana Viorel, Ionescu Laurentiu, Gorie Jean, Petrescu Cristina, Draghici Mircea, Lacatusu Beatrice: TRANSYLVANIAN BASIN TECTONIC STRUCTURE UNREVELED BY GEOPHYSICAL DATA

147-70 Booth 293

Ersoy Yalcin *, Heivaci Cahit, Sozbiir Hasan, Erkul Fuat: EVIDENCE FOR TOP TO NORTHEAST MOVEMENT OF THE NEO-TETHYAN OPHIOLITES ON THE MENDERES METAMORPHIC MASSIF, KULA DETACHMENT FAULT, WESTERN ANATOLIA, TURKEY

147-71 Booth 294

Galliccio Salvatore *: DEPOSITIONAL AND TECTONIC EVIDENCES OF LANGHIAN-SERRAVALIAN EASTWARD MIGRATION OF THE SOUTHERN APENNINE FOREDEEP (ITALY)

147-72 Booth 295

Gorozhanina Yelena Nikolaevna *, Brown Dennis, Willner Arne, Pazukhin Vladimir, Zufa Gian Gaspare, Puchkov Victor: THE SEDIMENTARY RESPONSE OF THE ARC-CONTINENT COLLISION IN THE SOUTHERN URALS (RUSSIA)

147-73 Booth 296

Baccini Giorgio, Gropelli Gianluca *, Zucali Michele, Corazzato Claudia, Solunchev Carlo: MESO- AND MICROSTRUCTURAL EVOLUTION OF THE SERVINO AND VERRUCANO FM. AT THE CONTACT WITH TRIASSIC SUBVOLCANIC BODIES (MONTECAMPIONE, ITALY)

147-74 Booth 297

García-Ramos José Carlos, Menéndez-Casares Eduardo, González Beatriz, Aramburu Carlos, Alonso Juan Luis, Gutiérrez-Claverol Manuel *: A NEW SYN-RIFT SUCCESSION OF THE JURASSIC-CRETACEOUS BOUNDARY IN ASTURIAS (NW SPAIN)

147-75 Booth 298

assume, that the last tectonic influence on the character of dislocations within the mobile belt. Thus, having arisen originally in conditions of a tension and deep downwarping at edge or between cratons, the mobile belt renders significant influence on intensity of downwarping the margins of adjacent cratons (or median masses). During inversion of tectonic movements in a mobile belt in adjacent depressions downwarping, isostatically compensating ascending movements in this belt, is in progress. Further during the period of orogenesis in a mobile belt force of gravitation causes movements of mountain masses to adjacent depressions. Thus there are the stresses of tangential compression derivative of initial mainly vertical movements.

147-61 Poster Leroy, Marie

POST BREAK-UP COMPRESSION OF ATLANTIC PASSIVE MARGINS AND ITS IMPACT ON BASIN SEDIMENTATION

LEROY Marie¹, DAUTEUIL Olivier¹, GUIRAUD Michel²¹ - Géosciences Rennes, Université de Rennes² - Biogéosciences-Dijon, Université de Bourgogne

Keywords: passive margin; post break-up; compression; deformation; sedimentation

After the continental break-up and the episode of thermal subsidence associated, passive margins have been subjected to further deformation. Among these deformations, the uplift of many passive margins (north-western European, west African and south-eastern Brazilian margins) is well argued in the literature from AFT analysis and geological markers. The origin of this uplift is still debated and its links with a horizontal deformation should be established. We report numerous evidences for post break-up horizontal displacements proving compression on Atlantic passive margins. Evaporitic sliding is removed in this analysis. Seismic lines and field indicators provide evidences for compressional structures such as basement involved shortening, contractional domes, folds, strike-slip movements and reverse faults, that occurred during former geological periods. These deformations are mostly controlled by the reactivation of pre-existing structures. The compressive regime still exists today, as shown with seismicity data, neotectonic faults and present day plate motions. Consequently, in addition to their vertical displacement, Atlantic passive margins seem therefore to have undergone post break-up horizontal shortening, and this deformation persists nowadays. This latter compression acts upon sedimentary systems from the continental drainage network to the ocean sedimentary basins. By controlling the relief growth, the deformations influence the relief of the drainage basin, and therefore modify the drainage patterns and the rivers erosion. The nature of rocks eroded and of sediments deposited in the basins can also be modified because of these deformations. On Atlantic passive margins, river captures successive to deformations have been put into relief. Some of these river captures led to the migration of the river system, and therefore to the modification of sedimentary basins associated along the margin. The post break-up compression of a passive margin seems to greatly influence the geomorphology of the continent, and also the geometry of the sedimentary basins associated to this margin. Because of its global consequences, it should be imperative to constrain the mechanics of this deformation.

