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SYNSEDIMENTARY TECTONICS CONTROLLING DEPOSITION OF MESOZOIC AND TERTIARY CARBONATIC SEQUENCES OF AREAS SURROUNDING VALLO DI DIANO (SOUTHERN APPENNINES)

Memoria del Socio PAOLO SCANDONE e del Dott. GLAUCO BONARDI (*)

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RIASSUNTO

Lo studio della regione circostante il Vallo di Diano, ha permesso di accertare che nei monti ad Est e ad Ovest di esso la successione stratigrafica presenta sostanziali differenze.

Nei monti ad Ovest del Vallo di Diano, corrispondenti ai massicci calcarei del Cilento, la serie stratigrafica è continua dall'Infralias al Cretacico sup. Le litofacies e le biofacies non differiscono da quelle, già note, riscontrate in gran parte dei massicci calcareo-dolomitici dell'Appennino meridionale.

Nei monti ad Est del Vallo di Diano, invece, la serie stratigrafica presenta numerose ed ampie lacune. Durante il Mesozoico ed il Terziario, un'attiva tettonica sinsedimentaria ha determinato forti variazioni nella successione stratigrafica da luogo a luogo. Queste variazioni sono di complessità tale da non poter essere riassunte in un'unica colonna stratigrafica.

Nell'Infralias una fase tettonica divise la regione studiata in due aree, corrispondenti attualmente ai massicci calcarei del Cilento ed ai Monti della Maddalena. Le dolomie triassiche e i calcari dell'Infralias costituiscono il basamento noto, comune alle due zone. La loro deposizione avvenne in ambiente di piattaforma.

Dopo l'individuazione delle due aree, quella occidentale presenta caratteri di unitarietà e vi permangono le condizioni di piattaforma. La zona orientale, invece, è frammentata in numerosi blocchi, ciascuno dei quali, avrà, dopo l'Infralias, una sua propria storia. In questa zona la sedimentazione nel Lias è limitata a pochi blocchi sommersi.

Nel Giura la sedimentazione continua nell'area occidentale per lo più con caratteri di *back-reef*, mentre nell'area orientale si hanno blocchi emersi e blocchi sommersi con sedimentazione di tipo bioermale o clastico organogena e chimica con caratteri di *fore-reef*.

Nel Cretacico inf. quest'ultima area è totalmente emersa.

Nel tardo Cretacico emerge l'area occidentale, mentre l'area orientale è interessata da una grande trasgressione che raggiunge il suo massimo nel Maestrichtiano.

Nell'Eocene inferiore le condizioni sono analoghe.

Dall'Eocene medio a tutto l'Oligocene entrambe le aree sono emerse. Esse saranno ricoperte dal mare nella grande trasgressione miocenica. I caratteri dei sedimenti testimoniano nell'Aquitaniano acque poco profonde. Il bacino andrà poi via via approfondendosi fino a presentare, nel Miocene medio, depositi quasi esclusivamente terrigeni, con marcati caratteri di flysch.

RESUMÉ

L'étude géologique de la région environnante le « Vallo di Diano » nous a permis de constater des différences profondes dans les séries stratigraphiques des reliefs à l'Est et à l'Ouest de ce *polje*.

Les montagnes à l'Ouest du « Vallo di Diano » (c'est à dire les massifs calcaires du Cilento) présentent une série stra-

(*) Work carried out with C.N.R. contribution. Istituto di Geologia dell'Università di Napoli.

tigraphique continue depuis l'Infralias jusqu'au Crétacé supérieur. Les lithofaciès et les biofaciès sont très semblables à celles, bien connues, qu'on peut rencontrer dans la plupart des massifs calcaires-dolomitiques de l'Apennin méridional.

Les montagnes à l'Est du « Vallo di Diano », par contre, nous montrent une série caracterisée par des nombreuses et amples lacunes stratigraphiques.

Pendant le Mésozoïque et le Tertiaire une énérgique tectonique synsédimentaire a causée des variations dans les successions stratigraphiques; ces variations sont tellement nombreuses et complexes, qu'on ne peut pas les représenter dans une seule coupe stratigraphique.

Le socle en commun aux montagnes à l'Est et à l'Ouest du « Vallo di Diano » est constitué par les dolomies triasiques et les calcaires infraliasiques, deposés dans un milieu de mer peu profonde.

