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DEPOSITIONAL CHANGES IN THE PARNASSUS - GHIONA ZONE, CENTRAL GREECE, DURING THE PALEOCENE

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ABSTRACT

The Paleocene was a period of major changes in deposition in the Parnassus - Ghiona Zone. These changes gave rise to the development of hardgrounds and karstification during the Late Maastrichtian and earlier Paleocene in extensive areas of the zone, while during the late Early and Middle Paleocene shallow marine environments, in which stromatolites lived, prevailed. The environment changed again during the Late Paleocene the sea becoming deeper through the subsidence of the platform on which the terrigenous of the flysch were then deposited.

ΠΕΡΙΛΗΨΗ

Σημαντικές αλλαγές στην ιζηματογένεση έλαβαν χώρα στη ζώνη Παρνασσού - Γκιώνας κατά τη διάρκεια του Παλαιοκαίνου. Κατά το Ανώτερο Μαιστρίχτιο και τη μετάβαση Μαιστριχτίου - Παλαιοκαίνου δημιουργήθηκαν hardgrounds και καρστικοποίηση του υποβάθρου σε εκτενείς περιοχές της ζώνης. Συνθήκες ρηχής θάλασσας αντίθετα απεκράτησαν κατά το Μέσο Παλαιόκαινο, οι οποίες επέτρεψαν την ανάπτυξη στρωματολίθων. Κατά το Ανώτερο Παλαιόκαινο η ιζηματογένεση έγινε κλαστική λόγω της ολικής βύθυνσης της πλατφόρμας και την έναρξη του φλύσχη.

INTRODUCTION

The Paleocene was a critical period for the Parnassus - Ghiona Zone since it underwent extensive environmental and depositional changes. From the Late Triassic to the Late Cretaceous the zone existed as a carbonate platform with neritic and pelagic carbonate sedimentation (locally until early Paleocene) except for three short periods where deposition was interrupted (bauxite horizons). As the result of the tectonic activity in the inner zones the deposition changed during the Paleocene and became terrigenous (flysch) (Papastamatiou, 1960; Celet, 1962; Richter & Mariolakos, 1974, Richter, 1976; Keupp, 1976; Solakius & Pomoni - Papaioannou, in press).

However, the transition from carbonate to flysch deposition was not continous in all parts of the zone since extensive areas exposed at the Cretaceous - Tertiary transition and became karstified (Richter & Mariolakos, 1974). Owing to this interruption a hardground developed at the top of the Maastristrichtian limestone (Celet, 1962; Richter & Mariolakos, 1974; Kalpakis, 1979; Solakius et al., 1989, Pomoni - Papaioannou & Solakius, 1991) above which the basal shales of the flysch complex were deposited at the end of the Paleocene (Solakius et al., 1989; Solakius et al., 1992). In only a few areas it was the

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transition from carbonate to flysch facies presumably continuous (Delphi depression, Keupp, 1976) but according to data from the Arachova section a break in deposition has taken place at the Cretaceous - Tertiary boundary (Gregou et al., in press).

The environmental conditions under which the hardground - stromatolitic unit developed, as well as the age of the stromatolites and the time of deposition of the overlying flysch deposits, indicate that substantial changes in deposition took place in extensive areas of the zone during the Paleocene. These changes will be discussed below. The interpretation presented is based on my study of a number of carbonate - flysch sections with a hardground - stromatolitic bed (Distomo, Zemeno, Davlia, Stena Pigadhia, Stirion, Osios Loucas, Kyriakion, Delphi, Sernikaki, Prossislion, Gravia, Arachova etc. Fig. 1), some of the investigation in collaboration with my colleagues Dr. Nikos Marangoudakis, Dr Fotini Pomoni - Papaioannou, Vassilios Tselepidis and Nikos Carras from the Institute of Geology and Mineral Exploration (IGME) in Athens. The interpretation given in this paper represents, however, my own opinion only.