147-62 Poster Malyshev, Nikolay

TECTONICS AND GEODYNAMICS OF THE NEOPROTEROZOIC COMPLEX OF THE MEZEN BASIN IN THE NORTH-EAST OF THE EAST-EUROPEAN CRATON

MALYSHEV Nikolay¹, PIMENOV Boris¹, TARASOV Pavel²¹ - Institute of Geology Xomi Science Centre Russian Academy of Sciences² - Severgeofizika

Keywords: TECTONICS; GEODYNAMICS; NEOPROTEROZOIC COMPLEX; PALEORIFTS; EVOLUTION

The modern structure and paleotectonics of the Mezen basin is considered according to new regional seismic reflection and well drilling data. The Neoproterozoic complex is presented here by the Riphean and Vendian deposits. The Riphean non-metamorphic deposits fill intercontinental paleorifts. They are bounded by comparatively narrow uplifts of north-western (sub-Timan) direction. The basement surface depth is considerably greater, than it was previously supposed, and estimated as 8-10 km. The paleorifts are filled by the Riphean terrigenous, and in the lower part possibly by volcano-terrigenous deposits as thick as 4-8 km and greater. Morphologically the rifts appeared dominantly as series of half-grabens controlled by major en echelon listric faults. More rarely full grabens are found. The architecture of the Riphean rifts is very similar to many Paleozoic and Mesozoic-Cenozoic rifts. The Riphean depocenters are confined to major boundary faults of half-grabens. In the same parts of half-grabens the linear inversion anticlines (result of poststriving compression) or the rollover structures are developed. The hanging walls of the half-grabens are split usually by faults synthetic and antithetic to the boundary fault. Beside paleorifts the Riphean complex is also developed in the eastern part of the Mezen basin in the PreKanin-Timan pericratonic trough where its thickness reaches 5-7 km. Here Riphean depocenters are situated near Kanin-Timan Range and overlain by the West Timan thrust. The Riphean complex is formed by both terrigenous and carbonate rocks and also by evaporites. The Upper Vendian terrigenous deposits in the Mezen basin form sinclinal complex. They are deposited practically horizontally and with angular and stratigraphic unconformity overlay the Riphean deposits and the epi-Karelian basement rocks. The results of paleotectonic analysis testify of two principally different stages of Neoproterozoic evolution of the Mezen basin: riftogenic (including series of extension and postrift subsidence phases) and sinclinal (Late Vendian). The first stage was completed in the end of the Late Riphean-Early Vendian with compression and general uplifting of the region. The Riphean complexes were deformed and partly eroded. Since the Late Vendian the character of tectonic movements within the Mezen basin substantially changed. Within this second stage large gently depressions and uplifts were formed.

147-63 Poster Akdag, Kemal

RELATIONSHIP BETWEEN SEDIMENTATION AND TECTONICS IN GÜMÜPHANE LATE CRETACEOUS BASIN (NE, TURKEY)

AKDAG Kemal¹, KIRMACI M. Ziya¹, TURAN Mehmet¹¹ - Karadeniz Teknik University

Keywords: Late Cretaceous; Eastern Pontides; syn-rift sediments; post-rift sediments.

The Eastern Pontides magmatic arc extends ~500 km in an E-W direction along the Black Sea coast and was disrupted by a series of fault systems trending NE-SW, NW-SE, E-W and N-S. These fault system are responsible for the formation of diachronous extensional basins in the northern, southern and axial zones of the Eastern Pontides during the Mesozoic. The Upper Cretaceous deposition of the Southern zone of the Eastern Pontides records sedimentation and subsidence during the Late Cretaceous. The Gümüphané Basin in the Gümüphané-Torul area is approximately 10 km wide and 25 km long. It is filled