A l'Infralias, une phase tectonique a divisé ce socle en deux zones: aujourd'hui elles correspondent aux massifs calcaires du Cilento et « Monti della Maddalena ». La zone à l'Ouest gardait des caractères de plateforme subsidente indivisée. La zone à l'Est, par contre, a été divisée en plusieurs blocs, qui auront, par la suite, chacun son histoire particulière.

Un tout petit nombre de ces blocs a été submergé au Lias et nous montre des dépôts de cet âge.

Au Jurassique (Dogger-Malm), dans la zone à l'Ouest on a une sédimentation continue de back-reef; toujours au Dogger-Malm, la zone orientale devait se montrer de la même façon qu'un archipel. Sur les blocs couverts par la mer on a des dépôts biohérmales ou détritiques-organogénes et chimiques, caracterisants un milieu de fore-reef.

Au Crétacé inferieur cette dernière zone est totalement émergée.

A la fin du Crétacé la mer régresse de la zone occidentale; à l'Est par contre, on observe une transgression dont le maximum est atteint au Maestrichtien.

Les mêmes conditions on peut constater à l'Eocène inferieur. Depuis l'Eocène moyen jusqu'à l'Oligocène le deux zones sont en domaine continental.

Enfin, pendant la générale transgression du Miocène, la région tout entière était submergée par la mer. Au début du Miocène, les dépôts d'âge aquitanien nous indiquent que la mer était peu profonde; mais la profondeur du bassin doit augmenter de façon progressive, à tel point que les dépôts d'âge Miocène moyen, presque exclusivement terrigènes, présentent une vraie faciès flysch.

INTRODUCTION

Vallo di Diano is a *polje* stretching in direction NNW-SSE and corresponds to a Villafranchian lake basin partly extinguished by filling, partly by erosion. Tanagro river runs South-North through it.

One of the most immediate observations, also deriving from rough analysis, of the mountains which surround Vallo di Diano is that on the West side, outcropping recent Mesozoic - mostly Cretaceous - terms

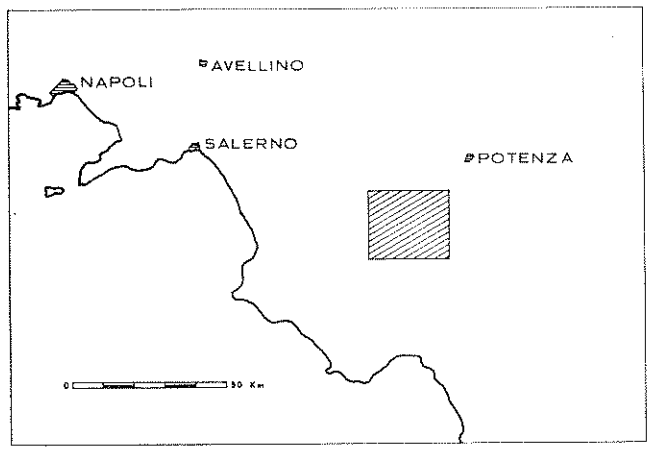

fig. 1 — Location of the studied area.

prevail, while on the East side (Monti della Maddalena) Triassic and Infraliassic (1) dolomites and dolomitic limestones prevail. This situation has been so far interpreted exclusively as a result of tectonic and physiographic Miocenic and post-Miocenic phenomena. In the present note we try to prove that the layers constituting the opposite sides of Vallo di Diano were formed expecially during the Mesozoic age starting from Lower Lias, into two different environments, each one with its peculiar story.

The tectonic lines from which Vallo di Diano's *graben* tooks its origin correspond to ancient tectonic lines living during the Mesozoic era and Tertiary period, reactivated and magnified by Miocenic and post-Miocenic tectonics.

STRATIGRAPHY

In surveying we used a lithobiostratigraphic criterion according to which the different rock stratigraphic units correspond to formations that can be recognized and separately mapped because of their petrological characters and palaeontological field characters.

Since formation limits coincide with chronological limits we prefer to adopt in the description the chronostratigraphic criterion which has the advantage of a mo-

(1) With the term Infralias we mean the period of time included between Norian with *Megalodon* sp., *Worthenia solitaria, Gervilleia* exilis and the Upper part of Lower Lias with *Palaeodasycladus mediterraneus.* Fossils permitting to distinguish Rhaetic from Hettangian have not been found in the layers corresponding to this period of time.

re immediate comparison among the layers of the two sides of the Vallo di Diano.