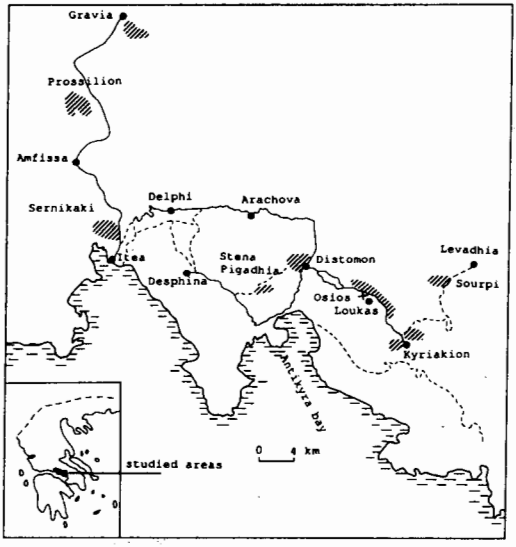

Fig. 1: Simplified map showing the location of the areas studied.
Απλοποιημένος χάρτης ο οποίος δείχνει την θέση των μελετηθέντων περιοχών.

INTERPRETATION

The marine environments that existed in the zone during the Maastrichtian and throughout the Paleocene were as follows (Fig. 2):

Maastrichtian

The Maastrichtian was characterized in the zone by neritic and pelagic carbonate environments (Fig. 2). In the neritic environments with rudists as the dominant fauna, rudist - bearing limestones were deposited which are found to occur extensively in the zone (viz. at Distomo, Davlia, and in the areas around Zemeno). They were deposited during the Senonian (Fig. 2, (3)).

In the pelagic environments (for example in Sernikaki, Prossilion - Gravia and Ano Sourpi), thin - bedded limestone is found in which *Globotruncanita stuarti* (De Lapparent), Globotruncana arca (Cushman) *Gansserina gasseri* (Bolli), *Globotruncana falsostuarti* (Sigal), *Abathomphalus mayaroensis* (Bolli) and *Kassabiana falsocalcarata* (Kerdany & Abdelsalam) were identified indicating that the beds were of Maastrichtian age (Fig. 2 (1)).

In the pelagic environments, found in the areas of Stirion, Osios Loucas and Zemeno, a thin - bedded limestone deposited above rudist - bearing limestones showing that a change in sea level had taken place (Fig. 2, (2)). In these limestone beds *Rosita contusa* (Cushman), *Abathomphalus mayaroensis*, *Globotruncanita stuarti* were found as well as *Saghalinites* cf. *wrighti* Birkelund (Tselepidis et al., in press) points to a Late Maastrichtian age.

At the end of the Maastichtian, the global regression resulted to that hardgrounds developed at the top of the Maastrichtian carbonate substratum (Fig. 2).

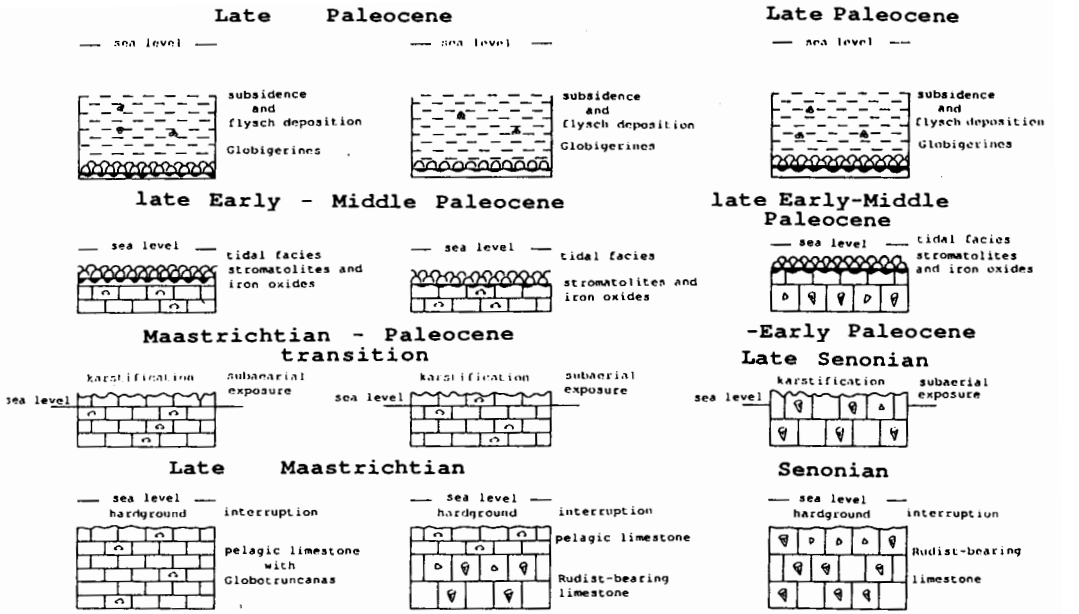

Fig. 2: Diagram showing the depositional changes which took place in the zone during the Late Maastrichtian and throughout the Paleocene. Διάγραμμα παρουσιάζον τις συνθήκες απόθεσης στη ζώνη κατά το Μαστρίχτιο και το Παλαιόκαινο.