by more than 1000 m of alluvial/shallow to deep marine deposits (Turonian-Maastrichtian). Facies and thickness changes within short horizontal distances in the basin suggest synsedimentary basin margin faulting. The Late Cretaceous sedimentation in the basin is characterized by two facies: Scyn-rift and post-rift facies. The syn-rift facies are characterized by red colored, poorly sorted, clast supported limestone conglomerates alternated with mudstones, and yellow colored, thin to thick bedded, bioturbated sandy calcarenites which include minor conglomeratic channel fillings. These lithologies have limited areal extent and show thickness variations and pinch-outs in short distances. The post-rift sediments are characterized by red pelagic limestones and overlying sandstone turbidites and have a more wide areal extent than the syn-rift sediments. Extensional structures within the Early Cretaceous basement of the basin include neptunian dikes which indicate NW-SE directed extension and sinistral strike slip at the southern margin suggest a pull-apart origin of the basin between E-W trending sinistral strike slip faults.

147-64 Poster Benvenuti, Marco

CHAIN-PARALLEL AND CHAIN-TRANVERSAL STRUCTURE INTERACTION IN THE DEPOSITIONAL DEVELOPMENT OF NEOGENE POST-COLLISIONAL BASINS OF CENTRAL TUSCANY (ITALY): EXAMPLES FROM THE VALDELSA AND CASINO BASINS

BENVENUTI Marco¹¹ - Dipartimento di Scienze della Terra, Università di Firenze Via G. La Pira 4, 50121 Firenze, Italy

Keywords: NORTHERN APENNINES; POST-COLLISIONAL BASINS; MESSINIAN-ZANCLEAN

One of the most debated aspects in the discussion on the Neogene-Quaternary evolution of the Northern Apennines concerns the tectonic development of the Tyrrhenian side of this orogen. Crustal extension and compression are both invoked to explain the post-collisional evolution and a strategic role in this discussion is played by the sedimentary basins developed since the mid-late Tortonian in central and southern Tuscany as well as in the northern Tyrrhenian area. These basins, alternatively referred to as graben-half graben or thrust-top basins, in fact, are filled with syn-tectonic successions up to 2,500 m thick made of alluvial, fluvio-lacustrine and shallow marine deposits which bear the record of wide-scale events such as the Messinian Salinity Crisis and the late Pliocene-Quaternary climatic fluctuations. The stratigraphic architecture of the basin fills and the structural lines of evidence are alternatively employed to support the hypothesis of a dominant extension or compression driving the tectono-sedimentary dynamic of these basins. Besides the differently interpreted tectonic regime these reconstructions stress the role of Northern Apennines chain parallel structures in controlling geometries, sediment accommodation and supply in these basins. The aim of this poster is to show how interacting chain-parallel and chain-transversal structures can better explain stratigraphic patterns and facies development observed in some of these basins. Messinian-Zandean fluvio-lacustrine and shallow marine successions exposed in the adjacent Valdeisa and Casino basins in central Tuscany are compared in their stratigraphic and facies architectures. Significant modifications of the basin geometries and of the palaeogeography will be discussed in the framework of interacting chain-parallel out-of-sequence thrust faults and chain-transversal actively growing ngs.

147-65 Poster Boiano, Umberto

INTEGRATED SEDIMENTOLOGIC, STRATIGRAPHIC AND TECTONIC DATA OF CASTELVETERE AND CAIAZZO TURBIDITE FORMATIONS (UPPER MIOCENE OF SOUTHERN APENNINES): IMPLICATIONS FOR FORELAND BASIN SEDIMENTARY EVOLUTION AND MODELLING

BOIANO Umberto¹¹ - Department of Earth Science, University of Naples

Keywords: Southern Apennines; Sediment gravity flow deposits; Turbidite systems; Tectonostratigraphy; Foreland basin system