During the Triassic and Infraliassic period, the condition of sedimentation in the analysed area was very uniform, as it happened to the carbonatic groups of Southern Appennines. Towards the end of Lower Lias the region appeared differentiated into two areas corresponding to the present calcareous Cilento Mountains and «Monti della Maddalena». These areas were to undergo different tectonic events which affected, we should better say conditionned, the sedimentation. Therefore it is necessary, starting from Lias s. s., to analyse separately the stratigraphic sequences in the mountains East and West of Vallo di Diano.

TRIASSIC

Triassic was recognized in this region in the last century (BALDACCI & VIOLA, 1894; DE LORENZO, 1896).

It is represented by white and grey micro- and macrocrystalline dolomites. The beds are 20-50 cmt and, very seldom, above 1 mt thick. The early texture of sediments is only recognizable within the rudites.

Lamination occurs frequently and is a useful field character to recognize the attitude of strata, since bedding is often hardly recognizable because of the strong brecciation.

Fossils are generally badly preserved. We have recognized *Megalodon* sp., *Gervilleia exilis* (STOPPANI), *Worthenia solitaria* (BENECKE), very rare and unclassifiable Ammonites.

Oncolites and Stromatolites are very frequent.

Estimated thickness in Sala Consilina mountains is about 500 mt and perhaps more. Numerous faults do not permit a better estimation.

INFRALIAS

The stratigraphic sequence is formed by dolomitic limestones, calcilutites, calcirudites and calcarenites bedded according to a thickness of 20-40 cmt. Starting from the bottom up to the top of the sequence, the prevailing terms follow the above mentionned order.

Calcilutites (lime mudstones and lime wackestones, DUNHAM 1962) are generally of a whitish colour, sometimes banded with colours which vary from white to greenish, pinkish to red «terra-cotta». They are only formed by calcareous mud with rare intraclasts and, most frequently, small bioclasts. At times limestones appear subsaccharoidal as a consequence of recrystallization.

Calcirudites are polychrome breccias with calcareous clasts and calcareous matrix, the latter being sometimes marly and dolomitized. At first sight these breccias can be interpreted as polygenic since they are polychrome, but in reality it is a matter of intraformational breccias, in which polychromy is justified by the fact that the intraclasts are originated by the above mentionned polychrome banded calcilutitic beds.

Along one single bed one can pass from breccias to banded calcilutites: this occurs very frequently.

Calcarenites (lime packstones more frequent than grainstones, DUNHAM, 1962) prevail in the upper part of the sequence we are dealing with.

They are grain-supported sediments, which are more or less rich in matrix, this at times is absent, but very seldom. Colour is whitish or light grey and becomes darker and darker as one approaches the upper part of the sequence.

Microbiofacies is: Algae among which *Thaumatoporella parvovesiculifera* RAINIERI, Foraminifers among which Textularidae and Valvulinidae.

Thickness of the Infraliassic sequence is 450-500 mt.

MOUNTAINS WEST OF VALLO DI DIANO

Lias (2)

It is represented by a sequence of grey and light brown calcarenites and pseudo-oolitic calcarenites which are regularly bedded and contain from the bottom to the top of the sequence *Palaeodasycladus mediterraneus* (PIA).

Limestones and yellow-greenish argillaceous marls alternate with each other in the middle-upper part of the sequence. The thickness of each bed of marls ranges from very few millimeters up to 20 cmt.

Calcarenites in the great majority of cases are grain-supported and generally poor or lacking matrix (lime packstones, lime grainstones); one can also find mud-supported calcarenites (lime wackestones). Clasts are very irregular in shape: the extreems being subspherical and rodlike. The latter shape is frequent among bioclasts.

(2) Actually we do not mean the entire Lias, but part of Lower Lias, the whole Middle and Upper Lias.

Due to this irregular shape of clasts, the sediment, before compaction, had a very high porosity. It is easily, then, to recognize to day, recorded in the rock floored interstices, shelter effects and, generally, geopetal structures.