The Cretaceous - Paleocene transition

The regression culminated in a fall in sea - level during the Maastrichtian - Paleocene transition (130m, Haq et al., 1987). In the Parnassus - Ghiona Zone as the result of the rapid fall in sea level extensive areasof the platform baceme axposed and karstfied (Fig. 2). Hardgrounds and karstic surfaces have been observed in all the boundary sections discussed that come from both neritic (Distomo, Davlia, Zemeno) and pelagic environments (Prossilion, Sernikaki).

The sedimentological evidence from carbonate sequences with a karstic surfaceon top showed that deposition had taken place in a tidal or supratidal environment (Jimenez de Cisneros & Vera, 1993). However, the presence of rhizolitic and Microcodium - like structures observed in the carbonate substratum and mineralized roots as well as the lack of sediments including *Globigerina eugubina* Luterbacher & Premoli - Silva, *Globigerina fringa* Subbotina and *Globoconusa conusa* Ghalilov and other planktonic foraminifera characteristic of the Maastrichtian - Paleocene transition provide that extensive areas of the platform were above sea level duding this interval (Fig. 2).

Paleocene

The global Paleocene transgression also reached the Parnassus - Ghiona Zone forming a shallow environment in which stromatolites were developed above the karstfied carbonate sea floor (Fig. 2). In these stromatolitic beds which are rich in iron oxides and phosphates the planktonic foraminifera *Morozovella pseudobulloides* (Plummer), *Globigerina triloculinoides* (Plummer), *Planorotalites compressa* (Plummer), *Morozovella trinidadensis* (Bolli), Planoratalites chapmani (Parr) and *Morozovella angulata* (White) indicate a late Early and Middle Paleocene age.

There are a few areas in which calcarenitic beds occur above the Maastrichtian limestone. *Morozovella pseudobulloides, Globigerina triloculinoides, Planorotalites compressa* and other species from the late Early and Middle Paleocene have been identified indicating that the beds are of the same age as the stromatolitic but were deposited in deeper waters (see Gregou, Sophia in this volume).

The extensive distribution of the stromatolites indicates that during the late Early and Middle Paleocene shallow water conditions prevailed in the platform (tidal facies Fig. 2).

During the Late Paleocene when the platform began to subside terrigenous sediments were deposited above the stromatolitic pavement (Fig. 2). *Planorotalites pseudomenardii* (Bolli), *Morozovella angulata* (White), Morozovella velascoensis (Cushman), Globigerina velascoensis (Cushman), Morozovella occlusa (Loeblich & Tappan) and Morozovella subbotinae (Morozova) were identified in the basal parts of the flysch complex indicating that it was deposited over considerable areas of the zone during the Late Paleocene. This changes from a shallow marine to a deep flysch environment, is the last depositional change in the zone persisted until Middle Eocene (Solakius & Pomoni - Papaioannou, in press).

CONCLUDING REMARKS

The above evidence showed that changes in deposition took place in the Parnassus - Ghiona Zone during the Paleocene. The fall in the sea level during the Late Cretaceous - Paleocene transition and the subsequent draining of the platform caused extensive areas to become exposed especially where the sea had ben shallow. The interruption continued throughout the earlier part of the Paleocene as shown the lack of sequences from this interval.

The transgression which began in the late Early Paleocene gave rise to shallow marine environments in which stromatolites lived and persist throughout the Middle Paleocene. Since the stromatolites lived in a tidal environment it can be concluded that in extensive areas of the zone tidal conditions prevailed during most part of the Paleocene. The reasons for shallow water conditions should be looked for tectonic activity of the period rather than ascibing to the eustatic sea level fall.

The subsidence of the platform began in the Late Paleocene where terrigenous sediments of the flysch were deposited. This is regarded as being the last event of the Paleocene depositional history of the Parnassus - Ghiona Zone.

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