The Castelvetere and Caiazzo turbidite Formations (upper Miocene, southern Apennines) have been revised and correlated, their lithostratigraphic units have been mapped in detail and numerous sedimentological and tectonic field data have been collected. Both formations consist of mixed siliciclastic-calcareous and detritic to basinal turbidite systems, arranged in three main architectural elements: the lower one is composed of unconformity-bounded arenaceous-conglomeratic channelized sedimentary bodies and pelitic-calcareous channel-levee complexes, alternating with argillaceous olistostromes, coarse clastic carbonate mass flow deposits and olistostromes. The middle element is made up of amalgamated and crudely stratified pebbly conglomerates and granular sandstones, showing lower progressive unconformities draped by grow strata, and upper forestepping deposits. The upper element consists of pelitic-arenaceous deposits arranged in medium to thin-bedded backstepping strata. After the inception of the peripheral foreland basin, the frontal edge of the southern Apennine fold-thrust belt was affected by gravitative and transtensional faults related to inversion and/or reactivation of pre-existing tectonic features of the Meso-Cenozoic carbonate platform domains; deposits of the lower architectural element originated in this tectonic setting. During the Tortonian the rate of forward propagation of the orogenic prism abruptly increased through in-sequence thrusting of previously deposited units. Consequently, deposits of the middle architectural element have been formed, genetically related to low efficiency of sand transport. During the Messinian, deposits of the upper architectural element have been formed, related to tectonic quiescence and relative climatic control. Therefore, the southern Apennine foredeep originated first in the lower Miocene as a typical peripheral foreland basin, but from the Tortonian it can be better defined as a "frontal foredeep", i.e. the evolutionary stage of the foreland basin system in which the main depocenter is directly located at the frontal edge of growing mountain belt and not in typical peripheral foredeep position. The studied turbidite units were deposited in confined basins produced by tectonic fragmentation of the frontal foredeep, and they are eastward diachronous between Tortonian and Messinian time.

147-63 Poster Akdag, Kemal

RELATIONSHIP BETWEEN SEDIMENTATION AND TECTONICS IN GÜMÜPHANE LATE CRETACEOUS BASIN (NE, TURKEY)

AKDAG Kemal¹, KIRMACI M. Ziya¹, TURAN Mehmet¹¹ - Karadeniz Teknik University

Keywords: Late Cretaceous; Eastern Pontides; syn-rift sediments; post-rift sediments.

The Eastern Pontides magmatic arc extends ~500 km in an E-W direction along the Black Sea coast and was disrupted by a series of fault systems trending NE-SW, NW-SE, E-W and N-S. These fault system are responsible for the formation of diachronous extensional basins in the northern, southern and axial zones of the Eastern Pontides during the Mesozoic. The Upper Cretaceous deposition of the Southern zone of the Eastern Pontides records sedimentation and subsidence during the Late Cretaceous. The Gümüphané Basin in the Gümüphané-Torul area is approximately 10 km wide and 25 km long. It is filled

147-66 Poster Cavinato, Gian Paolo

ROLE OF MESO-CENOZOIC PALEO GEOGRAPHY ON MESSINIAN AND EARLY PLIOCENE TECTONIC-CONTROLLED SEQUENCES WITHIN CENTRAL APENNINES (ITALY)

CAVINATO Gian Paolo¹, PAROTTO Maurizio¹, SIRNA Maurizio¹, DI LUZIO Emiliano¹¹ - CNR-IGAG (Istituto di Geologia Ambientale e Geoingegneria), sezione di Roma "La Sapienza", P. le Aldo Moro, 5, 00185 - Roma² - Dipartimento di Scienze Geologiche, Università di Roma Tre, Largo San Marialdo, 1, 00146 - Roma³ - Dipartimento di Scienze Ambientali, II Università di Napoli, Caserta, Via Arena, 22, 81100, Italia⁴ - SOLES S.p.A. Via Caroncini, 27, 00197 Roma

5 - Via Aia Cardarillo, 35, 03029 Veroli (FR), Italia

Keywords: Paleogeography; Thrust-related sequences; central apennines; ITALY

Some depositional and non-depositional events controlled by tectonic and eustatic processes have been recognized analyzing many sequences outcropping in the central area of the Latium-Abruzzi carbonate platform. For some of these events the horizontal disposition and vertical evolution of the Mesozoic litho-biofacies allows to determine distribution and main trends of paleo-tectonic lineaments. These played successively an important role during the Neogene-to-Quaternary tectonic phases. A gradual facies transition of the carbonate platform, Mesozoic litho-biofacies can be observed within the Simbruni-Ernici ridge in a SE-NW main direction. Facies of restricted to inter-supratidal environments have been recognized in the south-eastern sector of the mountain ridge whereas transitional-to-marginal facies are located in the central and northern areas. Besides, isopach zones within the same facies show a NE-SW to N-S trend from the Early Jurassic to the Late Cretaceous. The Mesozoic sequences are locally discontinuous and interrupted at different stratigraphic levels from the Late Santonian to the Early Maastrichtian. The stratigraphic record is complete in several sequences outcropping in the north-western area of the ridge, whereas those characterized by longer hiatuses are located in the south-eastern areas. Numerous transverse faults (striking from NE-SW to N-S), seems to be related to paleo-tectonic lineaments inherited by the Mesozoic paleogeography; they acted as lateral ramps during formation of thrusting-related structures and were successively reactivated as normal faults during the Plio-Quaternary extensional phase. The paleogeographic setting determined by meso-cenozoic tectonics deeply influenced also the sedimentation and distribution of syn-thrusting, fold-growth clastic strata in the hanging-wall of the Simbruni thrust during Early Messinian and successively in the Late Messinian- Early Pliocene tectonic event. Facies and thickness of fluvial to alluvial fan deposits shows sharp variations within the mountain ridges, following inherited tectonic pattern. Other examples of tectonic-controlled, Miocene-Lower Pliocene sedimentary sequence are in the Gran Sasso Massif and within the Morrone Ridge.