Like in all known places of Mesozoic Carbonatic Groups, it is possible to recognize in a determined middle-upper portion of «calcari a *Palaeodasycladus*» sequence, limestones with *Orbitopsella praecursor* followed by a key bed with large sparry pelecypods («livello a *Lithiotis* » auct.). In this key bed the predominant litho types are grain-supported calcarenites which are very rich in matrix and mud supported calcarenites.

Nearby «Grotta di Pertosa» we found numerous pelecypods (Megalodontidae and Ostreidae) in a marly stratum 20 cmt thick. These fossils can be easily removed.

Microbiofacies is: *Palaeodasycladus mediterraneus* (PIA), *Thaumatoporella parvovesiculifera* RAINIERI, *Orbitopsella praecursor* GÜMBEL, *Haurania* sp., Lituolidae, Valvulinidae, Textularidae, Ammodiscidae, Reophacidae, rare Miliolidae, *Aeolisaccus dunningtoni* ELLIOT.

On the top of the bed with large sparry pelecypods there are white oolitic limestones (50 mt) with sparry calcite cement which lack matrix.

Small gastropods and arenaceous foraminifers (Textularidae) are the only fossils.

The thickness of the whole described sequence is about 200 mt.

Jurassic s. s. (Dogger-Malm)

The sequence of Jurassic layers can be seen between «Grotta di Pertosa» and the village of Polla. The exposure is not good because of the soil mantle.

Grey and light brown calcarenites, more or less rich in matrix and, less frequently, calcilutites form the lowest terms.

Selliporella donzelli SARTONI & CRESCENTI and *Pfenderina salernitana* SARTONI & CRESCENTI are the microfossils of stratigraphic significance.

Continuing the sequence, we found grey and blackish calcilutites (lime mudstones) containing *Cladocoropsis mirabilis* FELIX and *Kurnubia* sp..

Further South (Montagna della Mutola West of Teggiano) calcilutites have a whitish colour and contain fine grained interbedded calcarenites (lime packstones) which are very rich in matrix.

Above limestones with *Cladocoropsis* we found calcarenites and mainly light grey and whitish calcilutites (lime wackestones) with gastropods (*Nerinea* sp.), *Clypeina jurassica* FAVRE and finally *Organisme C* FAVRE.

Oolitic limestones with blackish oolites and less frequent calcirudites with lithoclasts of the above mentionned calcilutites, calcarenites and oolitic limestones appear simultaneously with *Organisme* C.

The estimated thickness is about 500 mt.

Cretaceous

From Neocomian up to Cenomanian litho-types are represented by well bedded grey and light brown calcarenites, rich in lime matrix, and calcilutites. Through the whole sequence gastropods are so numerous to constitute shelly beds. Diceratidae are also numerous but in minor quantity.

Microfossils of stratigraphic value are: primitive forms of *Cuneolina* in the lower part of the sequence; *Cuneolina pavonia parva* HENSON, *Rapydionina laurinensis* DE CASTRO and *Cisalveolina fallax* REICHEL in the middle-upper part (Cenomanian stage).

Calcarenites with sparry calcite cement (lime grainstones) with numerous fragments of rudistids appear and become more and more frequent starting from limestones with *Cisalveolina*.

The outcropping upper part of Cretaceous sequence (Cenomanian-Turonian stage) mainly consists of the above mentionned calcarenites alternated to calcilutites (lime wackestones), fine grained calcarenites which are very rich in matrix, calcirudites with frequently black calcareous clasts.

Microfossils are Rotalidae, generally fragmented *Cuneolina* and *Dicyclina*, and Miliolidae which are very numerous through the whole Cretaceous sequence.

The entire thickness is about 1000 mt.

Only in the vicinity of Teggiano calcarenites with sparry calcite cement and calcirudites both carrying rudistids fragments and *Orbitoides media*(D'ARCHIAC) outcrop. They belong to the Maestrichtian stage and are identical of those isopical ones largely outcropping East of Vallo di Diano.

Upper Cretaceous system shows different lithofacies and biofacies West of the analyzed area (M. Cervati): calcarenites with sparry calcite cement diminish

or disappear completely and are replaced by calcarenites and calcilutites that include very numerous non-fragmented, often in growth position, rudistids. The latter ones form biostromes.

Eocene

On M. Cocuzzo delle Puglie we found outcrops of limited extension of calcirudites and calcarenites with nummulites and alveolines that transgress over calcarenites with sparry calcite cement of Upper Cretaceous.