147-67 Poster Doglioni, Nicolò

THE NEOGENE STRATIGRAPHIC AND TECTONIC EVOLUTION OF THE NORTHERN CROTONE BASIN (CALABRIA, ITALY): NEW DATA ON THE MESSINIAN SALINITY CRISIS

DOMINICI Rocco¹, DOGLIONI Nicolò², MUTO Francesco³, BARONE Mirko¹, CAVOZZI Cristian², LUGLI Stefano², COSTA Elisabetta²

1 - Dipartimento di Scienze della Terra, Università degli Studi della Calabria, 87036 Arcavacata di Rende (CS), Italy
2 - Dipartimento di Scienze della Terra, Università degli Studi di Parma, Parco Area delle Scienze 157/A, 43100 Parma, Italy
3 - Dipartimento di Scienze della Terra, Università degli Studi di Modena e Reggio Emilia, Largo S. Eufemia 19, 41100 Modena, Italy

Keywords: Neogene; Crotone; Calabria; Messinian

The Crotone Basin is located in the eastern Ionian side of the Calabrian Arc. The Basin is limited by two main NW-SE strike-slip faults, whose movement influenced also the facies distribution. This area forms the wedge-top depocenters of the Southern Italy foreland basin system filled by Tortonian to Pleistocene sediments (Roda, 1964). Our new field data indicate that the Messinian evaporites here can not be divided into lower and upper units, as previously reported. The main evaporite facies is represented by an extensive and thick gypsum unit overlain by the Lago Mare facies. The Crotone Basin evaporites in turn overlie the Tortonian pelitic Ponda and Tripoli Fms. They consist of clastic sulfates and minor carbonates that underwent denaturation possibly by burial diagenesis. The Lago Mare facies above the gypsum unit are mainly composed by marls and siliciclastic arenite layers cemented by gypsum. The Messinian succession is topped by the conglomerates of the Carvane fm. Salt forms walls and diapirs rising along faults. In the Zinga area the diapirs outcrop along ENE-WSW fault systems, piercing progressively younger stratigraphic levels toward the northeast. In the Belvedere di Spinello area a salt wall can be traced by the subsurface data of the local hydrosolution plant and is aligned along a roughly N-S fault. The facies distribution and thickness of the post-Messinian sequences in these areas have been probably influenced by salt tectonics. Both the genesis and stratigraphic position of the halite is still unclear, because of its recrystallization and flow. Welding surfaces are possible marked by nodular gypsum and chaotic sulfate-pelitic facies. Roda C., 1964. Distribuzione e facies nei sedimenti neogenici del Bacino Crotone. *Geologica Romana*, 3, 319-366.

147-68 Poster Costa Pisani, Patrizia

ACTIVE THRUST FRONT/FOREDEEP DEPOCENTER MIGRATION VS FLEXURE MIGRATION: THE EVOLUTION OF CENTRAL APENNINES

BIGI Sabina¹, COSTA PISANI Patrizia², MILLI Salvatore¹, MOSCATELLI Massimiliano¹

1 - University of Roma "La Sapienza"
2 - University of Hawaii
3 - I.G.A.G. - CNR Roma

Keywords: foredeep; fold and thrust belt; flexure; Late Miocene; Central Apennines

The results provided by the integration of literature, surface (structural and stratigraphic) and subsurface (wells and seismic lines) data, in the Monti Lepini front-Adriatic offshore (Central Apennines) are presented in order to constrain the Late Miocene Apennines chain-foredeep-foreland system migration. The Central Apennines is constituted by two main paleogeographic domains (Triassic-Miocene in age): the Lazio-Abruzzi carbonate platform domain in the south (5-6 km thick), and the Marche-Abruzzi carbonate pelagic domain (3-4 km thick) in the north. These domains overlie a Permian-Triassic continental to shallow marine sedimentary succession having a maximum thickness of 3 Km. In the study area two complex foredeeps filled by siliciclastic successions overlapping onto south-westward tilted foreland ramp have been recognized: (1) Upper Tortonian-Lower Messinian turbidite deposits onto Orbulina Marls formation; (2) Upper Messinian-Recent turbidity deposits onto Gassoso-Solfifera formation. We related this tectonic and stratigraphic setting to the flexure of Adriatic plate, connected to the migration of the chain-foredeep-foreland system. Based on the thickness, geometry and stratigraphic organization of the foredeep turbidite sandstones it is possible recognize several depocenters of different ages into the foredeep basins. We observed that the position and the development of these depocenters is influenced by the Triassic-Miocene paleogeography. The thrust fronts occurring in the carbonate platform domain are controlled by the pre-thrusting foreland deformation. Normal faults affected the foreland during Tortonian-Messinian time, and are presently well exposed along the margin of depressions filled by the highest thickness of siliciclastic turbidites. The pre-thrusting normal faults have been interpreted as passively translated on the backside of the main thrust fronts, during the stacking of the fold-and-thrust belt. Instead the thrust fronts recognized in the pelagic domain show growth geometries on the main structures consisting of tilted and folded strata. Therefore the depocenter positions seem to be controlled by different

features: in the platform domain, by the pre-thrusting normal faults and their syndimentary rotation caused by the initial thrust propagation; in the pelagic domain by the propagation of thrust fronts inside the same foredeep domain.

147-69 Poster Dordea, Dorin

TRANSYLVANIAN BASIN TECTONIC STRUCTURE UNREVELED BY GEOPHYSICAL DATA

DORDEA Dorin¹, SPRINCEANA Viorel¹, IONESCU Laurentiu², GORIE Jean¹, PETRESCU Cristina¹, DRAGHICI Mircea¹, LACATUSU Beatrice¹

1 - S.G. Prospectiuni S.A., 1 Caransebes str., 012271-Bucuresti, ROMANIA
2 - ROMGAZ S.A., 4 Unirii str., Medias, Romania
3 - ROMGAZ S.A., 4 Unirii str., Medias, Romania

Keywords: Transylvanian Basin; ophiolite complex; ocean mantle; gravity and magnetic modeling

The Transylvanian Basin (TB ~15000 km²) has a geological history, which starts with mid-Triassic - mic-Jurassic opening of the Tethys Ocean, although some Permian or Low Triassic deposits could occur on its southern-eastern borders. The presence of consistent gas deposits in TB motivated lots of programs of geological drilling, seismic investigation, boreholes logging, gas extraction, stratigraphical studies which led to a regional concept on its geological structure. The present work purpose is to gather magnetic and gravity data from TB with drilling and seismic data, to generate a more detailed tectonic image. The gravity and airmagnetic regional data, brought into a homogenous digital format, indicate very extended Bouguer (-38mgal, ~4500 km²) and magnetic (>300nT, ~4800 km²) anomalies (the most extended and intense of the Romanian territory) for TB. These anomalies overlap the major succeeding Badenian subsidence of TB. The seismic and drilling data have been used to advance a certain structural model concerning its upper part (ophiolites-Jurassic-Lower Cretaceous-Upper Cretaceous-Eocene-Oligocene-Burdigalian-Badenian-Sarmatian-Pannonian) and less certain one for the lower part (basaltic layer-granitic layer- crystalline rocks/ocean mantle-ophiolite complex). Physical properties (density, magnetic susceptibility) have been assigned to these hypothetical structural-stratigraphical layers in more variants, suitable to many petrographical categories. The assignments of the oceanic mantle or continental crust are the most important for the analyzed successions of the basement (11-55 km) and less important by the petrographic specific type of its upper part (0-11 km). Among the chosen variants, those corresponding to the oceanic mantle - ophiolite complex - upper Jurassic - lower Cretaceous - upper Cretaceous - Eocene - Oligocene - Burdigalian - Badenian - Sarmatian - Pannonian is the single generating the same gravity and magnetic field as the ones recorded. The advanced structural model is about a preserved oceanic crust cañote trapped between the concave margins of two collisioned continental crusts (Internal Dacides and Median Dacides) in the central TB (Tarnave Depression). The rapid cooling (7-8 m.a.) of the oceanic mantle after the ocean cañote trapping in between the cold continental crust and consequently its rapid compression, is the generating factor of the succeeding-Badenian subsidence.