The extension of these outcrops is of a few square meters; the thickness is of a few decimeters.

The lithobiofacies of these limestones allows correlation with limestones outcropping in Castello di Lepre (SCANDONE, 1964) of which it will be written later on.

Nummulitic layers of M. Cocuzzo delle Puglie, even though not widely extended, offer, however, a great interest.

They permit to assert that Eocenic transgression, coming from East ,as we will see later, has affected, even if marginally, mountains West of Vallo di Diano.

Not very far from the analyzed area there are Paleocenic layers transgressive over Cretaceous layers and Miocenic layers transgressive over Paleocenic, most frequently Cretaceous, layers. This question is well explained by SELLI (1957; 1962).

MOUNTAINS EAST OF VALLO DI DIANO

Lias

Limestones with *Palaeodasycladus* and large sparry pelecypods outcrop in Monti della Maddalena, only at M. Capo la Serra, Serra Capo l'Arestra, where they have been found recently by RADINA (1965).

Lithological and palaeontological characters are similar to those of the Liassic sequence that has been already reported about the mountains West of Vallo di Diano.

We observed a difference in the increase of micritic terms: calcilutites are more numerous; calcarenites richer in matrix; fossils are less recurrent.

The thickness is 100-150 mt.

Jurassic s. s. (Dogger-Malm)

Jurassic is represented by limestones that are generally oolitic and pseudo-oolitic; in some places, in the Tithonian epoch, by reef limestones.

Outcrops are more or less large. Jurassic terms where one can see them, are always transgressive.

The thickest sequence (Dogger-Malm) outcrops nearby Caggiano, but it is not possible to see the base. The sequence, about 250 mt thick, is rather monotonous. Oolitic limestones, oolitic and pseudo-oolitic grey and light brown, grain-supported calcarenites, that are poor or lacking matrix, prevail in it. Calcilutites (lime wackestones) are less frequent.

Unclassifiable corals and gastropods are often numerous.

Microfossils are, mainly, arenaceous foraminifers. *Pfenderina salernitana* SARTONI & CRESCENTI in the lower part and *Kurnubia* in the upper part of the sequence have stratigraphic significance.

At Serra Capo l'Arestra and M. Capo la Serra, Malm transgresses over Lias (RADINA, 1965); at M. Capo la Serra, Castiglione, Mandranello (where it appears as a reef facies) over Infralias; at Mount S. Salvatore, Crocefisso di Brienza and Serra di Capurso near Paterno (where it also appears as a reef facies) over Triassic.

Ruditic terms are frequent where Malm transgresses directly over Triassic or Infralias. Clasts are either originated from more ancient layers (Triassic dolomites, Infraliassic limestones) or from Upper Jurassic layers (oolitic limestones and limestones with *Ellipsactinia*).

The age of transgression is furnished by *Kurnubia*.

Some reefs with *Ellipsactinia, Chaetetes* and corals outcrop among Paterno, Marsico Nuovo and Sala Consilina.

We are dealing with small reefs which are limited in the time (Tithonian) and in the space (they are found only on the South-Eastern part of Monti della Maddalena).

Lithofacies are reef limestones (boundstone, DUNHAM, 1962), calcarenites, oolitic calcarenites, breccias with clasts that very often originated from reef-limestones. No beddings is evident. Thickness is not more than 100 mt.

Gastropods (*Nerinea* sp.) and unclassified pelecypods are recognized among the macrofossils besides those already mentionned.

Microfossils are useless arenaceous foraminifers among which *Trocholina* prevails.

Cretaceous

Only Upper Cretaceous is present. It is constituted by white calcarenites with sparry calcite cement and calcirudites with extraformational clasts. Calcarenites look saccharoidal; therefore from now on we will call them pseudo-saccharoidal limestones.

Fragments of rudistids, varying in size from few millimeters up to 1 dmt, recur very often.

Bedding is always well marked. The thickness of the sequence is highly variable and at Serra Cornaleta it reaches a maximum of 400 mt.

Microfossils are: large *Orbitolina, Orbitoides media* (D'ARCHIAC), *Siderolites calcitrapoides* LAMARK, *Globotruncana stuarti* DE LAPPARENT. Age is Maestrichtian.

Beds rich in nummulites and alveolines are present in the upper part of the sequence in some places (199 IV SO Polla). No transgression is in evidence on the field; and lithofacies of limestones on the top and on the bottom of nummulitic beds is not different from that of pseudosaccharoidal limestones. Therefore it seems that we are dealing with a continous sedimentation from Upper Cretaceous to Eocene without any change in lithofacies.

Somewhere else, instead, like at Castello di Lepre, nummulitic limestones appear clearly transgressive.

Eocene

At Castello di Lepre we found a transgressive sequence on Maestrichtian pseudosaccharoidal limestones.

It is formed by generally grey, well bedded calcarenites and calcirudites both containing nummulites and alveolines.

Clasts of calcirudites are furnished from Triassic dolomites, Infraliassic, Tithonian, Turonian (biostromal «calcari a rudiste»), Maestrichtian limestones.

Microfossils are: *Alveolina fornasinii* CHECCHIA RISPOLI, *Alveolina cremae* CHECCHIA RISPOLI, A. *pinguis* HOTTINGER, *A. distefanoi* CHECCHIA RISPOLI, *A.* cfr. *frumentiformis* SCHWAGER, *Alveolina* ex group of *A. indicatrix* HOTTINGER, *A.minutula* REICHEL. *Orbitolites* sp., *Discocyclina* sp., rotalidae, bryozoans, spines of echinoids, algae.

Age is Upper Cuisian and perhaps Luthetian. Thickness is about 80 mt.

Miocene

Miocenic calcarenites and calcirudites are found transgressive over Triassic dolomites at M. Sierio. The same terms are transgressive over Eocenic limestones at Castello di Lepre.

The outcropping sequence has a good exposure at M. Sierio. The thickness is about 25 mt.

Calcarenites and calcirudites are rich in bryozoans, pectinidae, ostreidae, *Lithotamnium, Miogypsina, Amphistegina, Operculina,* orbitoididae.

About 15 mt above the transgression surface, a bed of yellowish marls 2 mt thick is intercalated between calcarenites.

Proceding upwards the calcarenitic sequence shows marly interbeds which gradually increase in number and thickness. Then it is possible to find an alternation of marls; calcarenites with macroforaminifers (*Miogypsina, Amphistegina, Lepidocyclina,* reworked nummulites and alveolines etc.); clays and silty marls both carrying in some places *Lepidocyclina* (SIGNORINI, 1941); matrix-supported conglomerates with clasts furnished from the carbonatic sequences; less frequent sandstones.

Afterwards calcarenites become gradually less frequent and are replaced with calcilutites alternating marls, more or less frequent silty clays and sandstones.

Continuing the sequence, sandstones become gradually so frequent to prevail over the other litho-types. Finally we reach an arenaceous sequence that shows well marked characters of flysch.

Further up these layers it is not possible to observe any prosecution of the sequence, because of tectonic disturbances.

Since the whole sequence, so far described, is in a very chaotic condition, stratigraphic reconstruction resulted an extremely difficult work.

Thickness of non-chaotic portion was estimated about 300 mt.

PALEOGEOGRAPHIC CONSIDERATIONS

Triassic-Infralias

During Norian, with certainty, and perhaps until Early Lias, the region looked like a subsident flat and uniform sea bottom covered by shallow water.

This condition was the same for a good part of Southern Appennines.

Reef facies do not seem to be present but, instead stromatolithic and biostromal (algae, pelecypods appear). No terrigenous material supply is present.

Presence of intraformational breccias with clasts reaching a maximum of cubic decimeter in Norian dolomites pushes us to think that some faulting, even though very slight, with displacement of sea bottom, must have already taken place during this early period.

These displacements became more and more intensive during Infralias as intraformational breccias were increased in number.

During Early Lias a tectonic phase leads to fracturing of the region giving rise to main zones that nowadays correspond to the mountains E and W of Vallo di Diano.

The Western zone continues to keep a unitary character and remains a highly subsident flat sea bottom.

The Eastern zone, instead, is subdivided into a mosaic of blocks originated from a network of faults.

Each one of these blocks will develop its own story which is rather different from the stories of the surrounding blocks, from this moment all the way up to Miocene.

A common characteristic is a great tectonic instability which results in numerous transgressions and regressions.

We must emphasize that, in spite of so intensive tectonic displacements, there is no tilting of faulted blocks.