147-70 Poster Ersoy, Yalcin

EVIDENCE FOR TOP TO NORTHEAST MOVEMENT OF THE NEO-TETHYAN OPHIOLITES ON THE MENDERES METAMORPHIC MASSIF, KULA DETACHMENT FAULT, WESTERN ANATOLIA, TURKEY

ERSOY Yalcin¹, HELVACI Canit¹, SOZBILIR Hasan¹, ERKUL Fuat¹
1 - Dokuz Eylul Universitesi, Muhendislik Fakultesi, Jeoloji Muhendisligi Bolumu, 25100, Bornova - IZMIR, TURKEY

Keywords: Kinematic evidence; Neo-Tethyan ophiolites; Menderes metamorphic massif; Kula detachment fault; Western Anatolia

Western Anatolia consists of three main tectonic units, from north to south, Izmir-Ankara Suture Zone, Menderes metamorphic massif and Lycian nappes. Izmir-Ankara Suture Zone is an accretionary prism which represents the remnants of northern branch of Neo-Tethys. The contact between Izmir-Ankara Suture Zone and Menderes metamorphic massif was previously considered as a thrust. However, Western Anatolia was highly extended in Miocene time, which resulted in crustal thinning and regional scale faulting along the low-angle detachment faults. Detachment fault systems in this province are associated with domal uplift of the Menderes Massif in the lower plate and the formation of extensional asymmetric supra-detachment basins in the upper plate. Movement along detachment faults and domal uplift of the lower plate produces tectonic and erosional denudation. This type of movement along the Kula detachment fault located in the eastern rim of the NE-trending Seindin Basin has been great enough to juxtapose the brittlely-deformed Neo-Tethyan ophiolites of the upper plate against the ductilely-deformed Menderes metamorphic massif in the footwall. The footwall in this area consists of well-foliated garnet-bearing mica schists that ended by low angle fault surface at the top. These metamorphics have a main foliation dipping shallowly southwest as the fault surface. A six-sense lineation is formed on the foliation and the fault surface as well. This lineation is oriented N 20-55 E and oblique to the strike of the foliation with rake of 56-63 S. The data may be attributed to the western flank of the NE-trending corrugation of the Kula detachment fault. According to the kinematic data, the Kula detachment fault represents a top-to-the-northeast low angle fault. These data reveal that deposition of the Inay Group postdate the activity of the Kula detachment fault.

147-71 Poster Gallicchio, Salvatore

DEPOSITIONAL AND TECTONIC EVIDENCES OF LANGHIAN-SERRAVALLIAN EASTWARD MIGRATION OF THE SOUTHERN APENNINE FOREDEEP (ITALY)

GALLICCHIO Salvatore¹

1 - Dipartimento di Geologia e Geofisica - Università degli Studi di Bari

Keywords: foredeep; Southern Apennines; Miocene

Recent geological survey carried out on Miocene turbidites outcropping in the external areas of the southern Apennines, in the Lucania-Apulia sector, allowed to observe stratigraphical, depositional and tectonic evidences which characterized the evolution of the foredeep during the Langhian-Serravallian time. The Apennine foreland system was located on the Adria Plate at the front of the Neogene E-verging Apennine accretionary wedge; its evolution was mainly controlled by the W-dipping subduction of the craton and the cratonward migration of the chain. According to the main literature the southern apenninic Miocene foreland basin system developed from the late Burdigalian and was characterized by deposition of several turbiditic units (e.g. Flysch di Gorgoglione, Serra Palazzo, and Flysch di Faeto Fms.) referable to different tectono-sedimentary domains (thrust-top, foredeep s.s. and "foreland" basins) the latter were filled without significant deformation until the Tortonian, when an important compressional stage, due to the opening of the Tyrrhenian Sea, deformed and split the older turbidite bodies in several thrust sheets; during Langhian-Serravallian time important tectonic events which could have affected the foredeep domains have never been described. In particular, new