We cannot exclude, however, that this phase had already begun with great displacements during Triassic. Sedimentation of sequences of Upper Jurassic (M. S. Salvatore, Serra di Capurso), Maestrichtian (Serra di Capurso, M. Cavallo, M. di Atena), Miocene (M. Sierio) over Norian dolomites can be thought to have taken place either over blocks that were emerged during Infralias, or over blocks that were originated after Infralias and had a very evolved morphology at the time of transgression.

Lias

On the Western zone there is still a shallow water condition, as we previously said.

There are only chemical or biochemical (algae and pelecypods) deposits; clasts are prevalently intraformational.

Terrigenous material supply is rare and restricted to the thinnest clastics (marly or argillaceous interbeds of limestones with *Palaeodasycladus*).

On the Eastern zone, the sedimentation is limited to some rare submerged blocks (M. Capo la Serra), with lithobiostratigraphic characters similar to those of the Western zone, but with reduced thicknesses.

The remaining blocks constituted in the whole an emerged barrier.

In the Liassic sequence of M. Capo la Serra, the absence of clasts deriving from this emerged land, pushes to think that weathering was not heavy, perhaps because of the little altitude.

Jurassic s. s. (Dogger-Malm)

On the Western zone the condition is the same. Sedimentation had marked back reef characters expecially during Malm.

On the Eastern zone, blocks are submerged, on which sedimentation had fore reef characters (Caggiano, M. S. Salvatore, M. Capo la Serra etc.) and, only during Tithonian, in some zones were coral and *Ellipsactinia* patch-reefs. A wall between Western and Eastern zone was well marked.

The transgressions over sinking blocks of the Eastern zone proceeded from East, that is to say from the basin located between Southern Appennines and Gargano-Murge.

The numerous ruditic terms with Triassic, Infraliassic and Liassic clasts prove that topography of these lands, over which the sea transgressed, was irregular. Early Jurassic clasts in ruditic Tithonian terms prove vertical oscillations in restricted areas.

Cretaceous

During Early, Middle and partially Late Cretaceous the condition described about Jurassic remained the same on the Western zone.

Eastern zone seems to have been completely emerged.

During Late Cenomanian and Turonian the Western zone was divided according direction NW-SE, into two parts. On the western one sediments were lime muds with biostromal episods due to rudistid biocenoses. On the Eastern part, closer to Vallo di Diano, at times lime muds, at times calcareous sands, poor or lacking matrix but very rich in bioclasts, deposited. Probably the latter zone corresponded to an elonged channel inter-

posed between the area with rudistid biostromes and the emerged wall of Monti della Maddalena. High speed currents furnished the environment with energy necessary to produce lithoclasts and bioclasts.

During Turonian and Senonian the zone that today corresponds to the mountains W of Vallo di Diano emerged.

The Eastern zone, instead, was sinking. Thus was realized the first regression from the Western zone and the first total ingression over the Eastern zone. The latter, most-likely, was completely submerged excepting maybe few little islands.

Sedimentation had marked fore-reef characters.

The Western zone, while emerging or already emerged, was furnishing numerous lithoclasts and bioclasts.

This paleogeography is well marked during Maestrichtian.

Eocene

The Western region was emerged. Sea could transgress over some more depressed zones (M. Cocuzzo delle Puglie). It is not to exclude that also Maestrichtian sea transgressed over the Western region, as proved in Teggiano area. Generally this is difficult to prove, if not with fortunate micropalaeontological reperts, because transgressive rocks would have lithological characteristics similar to underlying Cenomanian-Turonian calcarenites.

Viceversa on the Eastern region, some places underwent the same previously described condition and lithofacies of Eocenic rocks are not different from that of Cretaceous rocks; in other places short stratigraphic breaks are proved (Castello di Lepre) and lithofacies of Eocenic sequence are very different from those of the underlying Cretaceous sequence.

During Middle-Late Eocene also the Eastern region emerged.

Oligocene

Oligocenic deposits are unknown all over the region.

Miocene

A great transgression interested the analyzed region. The two zones were differentiated after Infralias and had different story up to Early-Middle Eocene. Afterwards they evolved toghether at least up to Middle Miocene.

During Early Miocene the sea transgressed bearing shallow water sediments which were clastic and organoclastic sediments.

Terrigenous material was furnished later on.

As depth was gradually increasing environmental condition became geosynclinalic condition with turbiditic flysch deposits.

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